ECLIPSE

Version 2021.3

File Formats Reference Manual

Schlumberger

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Introduction

This document describes the format and contents of the principal output files created by the ECLIPSE simulator. The information here does not include all data produced by ECLIPSE, but should be sufficient for defining external interfaces for most post-processing purposes.

The file formats described here are also used for output from other simulation packages, input to pre- and post-processing programs such as PETREL, and for exporting ECLIPSE results to third-party packages.

The FrontSim simulator also uses the formats described here, where applicable. The streamline output files are described at the end of this document.

If you require more information, please contact your customer support representative.

Note: Additional data such as simulator-specific restart data may also be stored in files of the types described here. Only data actually needed for post-processing is detailed in this document.

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ECLIPSE Output Files

The following table shows the ECLIPSE output file types described in this document.

File	Description
Summary Specification file (Spec file)	Specification file defining the vector data which is written to the summary files. In ECLIPSE runs, the output vectors are selected in the SUMMARYsection. Specification file contents are described in Summary Files.
Summary files	Files containing the vector data values at each timestep. Output may consist of multiple summary files, written at each report step, or one unified summary file. Summary file contents are described in Summary Files.
Grid file	Corner point data defining the field geometry. Grid file contents are described in GRID Files.
Extensible grid file	A new extensible grid file format (EGRID) is available in 2000A and later releases. This provides a more efficient way of handling corner point geometry and can also be used for unstructured grids, see EGRID Extensible Grid Files.
Restart files	Files containing the solution data values for each active grid cell at each report step. Output may consist of multiple files, with a separate restart file for each step, or one unified restart file. Restart file contents are described in Restart Files.
Initial file (Init file)	Initial data, consisting of vector data corresponding to the ECLIPSE PROPS data for saturation tables and PVT tables, and solution data corresponding to ECLIPSE grid properties. The Init file is specific to ECLIPSE and it is recommended that similar data from other simulators be loaded using User Data Files. Init file contents are described in INIT Files.
RFT file	RFT data, consisting of vector data defining pressure, saturation and depth values at well connections, for selected wells at selected times. Additional PLT data for well connections and segments may also be available in the RFT file. RFT file contents are described in RFT Vector Files.
Optimization state files	Files containing the state of the Reservoir Optimization at each iteration. Optimization state file contents are described in Optimization State Files.

File	Description
Message service files	Database files with a .dbprtx suffix. These contain messages from the simulation run together with metadata identifying the entities that the messages refer to. These files are not human readable and are intended for use with the Petrel message service facility.

Table 2.1: ECLIPSE file types

Output files may be formatted (ASCII text) or unformatted (Fortran binary). Summary and restart files may be unified or multiple (non-unified). For unified files, one file is opened at the start of the run, data are added at each report step and the file is closed at the end of the run. For multiple files, a new file is generated whenever a report is produced. Summary file data are written at every timestep, but restart file data are written only at report steps, as requested by the user.

Data types

The following major types of data are considered here:

Vector Data

A set of numbers which can be used for constructing line graphs, for example field oil production (FOPR) at each timestep. Vector data can be read from ECLIPSE Summary files, RFT files or User Data files. The ECLIPSE Init file also contains some vector data, such as for relative permeabilities versus saturations.

Grid Data

Grid geometry defined by corner point data, read from an ECLIPSE `GRID` or `EGRID` file.

Solution Data

An array of solution variables which are defined for each cell at a report step, for example pressure and saturation. Solution data are read from ECLIPSE Restart files or User Data files. Additional data defining well positions and completions may be associated with solution data. The ECLIPSE `INIT` file also contains grid property data which can be handled as solution data, for example porosity.

Manipulating output files

The following utility programs are available for manipulating output files:

1. Convert - Converts between formatted and unformatted or between unified and multiple files.
2. Extract - Extracts selected data from existing output files, to create smaller files for more efficient storage and processing.
3. Convertgrid - Converts between the old grid file format (`.GRID`) and the extensible grid file format (`.EGRID`).

Structure of unformatted files

Fortran "unformatted" files are composed of successive records (referred to as "physical records" in a later section). The format implemented by the compilers used to build ECLIPSE is as follows.

Each record is composed of a payload prefixed and suffixed by a signed 4-byte integer encoding the payload size in bytes. If the payload size in bytes exceeds 2^{31} (that is 2 Gigabytes), the record is split into

sub-records. The sign bit of the prefix indicates whether the sub-record is continued or not. The sign bit of the suffix indicates the presence of a preceding sub-record.

ECLIPSE unformatted files are written in big-endian mode. The encoding of "LOGICAL" data is such that "false" has all bits set to zero and "true" has at least one non-zero bit. It is recommended that the "LOGICAL" values read from file are converted to the native "LOGICAL" encoding.

Programmers using Intel Fortran or GNU Fortran need to use `CONVERT='BIG_ENDIAN'` when they open an unformatted file, for example:

```
OPEN(UNIT=IUNIT,FILE=ZFILE,FORM='UNFORMATTED',CONVERT='BIG_ENDIAN')
```

Additionally, when using a program built by Intel Fortran, use of big-endian conversion can be selected at run time by setting the environment variable `F_UFMTENDIAN` to `"big"`.

ECLIPSE naming convention

The ECLIPSE naming convention must be used for these files. In general, file names are of the form:

`root.extension`

where

`root` corresponds to the data origin for a particular run

`extension` defines the file type as shown below

Unformatted	Formatted	Description
SMSPEC	FSMSPEC	summary specification file
Snnnn	Annnn	summary file for report step nnnn (for example CHAP.S0001)
UNSMRY	FUNSMRY	unified summary file
LGR	FLGR	LGR summary file
GRID	FGRID	grid file
Xnnnn	Fnnnn	restart file for report step nnnn (for example `CHAP.X0001`)
UNRST	FUNRST	unified restart file
INIT	FINIT	initial file
RFT	FRFT	unformatted RFT vector file
Jnnnn	Knnnn	optimization state file for iteration nnnn (for example CHAP.J0001)
OPT	FOPT	unified optimization file

Table 2.2: File extensions

Further details of file naming conventions used for different computer systems are given in ECLIPSE File Names.

ECLIPSE output formats

Output files are written in a general format which consists of data arrays, each headed by a data descriptor record. The header record consists of:

1. An 8-character keyword which identifies the data in the block. Valid keywords are described in the following chapters. Where appropriate, the keyword may be a property, region or solution name. Use of names containing embedded blanks is not recommended.
2. A 4-byte signed integer defining the number of elements in the block. The maximum allowed value is 2^{31}-1. Unless the header is of type `X231`, this value should be non-negative.
3. A 4-character keyword defining the type of data in the block. Possible types are:

`INTE` standard (4 byte) signed integers

`REAL` single precision (4 byte) floating point reals

`LOGI` standard (4 byte) logicals

`DOUB` double precision (8 byte) floating point reals

`CHAR` characters (handled as 8-character words)

`C0nn` CHARACTER(len=nn) strings (for example C065 for 65-character strings)

`MESS` "Sentinel" header that has no data associated

`X231` indicates that this array has at least 2^{31} elements

This means that item 2 cannot be used to represent the size of the data. Instead a pair of headers is used to communicate the size of the array. An `X231` header has no associated data and item 2 of the header must be a negative value. In addition an `X231` header must be followed immediately by another header that is not of type `X231`. Details on the use of the `X231` header can be found in "Output of Large Arrays".

If the file is unformatted, the three header items are read as a single physical record. If the file is formatted, the following Fortran format is used:

```
(1X, "'", A8, "'", 1X, I11, 1X, "'", A4, "'")
```

In ECLIPSE formatted output files, the character strings are surrounded by single quotes (ASCII character decimal 39) for readability.

The data contents follow the descriptor (starting on a new record). Numerical arrays are divided into blocks of up to 1000 items each. Character data are divided blocks of up to 105 8-character words each. For unformatted files, the physical record size is the same as the block size. Formatted files consist of 80-character physical records, read using the following Fortran formats:

Integer `6(1X, I11)`

Real `4(1X, E16.8)`

Logical `25(1X, L2)`

Double Precision `3(1X, D22.14)`

Character(len=8) `7(1X, "'", A8, "'")`

Character(len=nn) (`1X, "'", Ann, "'"`), repeated if possible within 80 characters

In ECLIPSE formatted output files, the 8-character or nn-character strings, are surrounded by single quotes (ASCII character decimal 39) for readability.

Note that multidimensional arrays are ordered according to the Fortran convention, with the left-hand index increasing fastest. For example, in a full array of cell values for a grid with dimensions `NX*NY*NZ`, the position of cell `(IX,IY,IZ)` would be given by:

```
ICELL = (IZ-1)*NX*NY + (IY-1)*NX + IX
```

Output of Large Arrays

Output of arrays having 2^{31} elements or more is facilitated by using a pair of headers. The first header should have the name of the data and the type X231. The second header should follow immediately after the first, have the same name, but the type of the header should reflect the type of the data, for example INTE. The total size of the array is encoded between the two headers as follows:

- The upper part of the total size, calculated as total array size divided by 2^{31} and written with a negative sign as item 2 of the `X231` header.
- The lower part of the total size, calculated as the remainder when divided by 2^{31} and written with a positive sign as item 2 of the second header.

So for example to output an array called 'ACTNUM' of 5,000,000,000 integers in a formatted file the following pair of headers would be required.

```
'ACTNUM  '          -2 'X231'
'ACTNUM  '   705032704 'INTE'
```

Note: The large array format extension (`X231` header) is not yet supported by the ECLIPSE Suite or Petrel, and is defined for use in future releases.

Output from FrontSim

The FrontSim streamline simulator also produces summary, grid, initial and restart files compatible with the formats in this document. Additional timestep files containing streamline information are described in FrontSim Streamline Output Files. They can be processed using packages such as PETREL. A list of files used with FrontSim is shown in FrontSim Files.

3

Summary Files

Summary data can be output in either separate files or in a single, unified file.

- For separate files, ECLIPSE creates one summary file at each simulation report step with a suffix such as Snnnn where nnnn can be between 0000 and 9999. If the summary files originate from a restart run, the suffix numbers will correspond to the restart report step sequence. (For example, for a run started from a restart file created at report step 9, the new summary files will have suffixes S0010, S0011 and so on.)
- For unified file output, data for all report steps are written to the same file, with a new header for each step.

The file naming convention is described in "ECLIPSE File Names".

For each report step, there may be one or more timesteps, also called ministeps, corresponding to the simulation steps taken between reports. Parameter values for the data vectors are output at each ministep. In a complete sequence of summary data, the first ministep will be ministep 0 (written at time 0.0), but the first report step will be report step 1 (written at the end of the first report period). In a restarted run, the ministep numbers are incremented from the previous run.

The summary file contents for each report step are as follows:

Keyword	No. of Items	Data Type	Contents
SEQHDR	1	INTE	Sequence header, with data value ISNUM = an encoded integer corresponding to the time the file was created. For files not originating from ECLIPSE, this value may be set to zero.
MINISTEP	1	INTE	Ministep number (starting at zero and incremented by 1 at each subsequent step)
PARAMS	NLIST	REAL	Vector parameter values at this ministep (corresponding to the vectors defined in the specification file)

Table 3.1: Summary file keywords

One SEQHDR keyword appears at the start of each report step, followed by pairs of MINISTEP and PARAMS keywords for each ministep.

Note: FrontSim uses -0.99999999E+33 as a null value for some summary vector output. This applies to properties that are only calculated once per report step and written out at the end of the step. The values for intermediate ministeps are undefined. The missing data can be filled in by FrontSim, but will give a stair-step effect. To request removal of null values, use the FrontSim keyword `OPTIONFS` and set control switch 2.

Specification file

The summary specification file must be available, for a post-processor to read ECLIPSE summary files. The following table lists the keywords used in the Specification file:

Keyword	No. of Items	Data Type	Contents
`INTEHEAD`	Specified in header	INTE	Integer header array This array is optional but if present should contain the following items: Item 1 – units type: 1 – METRIC, 2 – FIELD, 3 –LAB, 4 - PVT-M Item 2 – simulation program identifier: 100 – ECLIPSE 100 300 – ECLIPSE 300 500 – ECLIPSE 300 (thermal option) 700 – INTERSECT 800 - FrontSim
`RESTART`	9	CHAR	Root name of restart file from which this run originated (if any), up to 72 characters divided into 8-character words
`DIMENS`	6	INTE	Item 1 - NLIST = number of data vector parameters stored at each timestep Item 2 - NDIVIX = number of cells in X-direction Item 3 - NDIVIY = number of cells in Y-direction Item 4 - NDIVIZ = number of cells in Z-direction Item 5 - Dummy Item 6 - ISTAR = report step number of restart file used to start this run (if any)
`KEYWORDS`	NLIST	CHAR	The mnemonic keyword associated with each data vector
`WGNAMES`	NLIST	CHAR	The well or group name associated with each data vector

Keyword	No. of Items	Data Type	Contents
NAMES	NLIST	C0nn	Alternative to WGNAMES for models where the standard short naming convention is not used. For more information see "Vector naming convention". Note: This keyword is not output by either ECLIPSE 100 or ECLIPSE 300.
NUMS	NLIST	INTE	The integer cell or region number associated with each data vector
LGRS	NLIST	CHAR	* The LGR name associated with each data vector (for runs with local grid refinement)
NUMLX	NLIST	INTE	* For local block or completion data vectors, the I-position in the local grid.
NUMLY	NLIST	INTE	* For local block or completion data vectors, the J-position in the local grid.
NUMLZ	NLIST	INTE	* For local block or completion data vectors, the K-position in the local grid.
LENGTHS	NLIST	REAL	* For horizontal well data, the length along the well associated with each summary item (that is distance from bottom- hole reference point to completion)
LENUNITS	1	CHAR	* The units used for horizontal well lengths
MEASRMNT	nblock* NLIST	CHAR	Measurements associated with each vector. “nblock” is an integer that can be obtained by dividing the provided number of elements of this record by “NLIST”.
UNITS	NLIST	CHAR	Units associated with each vector, used when assigning axes to a line graph
STARTDAT	6	INTE	The date of the run start (a) Day (1-31) (b) Month (1-12) (c) Year (as four digits, for example 1952) (d) Hour (0-23) (e) Minute (0-59) (f) Second (expressed in microseconds, 0-59,999,999)
LGRNAMES	NLGR	CHAR	* The names of the local grids defined for this run, if any. (NLGR = number of local grids) Note: This keyword is not output by ECLIPSE 300.
LGRVEC	NLGR	INTE	* The number of summary vectors associated with each LGR Note: This keyword is not output by ECLIPSE 300.
LGRTIMES	NLGR	INTE	* Total number of local ministeps associated with each LGR Note: This keyword is not output by ECLIPSE 300.

Keyword	No. of Items	Data Type	Contents
RUNTIMEI	50	INTE	** Integer data used for run-time monitoring Item 1: 2 if the simulation is finished, 1 otherwise Item 2: initial report number Item 3: current report number Items 4 to 9: initial clock date and time as YYYY, MM, DD, HH, MM, SS Items 10 to 15: most recent clock date and time as YYYY, MM, DD, HH, MM, SS Item 35: value assigned to “BASIC” mnemonic in the RPTRST keyword
RUNTIMED	5	DOUB	** Double precision data used for run-time monitoring
STEPRESN	30	CHAR	* Character mnemonics describing the reasons for selecting timestep lengths in the simulation run (corresponding to integer values of the summary vector STEPTYPE, see "Simulator performance keywords" in the *ECLIPSE Reference Manual*).
XCOORD	NLIST	REAL	Completion coordinates for use with the OFM program Note: This keyword is not output by ECLIPSE 300.
YCOORD	NLIST	REAL	Completion coordinates for use with the OFM program Note: This keyword is not output by ECLIPSE 300.
TIMESTMP	6	INTE	* Integer data to timestamp the summary files in the format YYYY, MM, DD, HH, MM, SS. This keyword is optional and maybe added or modified by the simulator or post-processing applications.

Table 3.2: Specification file keywords

After the NUMS keyword, the keywords are in no particular order.

The naming conventions for identifying data vectors are outlined in "Vector naming convention".

Keywords marked * are optional, depending on the options used in the simulation run. Keywords marked ** are required in ECLIPSE Office.

If an array is present, it must be complete. Data items for which no values are defined may be set to zero (or a blank character string).

Note: Where defaults are used in summary vector specifications in ECLIPSE 100 or ECLIPSE 300, any associated NUMS, NUMLX, NUMLY and NUMLZ values will be negative, and WGNAMES will contain a placeholder string, until they are defined during simulation, at which point the correct values will be inserted into the correct position in the specification file. NLIST in these cases is determined at the start of simulation by the maximum number of values permitted by the dimensioning keywords in the dataset. Items which are never defined (for instance, if a connection vector is requested for all connections in all wells and some wells have more connections than others) will contain these placeholder values even when the run is complete.

LGR summary data

For ECLIPSE 100 runs with local grid refinement, an additional data file with suffix LGR (or FLGR) is produced. This contains LGR summary data for the local ministeps (which may be different for each local grid). Only vectors beginning with LB, LC or LW are written, together with TIME and YEARS values for the local ministeps. The LGR summary file is always unified. The names of the LGRs, the number of summary vectors and the total number of ministeps are defined by the arrays LGRNAMES, LGRVEC and LGRTIMES in the corresponding summary specification file (see "Specification file").

Note that values for the LGR vectors at global timesteps can be read from the standard global summary files.

The following table shows the LGR summary file data produced for each report step:

Keyword	No. of Items	Data Type	Contents
SEQHDR	2	INTE	Sequence header, defining: Item 1 - ISNUM = an encoded integer corresponding to the time the file was created. Item 2 - The global report step number
LGRNAME	1	CHAR	LGR name
MINISTEP	1	INTE	Local ministep number (starting at zero and incremented by 1 at each subsequent step)
PARAMS	NLVEC	REAL	Vector parameter values at this ministep (corresponding to the LGR vectors defined in the specification file). NLVEC = number of parameters for the LGR, defined in array LGRVEC in the SMSPEC file.

Table 3.3: LGR summary file data

One SEQHDR keyword appears at the start of each report step, followed by local ministep data for each LGR. Each LGR name is followed by pairs of MINISTEP and PARAMS keywords for each ministep associated with this local grid.

Vector naming convention

Petrel recognizes the ECLIPSE naming convention for data mnemonics. The initial letters of the vector names are used to determine the vector type and decide what other data are required to uniquely identify the vector, as shown below:

Initial Letter(s)	Data Type	Additional Data Required	Specification File Data
A	Aquifer	Aquifer index number	NUMS keyword
B	Block data	Cell index, calculated from the natural position as (IZ-1)*NX*NY+(IY-1)*NX+IX	NUMS keyword
C	Completion or connection data	Well name and cell index	WGNAMES (or NAMES *) and NUMS keywords

Initial Letter(s)	Data Type	Additional Data Required	Specification File Data
E	Edge data produced by the FrontSim GEOFLOFS option or the ELAPSED keyword	None	
F	Field data	None	
G	Group data	Group name	WGNAMES (or NAMES *) keyword
LB	Local grid block data	LGR name and local grid block i,j,k indices	LGRS keyword and NUMLX, NUMLY, NUMLZ keywords
LC	Local grid completion or connection data	LGR name, well name and local grid block i,j,k indices	LGRS, WGNAMES (or NAMES *) and NUMLX, NUMLY, NUMLZ keywords
LW	Local grid well data	LGR name and well name	LGRS keyword and WGNAMES (or NAMES *) keyword
N	Network node or network general data	Network node vectors require node name. General network vectors require a network name. Other vectors beginning with N require no additional data. (See note below)	WGNAMES (or NAMES *) keyword
P	Network branch (or “pipe”) data	Network branch vectors require branch name, but other vectors beginning with PSS require no additional data	WGNAMES (or NAMES *) keyword
R	Region data	Region number	NUMS keyword. Optional WNAMES (or NAMES *) keyword for simulators that support named regions.
R*F (where * is any letter) and RNLF	Region to region flows	Combined region number calculated as IR1 + 32768*(IR2+10) where flow is from IR1 to IR2	NUMS keyword
RC*M (where * is any letter)	Region with a component number	Combined region and component number calculated as IR + 32768*(IC+10)	NUMS keyword
S	Well segment data	Well segment vectors require the well name and the segment number; other vectors beginning with S require no additional data	WGNAMES (or NAMES *) and NUMS keywords

Initial Letter(s)	Data Type	Additional Data Required	Specification File Data
W	Well or completion data	Well name	WGNAMES (or NAMES *) keyword

Table 3.4: Vector naming convention

Where marked * the NAMES keyword is used between Petrel and INTERSECT for supporting names longer than 8 characters and to support extended names as follows. To support multiple networks, network node and branch names are prefixed with the network name separated with ":". For properties on named completions and segmented well devices the device or completion name is prefixed by the well name separated with ":". For region properties the region name is prefixed by the region family name separated by ":" — this is addition to the numerical region number.

Notes

Note that some vectors are identified as special cases by Petrel:

1. Simulator performance vectors NEWTON, NLINEARS, and so on are not handled as network node data.
2. The vector STEPTYPE and vectors beginning with SGAS, SOIL or SWAT are not treated as well segment vectors.
3. The gradient performance vectors TCPUH, TCPUTSH, HLINEARS, HSUMLINS (used with SimOpt) are non-standard and require parameter name and number, which are defined by keywords WGNAMES and NUMS in the specification file.

Note that several special mnemonics beginning with 'FM', 'GM' and 'WM' are reserved for ECLIPSE control mode vectors and integer counters. The control mode vectors contain integers corresponding to well / group control modes. Current examples include:

WMCTL Well mode of control

FMCTP Field mode of control for production

FMCTG Field mode of control for gas injection

FMCTW Field mode of control for water injection

GMCTP Group mode of control for production

GMCTG Group mode of control for gas injection

GMCTW Group mode of control for water injection

GMCPL Group multi-level compressor level

FMWPR Number of active production wells

FMWIN Number of active injection wells

Additional special mnemonics output by ECLIPSE include:

TIME Simulated time (days or hours in LAB units)

YEARS Simulated time (years)

DAY Calendar day from DATE keyword (1-31)

MONTH Calendar month from DATE keyword (1-12)

YEAR Calendar year from DATE keyword (as four digits, for example 1952)

ECLIPSE can also write out the following simulator performance keywords.

ELAPSED Elapsed run time (seconds)

MAXDPR Maximum pressure change per timestep

MAXDSO Maximum oil saturation change per timestep

MAXDSG Maximum gas saturation change per timestep

MAXDSW Maximum water saturation change per timestep

NEWTON Newton iterations per timestep

NLINEARS Average number of linear iterations per Newton iteration for each timestep

STEPTYPE Reasons for selecting timestep length (integer values corresponding to the mnemonics in the STEPRESN array in the specification file — see "Simulator performance keywords" in the *ECLIPSE Reference Manual*).

TCPU Current CPU usage (seconds)

TCPUTS CPU usage per timestep (seconds)

TCPUDAY CPU usage per simulated day (seconds) or per hour in LAB units

TELAPTS Elapsed time per timestep (seconds)

TELAPDAY Elapsed time per simulated day (seconds) or per hour in LAB units

TIMESTEP Timestep length

A complete list of ECLIPSE summary file mnemonics is given in the *ECLIPSE Reference Manual*.

For output from other simulators, advantage may be taken of the naming convention described here or, alternatively, vector names may be selected to avoid the specified initial letters.

4

GRID Files

The grid geometry file defines the positions of all the cell corner points. The number of active cells and the cell ordering defined in this file must correspond to the ordering of any solution data which will be read in via restart files or user data files.

This chapter describes the original standard corner point geometry format. Files in this format have extension .GRID (binary) or .FGRID (formatted). For 2000A and later releases, a new extensible grid file format is available. This is described in EGRID Extensible Grid Files.

Grid data

The contents of the grid file depend on the `GRIDFILE` option set for the ECLIPSE run. If the `GRIDFILE` option is set to 1, only active global cells are written to the grid geometry file. If the `GRIDFILE` option is set to 2 in the `GRID` section of the ECLIPSE input data, additional data are written out, defining local grid refinements and coarsening groups. The coordinates of any inactive cells are also written out when `GRIDFILE` option 2 is selected.

The grid file contents are arranged as follows:

1. `DIMENS` array for global grid
2. `RADIAL` flag (optional)
3. `BOXORIG` array (optional)
4. `MAPUNITS` keyword (optional)
5. `MAPAXES` array (optional)
6. `GRIDUNIT` array
7. `GDORIENT` keyword (optional)
8. For each global grid cell:
    a. `COORDS` array
    b. `CORNERS` array
9. For each local grid:
    a. `LGR` keyword

   b. LGRILG array

10. DIMENS array for local grid
11. BOXORIG array (optional)
12. RADIAL flag for local grid
13. For each local grid cell:
    a. COORDS array
    b. CORNERS array
14. Non-neighbor connection data for the global grid and for each local grid (optional):
15. NNCHEAD array
16. NNC1 array
17. NNC2 array
18. NNCL array (For LGRs only)
19. NNCG array (For LGRs only)
20. NNCHEADA keyword
21. NNA1 array (For amalgamated LGRs only)
22. NNA2 array (For amalgamated LGRs only)

The MAPUNITS keyword, and the MAPAXES and GRIDUNIT arrays can be used when reloading a simulation grid file into FloGrid.

For a dual porosity model, the grid is set up with the first (NX*NY*NZ)/2 cells defining the matrix blocks and the next (NX*NY*NZ)/2 cells defining the fracture cells.

Note: Grid cells need not be in natural order (such as the output from parallel runs may be in mixed order, depending on which process wrote data first.)

Keyword	No. of Items	Data Type	Contents
DIMENS	3	INTE	Grid dimensions, NX,NY,NZ
RADIAL	1	CHAR	Set to TRUE or FALSE to indicate whether grid is radial
BOXORIG	3	INTE	For a subset of a full grid or LGR, output by the Extract program, the box origin IX,IY,IZ relative to the original grid.
MAPUNITS	1	CHAR	Units used for the MAPAXES data (for example METRES).

Keyword	No. of Items	Data Type	Contents
MAPAXES	6	REAL	Axes defining grid position relative to map coordinates: (a) X-coordinate of end of Y-axis (b) Y-coordinate of end of Y-axis (c) X-coordinate of origin (d) Y-coordinate of origin (e) X-coordinate of end of X-axis (f) Y-coordinate of end of X-axis
GRIDUNIT	2	CHAR	Units used for grid x,y,z data, with flag indicating whether these were output in map or grid coordinates. (a) Units (for example METRES) (b) MAP or MAPFT if map coordinates used, blank otherwise.
GDORIENT	5	CHAR	Grid orientation (a) Property ordering in I direction (b) Property ordering in J direction (c) Property ordering in K direction (d) Z-direction (e) Grid handedness See the GDORIENT keyword in the *ECLIPSE Reference Manual* for more details.
COORDS	4	INTE	All cells active (a) Cell coordinates, IX,IY,IZ (b) Cell number, ICELL
or	5	INTE	Only specified cells active (a) Cell coordinates, IX,IY,IZ (b) Cell number, ICELL (c) Active cell indicator (0 - inactive, 1 - active)
or	7	INTE	Only specified cells active (a) Cell coordinates IX,IY,IZ (b) Cell number, ICELL (c) Active cell indicator (0 - inactive, 1 - active) (d) Host cell number, for an LGR (e) For a coarsened cell, the coarsening group number (or for compressed VE cases, the cell at the top of the compressed VE column).

Keyword	No. of Items	Data Type	Contents
CORNERS	24	REAL	Corner point position array, RC(3,0:1,0:1,0:1) where RC(IDIR,IPOS,JPOS,KPOS) is the value of coordinate IDIR (1=x, 2=y, 3=z) at the cell corner specified by IPOS, JPOS, KPOS. The corner positions are 0 or 1.
LGR	1	CHAR	LGR name
or	2	CHAR	Local grid identification for nested LGR model (used in ECLIPSE 300): Item 1 - LGR name Item 2 - name of parent LGR (or GLOBAL if parent is the global grid) If only the name of the LGR is defined, it will be assumed that the global grid is the parent.
LGRILG	11	INTE	Integer parameters for LGR: Item 1 - NTHETA (=0 for non-radial, =1, 4 or 8 for radial LGR) Items 2 to 7 define the LGR position in the host grid: Item 2 - Lower I-index in host Item 3 - Lower J-index in host Item 4 - Lower K-index in host Item 5 - Upper K-index in host Item 6 - Upper J-index in host Item 7 - Upper I-index in host Item 8 - Max wells in LGR Item 9 - NX for local grid Item 10 - NY for local grid Item 11 - NZ for local grid
NNCHEAD	10	INTE	Non-neighbor connection header. (This excludes NNCs between two amalgamated LGRs, which are reported by NNCHEADA.) Item 1 - NUMNNC = number of NNCs Item 2 - LGR number (0 for global grid) Items 3-10 - Spare
NNC1	NUMNNC	INTE	Upstream cell numbers for non-neighbor connections.
NNC2	NUMNNC	INTE	Downstream cell numbers for non-neighbor connections.
NNCL	NCONGL	INTE	Integer LGR cell numbers, identifying the local cells connected to global grid.
NNCG	NCONGL	INTE	Integer global cell numbers, identifying cells connected to the local grid cells given by the NNCL array. (No of connections = NCONGL.)

Keyword	No. of Items	Data Type	Contents
NNCHEADA	10	INTE	Header for NNCs between two amalgamated LGRs: Item 1 - ILOC1 = index of first LGR Item 2 - ILOC2 = index of second LGR
NNA1	NUMNCA	INTE	Cell numbers in connecting local grid ILOC1
NNA2	NUMNCA	INTE	Cell numbers in connecting local grid ILOC2

Table 4.1: Grid file keywords

Notes on local grid refinement

1. Cell numbers in a local grid are counted independently, starting from 1.
2. Note that radial LGR coordinates are stored in R, Theta, Z units, where Theta is the azimuthal angle measured clockwise in degrees.
3. The following numbering convention is used for local radial grids contained in a single column of host cells:

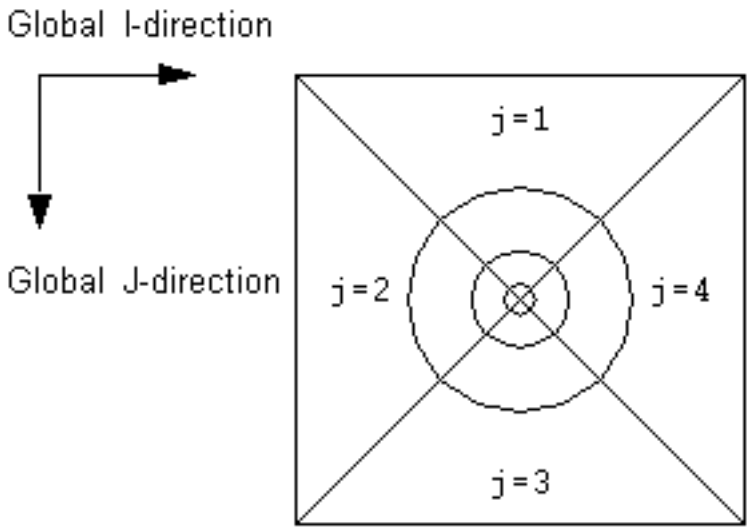

Figure 4.1. Numbering convention used for local radial grids contained in a single column of host cells

   a. The radial cells are numbered so that Theta increases in an anti-clockwise direction.

4. The following numbering convention is used for local radial grids contained in a box of 4 host columns:

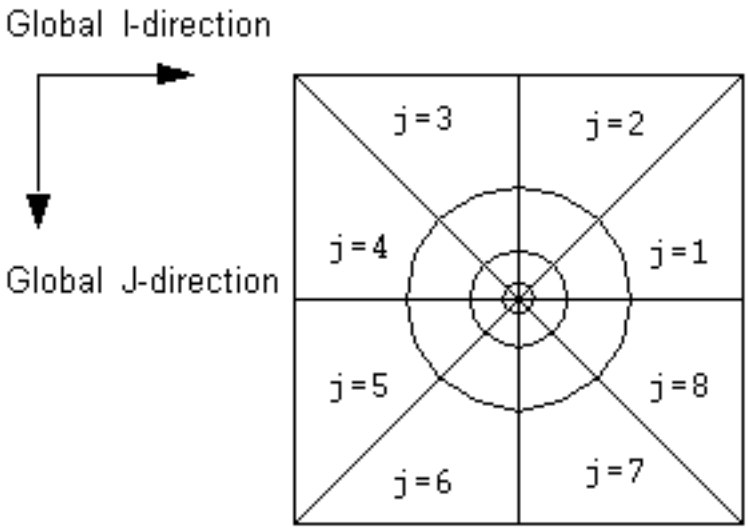

Figure 4.2. Numbering convention used for local radial grids contained in a box of four host columns

a. The LGR center is taken as the coordinate line at the center of the box of host cells.

5. For a single-column radial refinement, the number of cells in the Theta-direction must be set to 1 or 4. A radial refinement in 4 host columns must be specified with 4 or 8 sectors.

Note: If a radial LGR is constructed in a corner-point host grid, ECLIPSE will fill in the maximum number of corners to fully define the local grid. For example, a radial LGR in a block of 4 columns with NTHETA=4 will be written to the grid file with NY=8. The correct value for NTHETA will be written to the LGRILG array and the corresponding solution data arrays will be dimensioned according to NTHETA.

---

6. For an LGR in a dual porosity grid, the position of the LGR is described in terms of the global matrix block.

Notes on coarsening

- Coarsening groups are identified by their coarsening group number, the 7th item in the `COORDS` data. Coarsening group numbers need not be consecutive.
- Coarsening groups are made up of 'rectangular' sets of cells, `(I,J,K)`, where

  I1 ≤ I ≤ I2, J1 ≤ J ≤ J2, K1 ≤ K ≤ K2
- For each active coarsening group in the global grid, one cell is active, called the representative cell. All the other cells are inactive. Solution data in the restart files is only given for the active cells, so there will only be solution data for the representative cell.

  For inactive coarsening groups in the global grid, all cells are inactive and there will be no solution data in the restart files.
- In ECLIPSE only the global grid can be coarsened.

5

EGRID Extensible Grid Files

The Extensible Grid (EGRID) file contains the same information as the standard grid file in corner point or block centered grids, including inactive cell data, non-neighbor connections, local grid refinements and coarsening. The format is typically more efficient, generating a smaller file that is faster to load into post processing programs. Files in this format have extension .EGRID (binary) or .FEGRID (formatted).

An EGRID file or an extended GRID file is required if the grid displays are to include the local grid refinements. The EGRID format is used to store unstructured grid data or hybrid structured/unstructured models (for example PEBI grids). These can be handled in pre- and post-processing software such as FloGrid and FloViz. The file format is described here for completeness.

EGRID files may be generated by pre-processors or selected for output from ECLIPSE, by setting the second GRIDFILE option to 1 in the GRID section of the ECLIPSE input data. Examples of use of the GRIDFILE keyword are shown below.

```
-- Extensible EGRID file only
GRIDFILE
0 1 /
```

```
-- Both EGRID and Extended GRID file
GRIDFILE
2 1 /
```

EGRID file structure

The EGRID file can contain a hierarchy of grids - a top level global grid and local grid refinements (LGRs). Each grid is a 3D array of simulation cells. Depending on the grid type the geometry of the cells can be structured (for example corner point) or unstructured (arbitrary polyhedral cells). With unstructured grids, the global grid or LGR may be a composite grid made up of unstructured sub-grids.

The grid file contents are arranged as follows.

1. File header data:
    a. FILEHEAD
    b. MAPUNITS (optional)
    c. MAPAXES (optional)

   d. `GRIDUNIT`
   e. `GDORIENT` (optional)
2. Global grid data:
   a. `GRIDHEAD`
   b. Keywords for global grid
   c. `ENDGRID`
3. For each LGR:
   a. `LGR`
   b. `LGRPARNT` (For nested LGRs only)
   c. `LGRSGRID` (For LGRs parented from a sub-grid only)
   d. `GRIDHEAD`
4. Keywords for LGR grid
   a. `ENDGRID`
   b. `ENDLGR`
5. Non-neighbor connection data for corner point grids

Keyword	No. of Items	Data Type	Contents
FILEHEAD	100	INTE	Grid file header information: Version number (>= 1) (1) Release year Reserved Backwards compatibility version (the earliest version this file will read into) Grid type: • 0 - Corner point • 1 - Unstructured • 2 - Hybrid (Corner point / Unstructured) Whether model is dual porosity: (>=1) (2) • 0 - single porosity • 1 - dual porosity • 2 - dual permeability Format of the original grid data • 0 - Unknown • 1 - Corner point • 2 - Block centered. • 8-100) not used.
MAPUNITS	1	CHAR	Units used for the MAPAXES data (for example METRES).
MAPAXES	6	REAL	Axes defining grid position relative to map coordinates: X-coordinate of end of Y-axis Y-coordinate of end of Y-axis X-coordinate of origin Y-coordinate of origin X-coordinate of end of X-axis Y-coordinate of end of X-axis
GRIDUNIT	2	CHAR	Units used for grid x,y,z data, with flag indicating whether these were output in map or grid coordinates. Units (for example METRES) MAP or MAPFT if map coordinates used, blank otherwise.

Keyword	No. of Items	Data Type	Contents
GDORIENT	5	CHAR	Grid orientation: Property ordering in I direction Property ordering in J direction Property ordering in K direction Z-direction Grid handedness See the GDORIENT keyword in the *ECLIPSE Reference Manual* for more details.

Table 5.1: EGRID file header keywords

(1) The version numbers are a positive integer (refer to revision history). The integer will be incremented each time a change in the format is released. This will not necessarily be every release cycle. The release year is included for information only.

(2) Dual porosity grids only have geometry for the matrix cells. LGR locations and coarsening groups are entered using matrix cell identifiers and are copied into the fracture system.The ACTNUM keyword has been expanded to store both matrix and fracture activity. This data is only output by ECLIPSE. Grids output by FloGrid and Grid are always nominally single porosity.

Each GRIDHEAD keyword indicates the geometry type for the following grid and the set of keywords used to describe it. Keywords for a grid should be processed until the next ENDGRID is encountered. Similarly LGR keywords should be processed until an ENDLGR keyword is read. For forwards compatibility, readers should skip any unrecognized keywords encountered.

Cell numbers in a local grid are counted independently starting from 1.

Keyword	No. of Items	Data Type	Contents
GRIDHEAD	100	INTE	Start of grid and header information. One of: Type of grid: • 0 - composite • 1 - corner point • 2 - unstructured NX NY NZ LGR index. 0 - global, >0 - LGR 6-24) not used. 25 - 100) reserved for grid type.
ENDGRID	0	INTE	Terminates keywords for a grid.
LGR	N	CHAR	LGR identification: LGR name

Keyword	No. of Items	Data Type	Contents
LGRPARNT	N	CHAR	Parent LGR (for nested LGRs)
LGRSGRID	N	CHAR	Parent sub-grid for LGR's parented from a composite grid
ENDLGR	0	INTE	Terminates LGR keywords.

Table 5.2: Grid keywords

Corner point grids

Keywords for corner point grids are valid following a GRIDHEAD keyword of type 1.

The keywords are arranged as follows:

1. BOXORIG (optional)
2. COORD
3. COORDSYS (optional)
4. ZCORN
5. ACTNUM (optional)
6. CORSNUM (optional)
7. HOSTNUM (for LGRs only)

Keyword	No. of Items	Data Type	Contents
GRIDHEAD	100	INTE	In addition to items described in Table 5.2: 25) NUMRES (number of reservoirs) 26) NSEG (number of coordinate line segments) = 1 27) NTHETA • = 0 for non-radial • > 0 for radial global • = 1, 4 or 8 for radial LGR 28) Lower I-index in host 29) Lower J-index in host 30) Lower K-index in host 31) Upper I-index in host 32) Upper J-index in host 33) Upper K-index in host
BOXORIG	3	INTE	For a subset of a full grid or LGR, output by the Extract program, the box origin IX,IY,IZ relative to the original grid.

Keyword	No. of Items	Data Type	Contents
COORD	6*(NY+1)*(NX +1)*NUMRES	REAL	Coordinate lines, for each reservoir, each defined by top and bottom X,Y,Z values. Syntax is as in the ECLIPSE input keyword of the same name. Where INTERSECT has imported a grid with missing pillars, it will export dummy values as required to be compatible with this format.
COORDSYS	6*NUMRES	INTE	Coordinate system layer definitions for each reservoir. 1) lower bound for block index in k 2) upper bound for block index in k 3) 0 — circle complete, 1 — circle incomplete 4) 0 — join reservoir, 1 — isolate reservoir 5) lower bound for lateral reservoir connection 6) upper bound for lateral reservoir connection Syntax as in the ECLIPSE input keyword of the same name.
ZCORN	(2*NX)*(2*NY)*(2*NZ)	REAL	Z-values for each node in the grid. Syntax as in the ECLIPSE input keyword of the same name. The size of ZCORN must meet the maximum size allowed for a data array as stated in "ECLIPSE output formats". For simulators that do not implement the extended size format described in "Output of Large Arrays", ZCORN imposes the limit that NX * NY * NZ must be less than 2^{28}. Where INTERSECT has imported a grid with missing pillars, it will export dummy values as required to be compatible with this format.
ACTNUM	NX*NY*NZ	INTE	Active cell index: 0 — inactive 1 — active (or active matrix for dual porosity runs) 2 — active fracture (for dual porosity runs) 3 — active matrix and fracture (for dual porosity runs) ECLIPSE LGR host cells are considered to be active. INTERSECT currently treats all cells as active within an EGRID file (value 1), and all dual porosity cells as active both matrix and fracture (value 3).
CORSNUM	NX*NY*NZ	INTE	Coarsening group numbers for each cell (if any)

Keyword	No. of Items	Data Type	Contents
HOSTNUM	NX*NY*NZ	INTE	Host cell number in the parent grid (LGR's only).

Table 5.3: Corner point grid keywords

Non-neighbor connections

Non-neighbor connection data may be included at the end of the file. The keywords are arranged as follows:

For the global grid and for each local grid (optional):

1. NNCHEAD array
2. NNC1 array
3. NNC2 array
4. NNCL array (For LGRs only)
5. NNCG array (For LGRs only)
6. NNCHEADA keyword
7. NNA1 array (For amalgamated LGRs only)
8. NNA2 array (For amalgamated LGRs only)

Keyword	No. of Items	Data Type	Contents
NNCHEAD	10	INTE	Non-neighbor connection header (This excludes NNCs between two amalgamated LGRs, which are reported by NNCHEADA) 1) NUMNNC = number of NNCs 2) LGR number (0 for global grid) 3-10) Spare
NNC1	NUMNNC	INTE	Upstream cell numbers for non-neighbor connections.
NNC2	NUMNNC	INTE	Downstream cell numbers for non-neighbor connections.
NNCL	NCONGL	INTE	Integer LGR cell numbers, identifying the local cells connected to global grid.
NNCG	NCONGL	INTE	Integer global cell numbers, identifying cells connected to the local grid cells given by the NNCL array. (No of connections = NCONGL)
NNCHEADA	10	INTE	Header for NNCs between two amalgamated LGRs: 1) ILOC1 = index of first LGR 2) ILOC2 = index of second LGR
NNA1	NUMNCA	INTE	Cell numbers in connecting local grid ILOC1

Keyword	No. of Items	Data Type	Contents
NNA2	NUMNCA	INTE	Cell numbers in connecting local grid ILOC2

Table 5.4: Corner point NNC keywords

Cell Geometry

The coordinates for node IPOS, JPOS, KPOS (either 0 or 1) for cell I,J,K are constructed from:

1. `x1,y1,z1,x2,y2,z2 = COORD(0:6,I+IPOS,J+JPOS,RES)`

   where `COORDSYS(1,RES) <= K <= COORDSYS(2,RES)`

   or `RES = 1` if not defined.

2. `z=ZCORN(2*I+IPOS-1,2*J+JPOS-1,2*K+KPOS-1)`

3. if `x1=x2` and `y1=y2` then `x=x1, y=y1`

   else

   `x=b*x1+a*x2`, `y=b*y1+a*y2`

   where `a=(z-z1)/(z2-z1)`, `b=1-a`.

Radial Grids

Radial coordinates are stored in R, Theta, Z units, where Theta is the azimuthal angle measured clockwise in degrees.

Global radial domains are numbered clockwise from vertical. Note that, for global radial domains `NY = NTHETA >= 1`.

The following figure shows the numbering convention used for local radial grids contained in a single column of host cells:

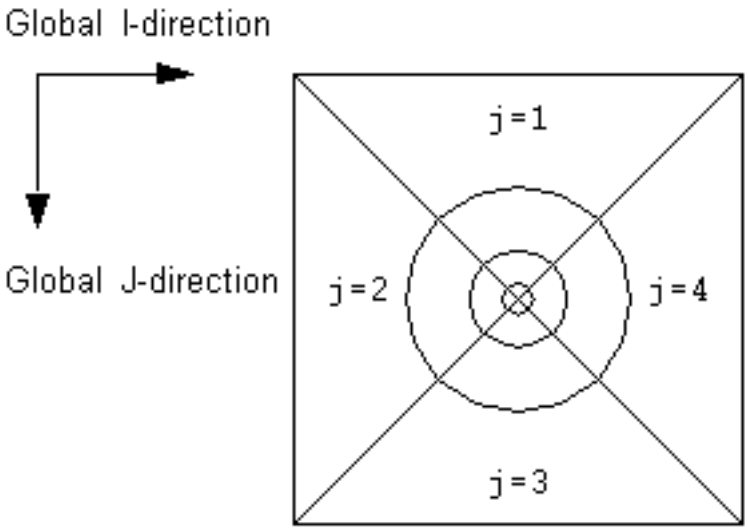

Figure 5.1. Numbering convention used for local radial grids contained in a single column of host cells

The radial cells are numbered so that Theta increases in an anti-clockwise direction.

For post processing displays, the LGR center should be calculated using the x, y coordinates of the geometric center of the top host cell face. Also note that the outer nodes of the radial grid are stored with the R-coordinate set to the outer equivalent radius of the LGR. These coordinates may need to be adjusted to fit the outer radial cells into the host cells.

The following numbering convention is used for local radial grids contained in a box of 4 host columns:

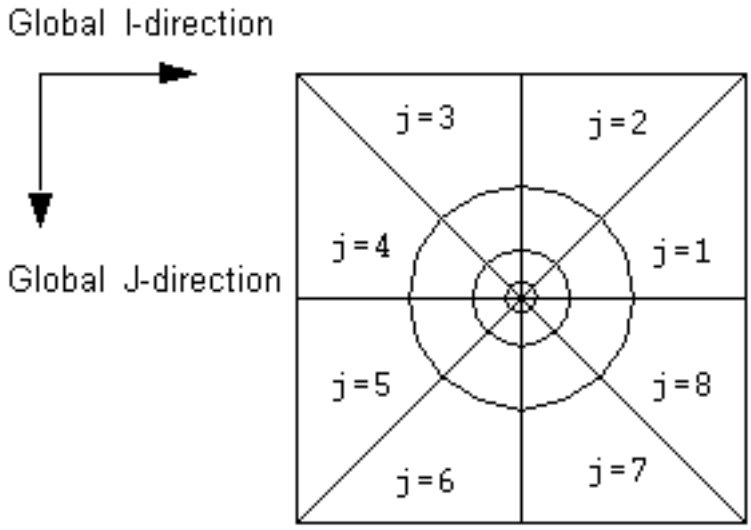

Figure 5.2. Numbering convention used for local radial grids contained in a box of four host columns

The LGR center is taken as the coordinate line at the center of the box of host cells.

For a single-column radial refinement, the number of cells in the Theta-direction must be set to 1 or 4. A radial refinement in 4 host columns must be specified with 4 or 8 sectors.

Note that if a radial LGR is constructed in a corner-point host grid, ECLIPSE may fill in the maximum number of coordinates to fully define the local grid. For a single theta refinement in a single host cell column NY may be 1 or 4. For a 4 theta refinement in 4 host columns NY is 8. The correct value for NTHETA will be written to the GRIDHEAD array. COORD and ZCORN are dimensioned with NY but all other arrays (for example ACTNUM, CORSNUM, HOSTNUM) and the corresponding solution data arrays will be dimensioned according to NTHETA.

Coarsening

Coarsening groups are identified by their coarsening group number with the CORSNUM keyword. Coarsening group numbers need not be consecutive.

Coarsening groups are made up of 'rectangular' sets of cells, (I,J,K), where

I1<=I<=I2, J1<=J<=J2, K1<=K<=K2.

For each active coarsening group in the global grid, one cell is active, called the representative cell. All the other cells are inactive. Solution data in the restart files is only given for the active cells, so there will only be solution data for the representative cell.

For inactive coarsening groups in the global grid, all cells are inactive and there will be no solution data in the restart files.

In ECLIPSE only the global grid can be coarsened. The file format however allows coarsened LGRs so that it can process data from other simulators. Coarsened LGR groups must be identical to their host cell.

As with global coarsening groups, active LGR coarsening groups can have one representative cell. However they need not have any. If all cells in an LGR coarsening group are inactive the solution values from the host cell should be used. In this case, if the host cell is itself inactive, the LGR coarsening group should be displayed as inactive.

Composite grids

Keywords for grids composed of sub-grids are valid following a GRIDHEAD keyword with type 0. They are arranged as follows:

1. EXTREPGL (optional for LGRs)
2. BOXES (optional)
3. For each sub-grid
    a. NAME
    b. GRIDHEAD
    c. Keywords for sub-grid

Composite grids support both a simulation numbering and a virtual grid. The simulation numbering gives a single IJK numbering across all sub-grid cells in order to provide a more efficient solution scheme in structured solvers. Each active sub-grid cell is mapped to exactly one simulation cell. A simulation cell is therefore associated with zero or one sub-grid cell. In the virtual grid all present sub-grid cells are sorted into a regular grid for visualization purposes. Each present sub-grid cell belongs to one virtual grid cell but a virtual grid cell can contain many sub-grid cells.

Keywords for each sub-grid should be processed until the next NAME keyword (or LGR keyword for the last sub-grid) or the end of file in encountered. Note that currently only unstructured grids are included in composite grids.

Keyword	No. of Items	Data Type	Contents
GRIDHEAD	100	INTE	In addition to items described in Table 5.2: 25) Number of sub-grids 26) NX of simulation numbering 27) NY of simulation numbering 28) NZ of simulation numbering 29) NX of virtual grid (or 0 if none defined) 30) NY of virtual grid (or 0 if none defined) 31) NZ of virtual grid (or 0 if none defined) 32) 0 - general unstructured grid, 1 - coordinate line based unstructured grid 33) 0 - disable hinge nodes on coordinate line based unstructured grids, 1 - enable hinge nodes
EXTREPGL	NUMHOST	INTE	Integer array of host cell ids for an LGR.
BOXES	6*NUMBOXES	INTE	Integer array BOXES(NUMBOXES,6) bounding occupancy boxes of present cells in the simulation grid. Each box is defined by minimum i,j,k maximum i,j,k.
NAME	N	CHAR	Name of sub-grid.

Table 5.5: Composite grid keywords

Unstructured grids

Keywords for unstructured grids are valid following a GRIDHEAD keyword with type 2. Unstructured grids may of type “general” in which all cells, faces and nodes are specified explicitly, or may be “coordinate line based” in which a coordinate line description is used for the “2.5D” parts. They are arranged as follows:

1. For 2.5D radial grids:
    a. RADAXIS
    b. RADANISO
2. For 3D radial grids:
    a. RAD3CAPK
    b. RAD3AXIS
    c. RAD3DIRS
    d. RAD3ANIS (optional)

3. AQUIFER (optional)
4. For a stand alone grid or the 1st grid in a composite grid (optional for coordinate line based unstructured grids):
    a. NDCOORD
    b. MODFACE (only for coordinate line based grids)
    c. NFACENOD
    d. FACENODS
    e. FACEHING
    f. FACETYPS
    g. FACEHALO
5. For the first coordinate line based unstructured grid using the areal grid and coordinate line set (there can be multiple areal grids and coordinate line sets):
    a. REPCELL
    b. COORDTYP (optional)
    c. COORDSEG (optional)
    d. COORD
    e. SPLIT (optional)
    f. NSPLITC (optional)
    g. SPLITC (optional)
    h. NULLCORN (optional)
6. At least one of the following:
    a. ZCORN
    b. EXICORN
    c. XYZCORN
7. NCELL2D
8. CELL2D
9. ENDFACE (optional)
10. SIDEFACE (optional)
11. For general unstructured grids and optionally for coordinate line based grids:
    a. MODCELL (only for coordinate line based grids)
    b. NCELLFAC
    c. CELLFACS
    d. CELLCTRS (not for coordinate line based grids)

12. SIMCELL (optional for grids within a composite grid)
13. VIRCELL (optional for grids within a composite grid)
14. EXTCELL (optional for grids within a composite grid)
15. HOSTCELL (For LGRs only)
16. AMALGAM (For LGRs only)

Note that nodes and faces are shared across unstructured grids within the same composite grid.

Keyword	No. of Items	Data Type	Contents
RADAXIS	6	REAL	For a radial grid, two points defining the axis of rotation. x1, y1, z1, x2, y2, z2.
RADANISO	1	REAL	XY permeability scale.
RAD3CAPK	1	INTE	For a 3D radial grid, the number of cells along the radial axis in each end cap.
RAD3AXIS	3*(NZ +2*NCAP-1)	REAL	For a 3D radial grid, x,y,z coordinates for each point on the radial axis.
RAD3DIRS	6*(2*NAXIS-1)	REAL	For a 3D radial grid, direction vectors giving disk directions, along and across the radial axis, alternately for each point on the radial axis and for each segment between points on the radial axis.
RAD3ANIS	3	REAL	For a 3D radial grid, anisotropic scaling in x,y,z.
AQUIFER	1	CHAR	Aquifer grid and type of aquifer ('NUMERICAL').
NDCOORD	3*NNODES	REAL	Real data array NDCOORD(NNODES,3) of nodal coordinates x,y,z for each node in ascending order.
MODFACE	NMFACES	INTE	List of implicit face IDs with modified nodes for coordinate line based grids. NFACENOD and FACENODS keywords following this only apply to the listed faces.
NFACENOD	NFACES	INTE	Integer array of number of nodes for each face, in ascending face order. Used in conjunction with FACENODS to determine the nodes of each face.
FACENODS	TOTAL NFACENOD	INTE	Integer array of nodes. For each face in ascending order, the nodes of that face are listed. Used in conjunction with NFACENOD to determine the nodes of each face.
FACEHING	2*NHIFACES	INTE	Face ID and hinge node ID pairs for each hinged face.
FACETYPS	2*NFTYPES	INTE	Face ID and face type (2-radial, 4 combined radial/linear, 16 spherical) pairs for faces with non-standard face types.
FACEHALO	2*NHAFACES	INTE	Face ID and halo cell ID pairs for faces on LGR cells connecting to the parent grid.
REPCELL	NRCELLS	INTE	List of cells replaced (in earlier grids) when new grids corresponding to the current areal grid and coordinate line set were added.

Keyword	No. of Items	Data Type	Contents
COORDTYP	NCLINES	INTE	Coordinate line types: 0 - undefined, 1 - vertical, 2 - straight, 3 - segmented, -1 general. Not needed if coordinate lines all of same type.
COORDSEG	1 or NSECLINES	INTE	Number of segments on each segmented coordinate line. If all segmented coordinate lines have the same number of segments then only a single value need be written.
COORD	3*NCPTS	REAL	x,y,z triples for vertical, straight and segmented coordinate lines. Top and bottom points are written for vertical and straight coordinate lines, NSEG+1 points are written for segmented coordinate lines.
SPLIT	2*NSPCLINES	INTE	Coordinate line index and number of unique splits for each split coordinate line.
NSPLITC		INTE	Number of cell corners shared by each unique split.
SPLITC		INTE	List of areal cell IDs (positive for top cell, negative for bottom cell) shared by each unique split.
NULLCORN		INTE	Number of present values followed by number of missing values, in ZCORN/EXICORN/XYZCORN order, repeated for all data. Only needed if there are missing values.
ZCORN		REAL	Z values on vertical coordinate lines, in order of unique splits, coordinate line index, then k layer.
EXICORN		REAL	Parameter values on straight and segmented coordinate lines, in order of unique splits, coordinate line index, then k layer. Parameters are scaled to be in the range 0 to 1 for straight coordinate lines and the first segment of segmented coordinate lines, 1 to 2 for the next segment, then 2 to 3, and so on.
XYZCORN		REAL	x,y,z triples for points on general coordinate lines, in order of unique splits, coordinate line index, then k layer.
NCELL2D	N2DCELLS	INTE	Number of coordinate lines defining each areal cell.
CELL2D	TOTAL 2DCELCLS	INTE	List of coordinate line indices for each areal cell. Cell center coordinate lines are automatically set from the last N2DCELL coordinate lines.
ENDFACE	N2DCELLS	INTE	Local top layer 3D face IDs for each areal cell (add number of faces in earlier grids to get true 3D face ID), or -1 if implicit face not used.
SIDEFACE	N2DEDGES	INTE	Local top layer 3D face IDs for each areal cell edge (add number of faces in earlier grids and total number of end faces in this grid to get true 3D face ID), or -1 if implicit face not used.
MODCELL	NMCELLS	INTE	List of implicit cell IDs with modified faces for coordinate line based grids. NCELLFAC and CELLFACS keywords following this only apply to the listed cells.

Keyword	No. of Items	Data Type	Contents
NCELLFAC	NX*NY*NZ	INTE	Integer array of number of faces each cell, in ascending cell ID order. A value of -1 indicates a non-present cell. Used in conjunction with CELLFACS to determine the faces of each cell. NUMCELLS=number of present cells.
CELLFACS	TOTAL NCELLFAC	INTE	Integer array of faces. For each present cell in ascending cell ID order, the faces of that cell are listed. Used in conjunction with NCELLFAC to determine the faces of each cell.
CELLCTRS	3*NUMCELLS	REAL	Real data array CELLCTRS(NUMCELLS,3) of coordinates x,y,z of present cell centers in ascending cell ID order.
SIMCELL	NUMCELLS	INTE	Integer array of mapping between present cell Ids and simulation cell Ids in ascending cell ID order.
VIRCELL	NUMCELLS	INTE	Integer array of mapping between present cell Ids and virtual cell Ids, in ascending cell ID order.
EXTCELL	NUMCELLS	INTE	Integer array of external cell Ids for each present cell.
HOSTCELL	NUMCELLS	INTE	Host cell ids for present local grid cells.
AMALGAM	4	INTE	1) number of domains 2) number of I-cells in external grid 3) number of J-cells in external grid 4) number of K-cells in external grid.

Table 5.6: Unstructured grid keywords

The virtual grid is only for display purposes, and the external grid is a simplified simulation grid, relating to (I,J,K) values.

Extensibility and backward compatibility

For future extensions of the EGRID format, file-related data can be added to the FILEHEAD keyword. Grid-specific integer data can be added to the GRIDHEAD keyword.

Extensibility to additional types of grid geometry would be achieved by defining new grid types via the GRIDHEAD keyword (for example for block-centered geometry or multisegment grids).

Backwards compatibility is supported by version numbers in the FILEHEAD keyword. This contains a unique integer version number which is incremented whenever the format specification version is updated. A backwards compatibility number is also included to determine which is the earliest version of the format that the file is compatible with. Any reader should issue an error message if this number is greater than the version it supports. This will allow old readers to safely read grids in newer formats by skipping keywords they do not recognize.

Currently, a backward compatibility version number of 7 is written if the file contains a coordinate line based unstructured grid.

EGRID revision history

This section describes the changes which have been made to the format each time it has been released - each with a unique FILEHEAD keyword.

Version 1 - Prototype

- Changes made responding to the formal technical review

Version 2 - 99B Release

- NNC Keywords moved to the end of the format.
- ENDGRID and ENDLGR keywords added to make parsing simpler.
- LGR index added to GRIDHEAD to tie NNC information with LGRs.
- Defined the allowable combinations of NTHETA and NY for radial grids.

Version 3 - 2000A Release

- EXTREPGL keyword added for composite grids.
- NTHETA = 1, NY = 1 radial LGRs added for E300.
- Clarified which arrays have NTHETA and NY dimensions if they are different.
- Amended GRIDUNIT keyword 2nd argument to allow MAPFT as well as MAP.
- Extract writes BOXORIG for each corner point grid (global and LGRs).
- Noted that grids output by FloGrid are always nominally single porosity.

Version 4 - 2001A_3 Release

- FACEHING keyword added for unstructured grid hinge nodes.

Version 5 - 2002A Release

- RAD3CAPK, RAD3AXIS, RAD3DIRS and RAD3ANIS keywords added to support 3D radial grids in unstructured grids.
- FACETYPS keyword added for unstructured grid face types.

Version 6

- Prototype extensions for coordinate line based unstructured grids.

Version 7 - 2003A_1 Release

- FACEHALO keyword added for unstructured grid LGRs.

- MODFACE, COORDTYP, COORDSEG, COORD, SPLIT, NSPLITC, SPLITC, NULLCORN, ZCORN, EXICORN, XYZCORN, NCELL2D, CELL2D, ENDFACE, SIDEFACE, MODCELL keywords added for coordinate line based unstructured grids.

6

Restart Files

Restart data

Restart data can be output in separate files, or in a single, unified file.

- For separate restart files, ECLIPSE creates a file at each report step with a suffix such as `Xnnnn`, where `nnnn` lies between 0000 and 9999.
- For unified file output, data for all report steps are written to the same file, with a new header for each step. The precise contents of the restart file depend on the simulator in use and the output requested.

The file naming convention is described in "ECLIPSE File Names".

1. For each report step, the restart file data include:
    a. `SEQNUM` keyword, defining the report step number (in unified files).
    b. Global header data (`INTEHEAD`, `LOGIHEAD`, `DOUBHEAD` arrays)
    c. Global wells, group and completion data
    d. Global solution arrays (for example `SWAT`, `PRESSURE`)
    e. Global NNC solution arrays
    f. `LGRNAMES` array (list of local grids)
    g. `NMATRING` output (additional values for multi-porosity models)
2. For each local grid:
    a. `LGR` keyword, defining grid name
    b. LGR header data (`LGRHEADI`, `LGRHEADQ`, `LGRHEADD`).
    c. Restart header arrays for this LGR (`INTEHEAD`, `LOGIHEAD`, `DOUBHEAD`)
    d. Local wells, group and completion data for this LGR
    e. Local solution arrays for this LGR
    f. Local NNC solution arrays for this LGR
    g. Local to global NNC solution arrays for this LGR

h. NNC flows from this LGR to all those amalgamated with it

i. NMATRING output (additional values for multi-porosity models)

j. An ENDLGR keyword (optional)

The restart file header arrays and LGR header data are used for internal ECLIPSE data. For restart files created from other simulation packages, items in these arrays may be set to dummy values, unless they are defined in this document.

The data contents of the arrays for each LGR are defined as for global arrays.

Keywords which are recognized by Petrel are described on the following pages. Note that other keywords may be present for restart purposes, which are not required for post-processing. The policy is to check the number of elements in an array with a non-standard keyword, and treat it as a solution array if it matches the number of active cells in the grid. The HIDDEN keyword can be used to name solution arrays which are not to be processed.

Keyword	No. of Items	Data Type	Contents
SEQNUM	1	INTE	Sequence number (unified restart files only), set equal to the current report step number.
INTEHEAD	Specified in header	INTE	Integer header array The following items are significant and must be present: Item 1 - ISNUM = an encoded integer corresponding to the time the file was created. For files not originating from ECLIPSE, this value may be set to zero. Item 3 - units type: 1 - METRIC, 2 - FIELD, 3 - LAB, 4 - PVT-M Items 9,10,11 - grid dimensions NX, NY and NZ Item 12 - NACTIV = number of active cells Item 15 - IPHS = phase indicator: • 1 - oil, 2 - water, 3 - oil/water, 4 - gas, 5 - oil/gas, 6 - gas/water, 7 - oil/water/gas (ECLIPSE output only) Item 17 - NWELLS = number of wells Item 18 - NCWMAX = maximum number of completions per well Item 20 - NWGMAX = maximum number of wells in any well group

Keyword	No. of Items	Data Type	Contents
			Item 21 - NGMAXZ = maximum number of groups in field Item 25 - NIWELZ = number of data elements per well in IWEL array Item 26 - NSWELZ = number of data elements per well in SWEL array Item 27 - NXWELZ = number of data elements per well in XWEL array Item 28 - NZWELZ = number of 8-character words per well in ZWEL array Item 33 - NICONZ = number of data elements per completion in ICON array
			Item 34 - NSCONZ = number of data elements per completion in SCON array Item 35 - NXCONZ = number of data elements per completion in XCON array Item 37 - NIGRPZ = number of data elements per group in IGRP array
			Item 38 - NSGRPZ = number of data elements per group in SGRP array Item 39 - NXGRPZ = number of data elements per group in XGRP array Item 40 - NZGRPZ = number of data elements per group in ZGRP array

Keyword	No. of Items	Data Type	Contents
INTEHEAD (continued)	Specified in header	INTE	Item 42 - NCAMAX = maximum number of analytic aquifer connections Item 43 - NIAAQZ = number of data elements per aquifer in IAAQ array Item 44 - NSAAQZ = number of data elements per aquifer in SAAQ array Item 45 - NXAAQZ = number of data elements per aquifer in XAAQ array Item 46 - NICAQZ= number of data elements per aquifer connection in ICAQ array Item 47 - NSCAQZ= number of data elements per aquifer connection in SCAQ array Item 48 - NACAQZ= number of data elements per aquifer connection in ACAQ array
			Item 65 - IDAY = calendar day at this report time (1-31) Item 66 - IMON = calendar month at this report time (1-12) Item 67 - IYEAR = calendar year at this report time (as four digits, for example 1952) Item 95 - IPROG = simulation program identifier: • 100 - ECLIPSE 100 • 300 - ECLIPSE 300 • 500 - ECLIPSE 300 (thermal option) • 700 - INTERSECT • 800 - FrontSim • negative - Other simulator

Keyword	No. of Items	Data Type	Contents
			Item 132 - NODMAX = maximum number of nodes in extended network option Item 133 - NBRMAX = maximum number of branches in extended network option Item 134 - NIBRAN = number of entries per branch in the IBRAN array Item 134 - NRBRAN = number of entries per branch in the RBRAN array Item 136 - NINODE = number of entries per node in the INODE array Item 137 - NRNODE = number of entries per node in the RNODE array Item 138 - NZNODE = number of entries per node in the ZNODE array Item 139 - NINOBR = size of the INOBR array
INTEHEAD (continued)	Specified in header	INTE	Item 163 - NGCAUS = maximum number of aquifer connections actually used. Item 176 - NSWLMX = maximum number of segmented wells Item 177 - NSEGMX = maximum number of segments per well Item 178 - NLBRMX = maximum number of lateral branches per well Item 179 - NISEGZ = number of entries per segment in ISEG array Item 180 - NRSEGZ = number of entries per segment in RSEG array Item 181 - NILBRZ = number of entries per segment in ILBR array Item 207 - IHOURZ = current simulation time HH:MM:SS - number of hours (HH) (0-23). Item 208 - IMINTS = current simulation time HH:MM:SS - number of minutes (MM) (0-59).

Keyword	No. of Items	Data Type	Contents
			Item 224 - NIIAQN = number of lines of integer AQUNUM data. Item 225 - NIRAQN = number of lines of real AQUNUM data. Item 227 - NUMAQN = number of lines of AQUNUM data entered. Item 235 - NICOTZ = number of entries in the ICOT array Item 236 - NXCOTZ = number of entries in the XCOT array Item 237 - NIWETZ = number of entries in the IWET array Item 238 - NXWETZ = number of entries in the XWET array Item 239 - NIGRTZ = number of entries in the IGRT array Item 240 - NXGRTZ = number of entries in the XGRT array Item 241 - NSTRA2 = number of tracers + 2 Item 253 - MAAQID = maximum number of analytic aquifers Item 271 - NCRDMX = maximum number of chord segment links per well Item 411- ISECND = current simulation time HH:MM:SS - number of seconds (SS), reported in microseconds (0-59,999,999) Undefined items in this array may be set to zero.

Keyword	No. of Items	Data Type	Contents
LOGIHEAD	Specified in header	LOGI	Logical header array The following items must be present: Item 4 - Flag set to FALSE for a non-radial model, TRUE for a radial model (ECLIPSE 300 and other simulators) Item 5 - Flag set to FALSE for a non-radial model, TRUE for a radial model (ECLIPSE 100) Item 15 - Flag for dual porosity model Item 31 - Flag for coalbed methane (ECLIPSE 100) Item 128 - Flag for coalbed methane (ECLIPSE 300) Undefined items in this array may be set to FALSE.
DOUBHEAD	Specified in header	DOUB	Double precision header array Item 1 - The time in days (or hours in LAB units), of this report step, since the start of the simulation. Item 161 - The simulation start time in days (or hours in LAB units). Item 162 - The current simulation time in days (or hours in LAB units). This is the sum of item 1 and item 161.

Keyword	No. of Items	Data Type	Contents
IGRP	NIGRPZ*NGMAXZ	INTE	Integer group data array IGRP(NIGRPZ,NGMAXZ) with dimensions in INTEHEAD. The following items are required for each group: Items from 1 to NWGMAX indicate the index of each well in the group, if this is a well group, or the index of each child group in this group if it is a node group Item (NWGMAX + 1) indicates the number of wells or child groups belonging to this group Item (NWGMAX + 27) is the group type: • 0 = well group, 1 = node group, 2 = satellite group, 3 = slave group Item (NWGMAX + 28) is the group level (0 = the field) Item (NWGMAX + 29) is the index of the parent group Undefined items in this array may be set to zero.
SGRP	NSGRPZ*NGMAXZ	REAL	Real group data array SGRP (NSGRPZ, NGMAXZ) with dimensions in INTEHEAD.
XGRP	NSGRPZ*NGMAXZ	DOUB	Double precision group data array XGRP(NXGRPZ,NGMAXZ) with dimensions in INTEHEAD.
ZGRP	NSGRPZ*NGMAXZ	CHAR	Character group data array ZGRP(NZGRPZ,NGMAXZ) with dimensions in INTEHEAD.

Keyword	No. of Items	Data Type	Contents
ISEG	NISEGZ*NSEGMX*NSWLMX (Max >18 items per well)	INTE	Integer multisegment well data array ISEG (NISEGZ, NSEGMX, NSWLMX) with dimensions in INTEHEAD. The following items are used by post-processing software: • Item 2 - Outlet segment number (=0 for segment nearest wellhead) • Item 4 = Branch for this segment (=1 for main stem, 0 if not active segment) More details on use of the multisegment well arrays will be added in future versions of this document.
RSEG	NISEGZ*NSEGMX*NSWLMX	DOUB	Double precision multisegment well data array RSEG(NRSEGZ,NSEGMX,NSWLMX) with dimensions in INTEHEAD.
ILBS	NLBRMX*NSWLMX	INTE	Integer multisegment well data array for lateral branches ILBS(NLBRMX,NSWLMX) with dimensions in INTEHEAD
ILBR	NILBRZ*NLBRMX*NSWLMX	INTE	Integer multisegment well data array for lateral branches ILBR (NILBRZ, NLBRMX, NSWLMX) with dimensions in INTEHEAD.
ICRD	2*NCRDMX*NSWLMX	INTE	Integer multisegment well data array for chords ICRD(2,NCRDMX,NSWLMX) with dimensions in INTEHEAD.

Keyword	No. of Items	Data Type	Contents
IWEL	NIWELZ*NWELLS (Max >110 items per well)	INTE	Integer well data array IWEL(NIWELZ,NWELLS) with dimensions defined in INTEHEAD. These are required for each well. Item 1 - Grid cell I-coordinate for wellhead (<= 0 for a well which is completed in current LGR but has wellhead in another LGR) Item 2 - Grid cell J-coordinate for wellhead (<= 0 for a well which is completed in current LGR but has wellhead in another LGR) Item 3 - Grid cell K-coordinate for wellhead Item 5 - Number of completion connections for this well (that is the total number of grid blocks in which the well is connected). For wells in amalgamated LGRs, this is the total over all LGRs Item 6 - Group index Item 7 - Well type: • 1 = producer, 2 = oil injection, 3 = water injection, 4 = gas injection Item 11 - Well status: • > 0 open, <= 0 shut Item 43 - LGR index for a well with local completions Item 49 - Friction well flag, non-zero for horizontal well Item 71 - Segmented well number (=0 for ordinary wells) Undefined items in this array may be set to zero
SWEL	NSWELZ*NWELLS	REAL	Real well data array SWEL(NSWELZ,NWELLS) with dimensions defined in INTEHEAD.

Keyword	No. of Items	Data Type	Contents
XWEL	NXWELZ*NWELLS	DOUB	Double precision well data array XWEL (NXWELZ, NWELLS) with dimensions defined in INTEHEAD.
ZWEL	NZWELZ*NWELLS	CHAR	All entries are 8 characters: The first entry is the well name The second is the well list to which the well has been allocated and will be blank otherwise The third is the last action triggered by the well this timestep
ICON	NICONZ*NCWMAX*NWELLS (Max >19 items per connection)	INTE	Integer completion data array ICON (NICONZ, NCWMAX, NWELLS) with dimensions defined by INTEHEAD. The following items are required for each completion in each well: Item 1 - Well connection index ICON(1,IC,IWELL) = IC (set to -IC if connection is not in current LGR) Item 2 - I-coordinate (<= 0 if not in this LGR) Item 3 - J-coordinate (<= 0 if not in this LGR) Item 4 - K-coordinate (<= 0 if not in this LGR) Item 6 - Connection status > 0 open, <= 0 shut Item 14 - Penetration direction (1=x, 2=y, 3=z, 4=fractured in x-direction, 5=fractured in y-direction) If undefined or zero, assume Z Item 15 - Segment number containing connection (for multisegment wells, =0 for ordinary wells) Undefined items in this array may be set to zero.

Keyword	No. of Items	Data Type	Contents
SCON	NSCONZ*NCWMAX*NWELSL	REAL	Real completion data array SCON (NSCONZ, NCWMAX, NWELLS) with dimensions defined by INTEHEAD. The following items are required for each completion in each well: Item 1 - Connection factor SCON(1,IC,IWELL) Item 4 - Effective Kh of connection SCON(4,IC,IWELL)
XCON	NXCONZ*NCWMAX*NWELLS	DOUB	Double precision completion data array XCON (NXCONZ, NCWMAX, NWELLS) with dimensions defined by INTEHEAD.
HIDDEN	NHID	CHAR	'Hidden' solution names, used internally in ECLIPSE for restart purposes, to be ignored by the post-processor
ZTRACER	1 or 2	CHAR	Item 1 - Tracer name (ECLIPSE 100 output). Must be followed by the solution data for the tracer concentration values, with solution mnemonic corresponding to the tracer name.
ICOT	NICOTZ*NSTRA2*NCWMAX*NWMAXZ	INTE	Integer tracer completion data array ICOT (NICOTZ, NSTRA2, NCWMAX, NWMAXZ) with dimensions defined by INTEHEAD.
XCOT	NXCOTZ*NSTRA2*NCWMAX*NWMAXZ	DOUB	Double precision tracer completion data array XCOT (NXCOTZ, NSTRA2, NCWMAX, NWMAXZ) with dimensions defined by INTEHEAD.
IWET	NIWETZ*NSTRA2*NWMAXZ	INTE	Integer tracer well data array IWET (NIWETZ, NSTRA2, NWMAXZ) with dimensions defined by INTEHEAD.
XWET	NXWETZ*NSTRA2*NWMAXZ	DOUB	Double precision tracer well data array XWET (NXWETZ, NSTRA2, NWMAXZ) with dimensions defined by INTEHEAD.

Keyword	No. of Items	Data Type	Contents
IGRT	NIGRTZ*NSTRA2*NCWMAX*NWMAXZ	INTE	Integer tracer group data array IGRT (NIGRTZ, NSTRA2, NCWMAX, NWMAXZ) with dimensions defined by INTEHEAD.
XGRT	NXGRTZ*NSTRA2*NCWMAX*NWMAXZ	DOUB	Double precision tracer group data array XGRT (NXGRTZ, NSTRA2, NCWMAX, NWMAXZ) with dimensions defined by INTEHEAD.
INODE	NINODE*NODMAX	INTE	Integer data for network node INODE (NINODE, NODMAX) with dimensions defined by INTEHEAD.
IBRAN	NIBRAN*NBRMAX	INTE	Integer data for network branches IBRAN (NIBRAN, NBRMAX) with dimensions defined by INTEHEAD.
INOBR	NINOBR	INTE	Integer data for network node-branch array INOBR (NINOBR) with dimensions defined by INTEHEAD.
RNODE	NRNODE*NODMAX	DOUB	Double precision data for network nodes RNODE (NRNODE, NODMAX) with dimensions defined by INTEHEAD.
RBRAN	NRBRAN*NBRMAX	DOUB	Double precision data for network branches RBRAN (NRBRAN, NBRMAX) with dimensions defined by INTEHEAD.
ZNODE	NZNODE*NODMAX	CHAR	Character data for network nodes ZNODE (NZNODE, NODMAX) with dimensions defined by INTEHEAD.
IAAQ	NIAAQZ*MAAQID	INTE	Integer data for analytic aquifers IAAQ (NIAAQZ, MAAQID) with dimensions defined by INTEHEAD.
SAAQ	NSAAQZ*MAAQID	REAL	Real data for analytic aquifers SAAQ (NSAAQZ, MAAQID) with dimensions defined by INTEHEAD.
XAAQ	NXAAQZ*MAAQID	DOUB	Double precision data for analytic aquifers XAAQ (NXAAQZ, MAAQID) with dimensions defined by INTEHEAD.

Keyword	No. of Items	Data Type	Contents
IAQL	NIAQLX*MXNALI*MXAAQL	INTE	Integer data for analytic aquifer lists IAQL (NIAQLX, MXNALI, MXAAQL) with dimensions defined by INTEHEAD.
ZAQL	NZAQLX*MXNALI	CHAR	Character data for analytic aquifer lists ZAQL (NZAQLX, MXNALI) with dimensions defined by INTEHEAD.
IAQN	NIIAQN*NUMAQN	INTE	Integer data for numerical aquifers IAQN (NIIAQN, NUMAQN) with dimensions defined by INTEHEAD.
RAQN	NIRAQN*NUMAQN	DOUB	Double precision data for numerical aquifers RAQN (NIRAQN, NUMAQN) with dimensions defined by INTEHEAD.
ICAQ	NICAQZ*NGCAUS*MAAQID	INTE	Integer data for analytic aquifer connections MAAQID arrays, each of size ICAQ (NICAQZ, NGCAUS) with dimensions defined by INTEHEAD.
SCAQ	NSCAQZ*NGCAUS*MAAQID	REAL	Real data for analytic aquifer connections MAAQID arrays, each of size SCAQ (NSCAQZ, NGCAUS with dimensions defined by INTEHEAD.
ACAQ	NACAQZ*NGCAUS*MAAQID	DOUB	Double precision data for analytic aquifer connections MAAQID arrays, each of size ACAQ (NACAQZ, NGCAUS) with dimensions defined by INTEHEAD.
Solution name	NACTIV or NX*NY*NZ	REAL	Solution data in compressed natural order (that is natural order with inactive cells removed, so there are NACTIV values) or solution data for all cells in the grid (NX*NY*NZ values) For a multi-porosity model, the first half of the array corresponds to the matrix blocks and the second half to the fracture cells. Selected values for the additional porosities are output separately using NMATRING.

Keyword	No. of Items	Data Type	Contents
NMATRING	1	INTE	The ring number for the multi-porosity data which follows. Note that this following data will have matrix blocks only, so the number of elements will be half that of the main solution arrays. Only a subset of properties is output for additional porosities.
ENDRING	0	MESS	Indicates the end of multi-porosity data for this grid (LGR or global)
LGRNAMES	NLGR	CHAR	List of LGR names (after end of global data)
LGR	1	CHAR	Name of local grid for which following data are defined.
LGRHEADI	45	INTE	Integer data for LGR, in which item 2 indicates if refinement is active (set <0 if not in use, positive otherwise)
LGRHEADQ	5	LOGI	Logical data for LGR
LGRHEADD	5	DOUB	Double precision data for LGR
LGRJOIN	2	CHAR	Header listing LGR names for connected LGRS, appears just before a FLOOILA+, FLOWATA+ or FLOGASA+ keyword: • Item 1 - ZLOC1 = name of first LGR • Item 2 - ZLOC2 = name of second LGR
ENDLGR	1	INTE	A record indicating the end of the arrays for a particular LGR. The item in the array is the index of the LGR. This record is optional.

Table 6.1: Restart keywords

INSPEC / RSSPEC File Format

This section describes the format of the INSPEC and RSSPEC files written by ECLIPSE, and the fields currently used by consumers of these files. Note that this file format assumes the creating product is written in FORTRAN. The addresses given by the POINTER and POINTERB records therefore point to the first character in a FORTRAN file record which will probably be a control character. If you are reading the file from an application written in anything other than FORTRAN you may need to account for this.

The file follows standard ECLIPSE formatting rules.

1. 'INTEHEAD'

Standard output from the simulator with various internal and external details. For instance, for the `INSPEC` file, the starting date can be accessed using items 65, 66, 67, 207, 208 and 411.

The following two records describe the date and report step and they are present at the start of each new step. The records that follow them relate to them. None of these items are mandatory for the `INSPEC` file where the starting date can be obtained using INTEHEAD.

1. 'TIME' - 1 DOUB

   (1) number of days (or hours in LAB units) since the start of simulation.

2. 'ITIME' - 13 INTE

   (1) Report number

   (2) Report day (1-31)

   (3) Report month (1-12)

   (4) Report year (as four digits, for example 1952)

   (5) Number of the current mini-step. Use -2345 if undefined.

   (6) 1 if the file is a unified restart, otherwise 0

   (7) 1 if the file is formatted, otherwise 0

   (8) 1 if the restart file is written to the save file, otherwise 0. Use -2345 if undefined.

   (9) 1 if the grid file is written and closed, otherwise 0. Use -2345 if undefined.

   (10) 1 if the init file is written and closed, otherwise 0. Use -2345 if undefined.

   (11) Report hour (0-23)

   (12) Report minute (0-59)

   (13) Report second (expressed in microseconds) (0-59,999,999)

The following group of vector records may be repeated several times:

1. 'NAME' - <n vectors> CHAR

   The names of all the vectors found in the INIT file

2. 'TYPE' - <n vectors> CHAR

   The type of the vectors (for example, INTE, LOGI, DOUB, REAL)

3. 'NUMBER' - <n vectors> INTE

   Size of the vectors above

4. 'POINTER' - <n vectors> INTE

   The lower part of the address of the record header in the INIT/RESTART file. This is calculated as modulo(address,2^{31}).

5. 'POINTERB' - <n vectors> INTE

   The upper part of the address of the record header. This is calculated as address/2^{31}. This is 0 for an address smaller than 2Gb. The address can be calculated as:

   `POINTERB*2`^{31}`+POINTER`

6. 'ARRAYMAX' - <n vectors> REAL

   The maximum size of the values of each vector above. Avoids the post-application having to calculate it.

7. 'ARRAYMIN' - <n vectors> REAL

   The minimum size of the values of each vector above. Avoids the post-application having to calculate it.

8. 'MEASRMNT' - <nblock*n vectors> CHAR

   The measurement associated with each vector above. It makes it possible to obtain the unit of the vectors using the measurement system as given by item 3 of INTEHEAD. "nblock" is an integer that can be obtained by dividing the provided number of elements of this record by "n".

9. 'UNITS' - <n vectors> CHAR

   The unit associated with each vector above.

Domain specifiers:

Groups of vector records may be followed by the LGRNAME or LGRSGONE keyword to change the domain to which the records that follow relate.

1. 'LGRNAME' - 1 CHAR

   The name of the LGR to which all following records relate

2. 'LGRSGONE' - 0 MESS

   Indicates the end of the LGR records

Note: Files larger than 2Gb can be produced by any supported versions of the simulators even on a 32bit operating system. The format of POINTER and POINTERB described above does not depend on the operating system.

ECLIPSE solution mnemonics

The following mnemonics are recognized by Petrel as special solution mnemonics. Note that other mnemonics may also be used as required, for output from simulators other than ECLIPSE.

Solution Mnemonic	Data Description	Comments
PRESSURE	Pressure	
SWAT	Water saturation	
SGAS	Gas saturation	
SOIL	Oil saturation	
RS	Gas-oil ratio	
RV	Oil-gas ratio	
RSSAT	Saturated gas-oil ratio	
RVSAT	Saturated oil-gas ratio	

Solution Mnemonic	Data Description	Comments
STATES	Gas-oil state indicator	ECLIPSE 100 output
OWC	Oil-water contact	Contact depth values used for VE displays
OGC	Oil-gas contact	
GWC	Gas-water contact	
EOWC	Minimum oil-water contact	
EOGC	Maximum oil-gas contact	
OILAPI	Oil API values	ECLIPSE 100 output. API tracking option only.
SDENO	Oil surface densities	ECLIPSE 100 output. API tracking option only.
FIPOIL	Oil fluid-in-place. Identical to SFIPOIL for ECLIPSE 100 and to RFIPOIL for ECLIPSE 300.	Used for volumetric calculations
FIPGAS	Gas fluid-in-place. Identical to SFIPGAS for ECLIPSE 100 and to RFIPGAS for ECLIPSE 300.	
FIPWAT	Water fluid-in-place. Identical to SFIPWAT for ECLIPSE 100 and to RFIPWAT for ECLIPSE 300.	
SFIPOIL	Oil fluid-in-place at surface/separator conditions.	
SFIPGAS	Gas fluid-in-place at surface/separator conditions.	
SFIPWAT	Water fluid-in-place at surface/separator conditions.	
SFIPPLY, RFIPPLY	Polymer-in-place (POLYMER option)	ECLIPSE 100 output
SFIPSAL, RFIPSAL	Salt-in-place (BRINE option when used with polymer)	ECLIPSE 100 output
SFIPSOL	Solvent-in-place at surface conditions (SOLVENT option)	ECLIPSE 100 output
SFIPGGI	Dry injection gas in place at surface conditions (GIMODEL option)	ECLIPSE 100 output
RFIPOIL	Oil fluid-in-place at reservoir conditions	
RFIPGAS	Gas fluid-in-place at reservoir conditions	
RFIPWAT	Water fluid-in-place at reservoir conditions	
RFIPSOL	Solvent-in-place at reservoir conditions (SOLVENT option)	ECLIPSE 100 output
RFIPGGI	Dry injection gas in place at reservoir conditions (GIMODEL option)	ECLIPSE 100 output
OIL-POTN	Oil potential	or OIL_POTN

Solution Mnemonic	Data Description	Comments
GAS-POTN	Gas potential	or GAS_POTN
WAT-POTN	Water potential	or WAT_POTN
POLYMER	Polymer concentrations	ECLIPSE 200 output
PADS	Adsorbed polymer concentrations	ECLIPSE 200 output
CABINnnn	This is for use with the PLYTRRFA keyword only. It is the part of PADS that has an RRF value produced by a temperature in the temperature interval nnn of the PLYTRRF keyword table. nnn can be between 001 and 999 but must not exceed the argument of PLYTRRFA.	ECLIPSE 200 output
POLYMAX	Maximum historic polymer concentration	ECLIPSE 200 output
SALT	Brine concentration	ECLIPSE 200 output
TEMP	Temperature	ECLIPSE 100 output
XMF	Liquid mole fractions	ECLIPSE 300 output
YMF	Vapor mole fractions	ECLIPSE 300 output
ZMF	Total mole fractions	ECLIPSE 300 output
SSOL	Solvent saturation	ECLIPSE 200 output
PBUB	Bubble point pressure	
PDEW	Dew point pressure	
SURFACT	Surface interactions	ECLIPSE 200 output
SURFADS	Adsorbed surfactant concentrations	ECLIPSE 200 output
SURFMAX	Maximum surfactant concentrations	ECLIPSE 200 output
SURFCNM	Surfactant capillary numbers	ECLIPSE 200 output
SURFST	Surface tension in surfactant runs.	ECLIPSE 200 output
GGI	GI injected gas ratio	ECLIPSE 200 output
WAT-PRES	Water phase pressure	or WAT_PRES
GAS-PRES	Gas phase pressure	or GAS_PRES
OIL-VISC	Oil viscosity	or OIL_VISC or VOIL (ECLIPSE 300)
WAT-VISC	Water viscosity	or WAT_VISC or VWAT (ECLIPSE 300))
GAS-VISC	Gas viscosity	or GAS_VISC or VGAS (ECLIPSE 300)
OIL-DEN	Oil density	or OIL_DEN
WAT-DEN	Water density	or WAT_DEN
GAS-DEN	Gas density	or GAS_DEN

Solution Mnemonic	Data Description	Comments
DRAINAGE	Drainage region numbers	Output as integer array for 2003A and later releases. Output as real array for previous versions.
DRAINMIN	Drainage sink indicator	
PCOW	Oil-water capillary pressure	
PCOG	Oil-gas capillary pressure	
1OVERBO	Reciprocal of oil formation volume factor	or 1/FVFOIL
1OVERBW	Reciprocal of water formation volume factor	or 1/FVFWAT
IOVERBG	Reciprocal of gas formation volume factor	or 1/FVFGAS
POT_CORR	Initial contact corrected potential	
OILKR	Oil relative permeability	
WATKR	Water relative permeability	
GASKR	Gas relative permeability	
HYDH	Hydraulic head	ECLIPSE 100 output
HYDHFW	Fresh water hydraulic head	ECLIPSE 100 output
PORV	Pore volume at surface conditions	
RPORV	Pore volume at reservoir conditions	
FOAM	Foam concentration	ECLIPSE 100 output
FOAMADS	Foam adsorption	ECLIPSE 100 output
FOAMMAX	Foam maximum historic concentration	ECLIPSE 100 output
FOAMDCY	Foam decay	ECLIPSE 100 output
FOAMCNM	Foam capillary numbers	ECLIPSE 100 output
FOAM_HL	Foam half-life	ECLIPSE 100 output
FOAMMOB	Foam mobility multiplier	ECLIPSE 100 output
ALKALINE	Alkaline concentration	ECLIPSE 100 output
ALKADS	Alkaline adsorption	ECLIPSE 100 output
ALKMAX	Alkaline maximum historic concentration	ECLIPSE 100 output
STMALK	Alkaline water/oil surface tension multipliers	ECLIPSE 100 output
SFADALK	Alkaline surfactant adsorption multipliers	ECLIPSE 100 output
PLADALK	Alkaline polymer adsorption multipliers	ECLIPSE 100 output
PADMAX	Alkaline polymer maximum historic adsorption	ECLIPSE 100 output
CATSURF	Divalent cation concentration associated with surfactant	ECLIPSE 100 output
CATROCK	Divalent cation concentration associated with rock	ECLIPSE 100 output
ESALSUR	Effective salinity for surfactant	ECLIPSE 100 output

Solution Mnemonic	Data Description	Comments
ESALPLY	Effective salinity for polymer	ECLIPSE 100 output
COALGAS	Coal gas concentration for coal bed methane option	ECLIPSE 100 output
COALSOLV	Solvent concentration for coal bed methane option	ECLIPSE 100 output
GASSATC	Initial coal gas saturated content for coal bed methane option	ECLIPSE 100 output
MLANG	Langmuir scaling factors for coal bed methane option	ECLIPSE 100 output
MLANGSLV	Langmuir scaling factors for solvent in coal bed methane option	ECLIPSE 100 output
SWMIN	Minimum water saturation	ECLIPSE 100 output
SWMAX	Maximum water saturation	ECLIPSE 100 output
ISTHW	Water capillary pressure state	ECLIPSE 100 output
SOMAX	Maximum oil saturation	ECLIPSE 100 output
ISTHG	Gas capillary pressure state	ECLIPSE 100 output
SGMIN	Minimum gas saturation	ECLIPSE 100 output
SGMAX	Maximum gas saturation	ECLIPSE 100 output
PRESROCC	Rock pressure values used for rock compaction model	ECLIPSE 100 output
CNV_OIL	Worst cells depending on the residual of the oil equation	ECLIPSE 100 output
CNV_WAT	Worst cells depending on the residual of the water equation	ECLIPSE 100 output
CNV_GAS	Worst cells depending on the residual of gas equation	ECLIPSE 100 output
CNV_PLY	Worst cells depending on the residual of the polymer equation (POLYMER option)	ECLIPSE 100 output
TRANEXX/Y/Z	Transmissibilities in excavation runs	
EXCAVNUM	Excavation status identifier	
CNV_SAL	Worst cells depending on the residual of the brine equation (BRINE option when used with polymer)	ECLIPSE 100 output
CNV_SOL	Worst cells depending on the residual of the solvent equation (SOLVENT option)	ECLIPSE 100 output
CNV_GGI	Worst cells depending on the residual of the Gi Pseudo-Compositional model (GIMODEL option)	ECLIPSE 100 output
CNV_DPRE	Worst cells depending on the pressure increment	ECLIPSE 100 output
CNV_DWAT	Worst cells depending on the water saturation increment	ECLIPSE 100 output

Solution Mnemonic	Data Description	Comments
CNV_DGAS	Worst cells depending on the gas saturation increment / R_v increment / R_s increment	ECLIPSE 100 output
CNV_DPLY	Worst cells depending on the polymer concentration increment	ECLIPSE 100 output
CNV_DSAL	Worst cells depending on the brine concentration increment	ECLIPSE 100 output
CNV_DSOL	Worst cells depending on the solvent concentration increment	ECLIPSE 100 output
CNV_DGGI	Worst cells depending on the dry injection gas parameter (Gi) increment	ECLIPSE 100 output
CONV_VBR	Worst cells depending on the volume balance residual	ECLIPSE 300 output
CONV_PRU	Worst cells depending on the pressure update	ECLIPSE 300 output
CONV_NEW	number of Newtons required by each cell in order to satisfy the solution change convergence criteria at the last timestep	ECLIPSE 300 output

Table 6.2: Solution mnemonics

Interblock flow data for arrow diagram plots

`FLOpppd+` Flow rate, at surface conditions, from a cell to its positive neighbors

where

`ppp` is the phase (OIL, GAS, WAT)

`d` is the coordinate direction (I,J,K)

`+` indicates the positive flow direction

for example `FLOOILI+`, `FLOOILJ+`, `FLOOILK+` and so on.

`FLRpppd+` Flow rate, at reservoir conditions, from a cell to its positive neighbors

where

`ppp` is the phase (OIL, GAS, WAT)

`d` is the coordinate direction (I,J,K)

`+` indicates the positive flow direction

for example `FLROILI+`, `FLROILJ+`, `FLROILK+` and so on.

`Vpppd+` Phase velocity for flow from a cell to its positive neighbors (not available in ECLIPSE output; retained for compatibility with some third party products)

where

`ppp` is the phase (OIL, GAS, WAT)

`d` is the coordinate direction (I,J,K)

+ indicates the positive flow direction

for example VWATI+, VWATJ+, VWATK+ and so on.

ECLIPSE can also write out non-neighbor connection data for interblock flows. The arrays are dimensioned by the number of connections and the naming convention is as follows:

FLOpppN+ flow rate, at surface conditions, across a non-neighbor connection

where

ppp is the phase (OIL, GAS, WAT)

+ indicates the positive flow direction

FLOpppL+ flow rate, at surface conditions, across a connection from the global grid to a local grid

where

ppp is the phase (OIL, GAS, WAT)

+ indicates the positive flow direction (from global to local)

FLOpppA+ flow rate, at surface conditions, across a connection from one local grid to another (for amalgamated LGRs)

where

ppp is the phase (OIL, GAS, WAT)

+ indicates the positive flow direction

FLRpppN+ flow rate, at reservoir conditions, across a non-neighbor connection

where

ppp is the phase (OIL, GAS, WAT)

+ indicates the positive flow direction

FLRpppL+ flow rate, at reservoir conditions, across a connection from the global grid to a local grid

where

ppp is the phase (OIL, GAS, WAT)

+ indicates the positive flow direction (from global to local)

FLRpppA+ flow rate, at reservoir conditions, across a connection from one local grid to another (for amalgamated LGRs)

where

ppp is the phase (OIL, GAS, WAT)

+ indicates the positive flow direction

Viscous displacement

`VISCDnPm` Viscous displacement potential of a cell in direction n for phase m in the viscous displacement,

where

`n` identifies the coordinate direction (1=I,2=J,3=K)

`m` identifies the phase (1=OIL, 2=GAS, 3=WAT)

7

INIT Files

INIT data

The initial file is similar in structure to the restart files. It contains grid block properties such as PERMX and also tabular data such as PVT tables, which are defined in the input data for a simulation run, along with some calculated values such as pore volumes. The INIT file contents are arranged as follows:

1. Global header data (INTEHEAD, LOGIHEAD, DOUBHEAD arrays)
2. Global property arrays (for example PORV, DX, PERMX.)
3. For each local grid:
    a. LGR codeph, defining grid name
    b. LGR header data (LGRHEADI, LGRHEADQ, LGRHEADD).
    c. LGR header arrays (INTEHEAD, LOGIHEAD, DOUBHEAD)
    d. Local property arrays for this LGR
4. LGRSGONE codeph to indicate end of LGR data section
5. Tabular data (TABDIMS, TAB, CON arrays)
6. Global region arrays (for example PVTNUM and SATNUM)
7. For each local grid:
    a. LGR codeph, defining grid name
    b. LGR header data (LGRHEADI, LGRHEADQ, LGRHEADD).
    c. Local region arrays for this LGR
8. LGRSGONE codeph to indicate end of LGR data section
9. Global saturation and relative permeability endpoints
10. For each local grid:
    a. LGR codeph, defining grid name
    b. LGR header data (LGRHEADI, LGRHEADQ, LGRHEADD).

c. Local saturation arrays for this LGR

11. LGRSGONE codeph to indicate end of LGR data section
12. For each local grid:
    a. LGR codeph, defining grid name
    b. Local NNC arrays for this LGR
    c. Extract writes BOXORIG for each corner point grid (global and LGRs). LGR codeph, defining grid nameLGR header data (LGRHEADI, LGRHEADQ, LGRHEADD).
13. LGRSGONE codeph to indicate end of LGR data section

Extract writes BOXORIG for each corner point grid (global and LGRs). LGR codeph, defining grid nameLGR header data (LGRHEADI, LGRHEADQ, LGRHEADD). Note that the INIT file does not contain well data or the initial set of solution data obtained from equilibration. Equilibration results are written to restart file 0, and well data are written to subsequent restart files as they are defined in the SCHEDULE section of an ECLIPSE run.

Keyword	No. of Items	Data Type	Contents
SEQNUM	1	INTE	Sequence number present in INIT files created by runs using the unified output option, but not used for post-processing
INTEHEAD	Specified in header	INTE	Integer header array The following items are significant in post-processing software: Item 3 - units type: 1 - METRIC, 2 - FIELD, 3 - LAB, 4 - PVT-M Items 9, 10, 11 - grid dimensions NX, NY and NZ Item 12 - NACTIV = number of active cells Item 14 - grid type. 0 - Corner point, 1 - Unstructured, 2 - Hybrid, 3 - Block center Item 15 - IPHS = phase indicator:1 - oil, 2 - water, 3 - oil/water, 4 - gas, 5 - oil/gas, 6 - gas/water, 7 - oil/water/gas (ECLIPSE output only)

Keyword	No. of Items	Data Type	Contents
			Item 65 - IDAY = calendar day at start of run (1-31) Item 66 - IMON = calendar month at start of run (1-12) Item 67 - IYEAR = calendar year at start of run (as four digits, for example 1952) Item 95 - IPROG = simulation program identifier: 100 - ECLIPSE 100 300 - ECLIPSE 300 500 - ECLIPSE 300 (thermal option) 700 - INTERSECT 800 - FrontSim negative - Other simulator Item 207- IHOURZ = current simulation time HH:MM:SS - number of hours (HH) (0-23). Item 208- IMINTS = current simulation time HH:MM:SS - number of minutes (MM) (0-59). Item 411- ISECND = current simulation time HH:MM:SS - number of seconds (SS), reported in microseconds (0-59,999,999). Undefined items in this array may be set to zero.

Keyword	No. of Items	Data Type	Contents
LOGIHEAD	Specified in header	LOGI	Logical header array The following items are significant in post-processing software: Item 1 - Dissolved gas flag Item 2 - Vaporized oil flag Item 3 - Flag for directional relative permeabilities Item 4 - Flag for reversible relative permeabilities (ECLIPSE 100) Item 4 - Radial model flag (ECLIPSE 300 and other simulators) Item 5 - Radial model flag (ECLIPSE 100) Item 5 - Flag for reversible relative permeabilities (ECLIPSE 300 and other simulators) Item 7 - Flag for hysteresis Item 15 - Flag for dual porosity model Item 17 - Flag for end point scaling Item 18 - Flag for directional end point scaling Item 19 - Flag for reversible end point scaling Item 20 - Flag for alternative end point scaling method Item 36 - Flag for miscible displacement Item 56 - Flag to scale water capillary pressure at maximum water saturation (that is minimum pressure) Item 57 - Flag to scale gas capillary pressure at minimum gas saturation (that is minimum pressure) Item 128 - Flag for coalbed methane (ECLIPSE 300)
DOUBHEAD	Specified in header	DOUB	Double precision header array
PORV	NX*NY*NZ	REAL	Pore volume array, stored in uncompressed natural order with zero values for inactive cells. This array can be used to identify active cells. It should be consistent with the active cell numbering in the GRID file (see GRID Files).

Keyword	No. of Items	Data Type	Contents
Property name	NACTIV (or NX*NY*NZ)	REAL	Grid block property data in compressed natural order (that is natural order with inactive cells removed, so there are NACTIV values) (for example PORO, PERMX, PERMY and PERMZ) for active cells. For a dual-porosity model, the first half of the array corresponds to the matrix blocks and the second half to the fracture cells. Any missing or non-applicable values are set to a dummy "undefined" value of -1.0E20. For a multi-porosity model, the first half of the array corresponds to the matrix blocks and the second half to the fracture cells. Values for the additional porosities are not currently available. Both ECLIPSE 100 and ECLIPSE 300 can also output properties in the uncompressed natural order, with existing values for inactive cells (NX*NY*NZ values). This is either done for all properties in the INIT file or none (except PORV which is always uncompressed).
LGR	1	CHAR	Name of local grid for which following data are defined.
LGRHEADI	45	INTE	Integer data for LGR
LGRHEADQ	5	LOGI	Logical data for LGR
LGRHEADD	5	DOUB	Double precision data for LGR
LGRSGONE	0	MESS	Indicates that last LGR array has been read: following data are for global grid
TABDIMS	Max 100	INTE	Table dimensions data where item 1 = NTABD (total size of table array)
TAB	NTABD	DOUB	Array of tabular data for PVT and saturation properties (see "Tabular data in INIT files")
CON	3	DOUB	Constant PVT data (RS dead oil, RV dead oil, bubble or dew point)
Region data name	NACTIV	INTE	Integer data defining regions in compressed natural order (for example FIPNUM and SATNUM)
Grid region name	NACTIV	INTE	Integer data defining grid regions (for example TNUM, FLUXNUM, MULTNUM, OPERNUM and CORSNUM)
CELLID	NACTIV	INTE	Global cell indices in compressed natural order (INTERSECT only)

Keyword	No. of Items	Data Type	Contents
Aquifer connections AQUIFERA AQUIFERG AQUIFERN	NACTIV	INTE	An array with the header names specified is written to illustrate which cells are connected to each aquifer. If a cell is connected to aquifer N then the number $2^{(N-1)}$ appears in the array
Rock connections ROCKCONA	NACTIV	INTE	An array with the header name specified is written to illustrate which cells are connected to each rock. If a cell is connected to rock N then the number $2^{(N-1)}$ appears in the array
Saturation data name	NACTIV	REAL	Grid block saturation endpoint data in compressed natural order (for example SWCR and SWL)
TRANNNC	NUMNNC	REAL	NNC transmissibilities
DIFFNNC	NUMNNC	REAL	NNC diffusivities
HEATNNC	NUMNNC	REAL	NNC thermal transmissibilities
TRANGL	NCONGL	REAL	For current LGR: Global-local transmissibilities (in LGR data section).
LGRJOIN	2	CHAR	Header listing LGR names for connected LGRs: Item 1 - ZLOC1 = name of first LGR Item 2 - ZLOC2 = name of second LGR
TRANLL	NUMNCA	REAL	Transmissibilities for local-local connections between LGRs ZLOC1 and ZLOC2

Table 7.1: INIT file keywords

ECLIPSE property mnemonics

The following sets of mnemonics are treated as equivalent by post-processing software (for example to allow radial LGR data to be included in a cartesian global grid).

Mnemonics			Description
DX	DR		Grid block dimensions in X or R direction
DY	DTHETA		Grid block dimensions in Y or THETA direction
PERMX	PERMR	PERMI	Permeability in X or R direction
PERMY	PERMTHT	PERMJ	Permeability in Y or THETA direction
PERMZ		PERMK	Permeability in Z direction
MULTX	MULTR	MULTI	Transmissibility multiplier in X+ or R+ direction
MULTY	MULTTHT	MULTJ	Transmissibility multiplier in Y+ or THETA+ direction
MULTZ		MULTK	Transmissibility multiplier in Z+ direction
TRANX	TRANR	TRANI	Transmissibility in X+ or R+ direction

Mnemonics			Description
TRANY	TRANTHT	TRANJ	Transmissibility in Y+ or THETA+ direction
TRANZ		TRANK	Transmissibility in Z+ direction
DIFFMX	DIFFMR	DIFFMI	Diffusivity multiplier in X+ or R+ direction
DIFFMY	DIFFMTHT	DIFFMJ	Diffusivity multiplier in Y+ or THETA+ direction
DIFFMZ		DIFFMK	Diffusivity multiplier in Z+ direction
DIFFX	DIFFR	DIFFI	Diffusivity in X+ or R+ direction
DIFFY	DIFFTHT	DIFFJ	Diffusivity in Y+ or THETA+ direction
DIFFZ		DIFFK	Diffusivity in Z+ direction
DIFFTX	DIFFTR	DIFFTI	Diffusivity in X+ or R+ direction (obsolete, see DIFFX)
DIFFTY	DIFFTTHT	DIFFTJ	Diffusivity in Y+ or THETA+ direction (obsolete, see DIFFY)
DIFFTZ		DIFFTK	Diffusivity in Z+ direction (obsolete, see DIFFZ)
HEATTX	HEATTR		Heat transmissibility in X+ or R+ direction
HEATTY	HEATTTHT		Heat transmissibility in Y+ or THETA+ direction
MLANGI			Input values of MLANG before transformation by LANGMUIR and GASSATC
MLNGSLVI			Input values of MLANGSLV before transformation by LANGSOLV
MLANG			Values of MLANG after transformation by LANGMUIR and GASSATC
MLANGSLV			Values of MLANGSLV after transformation by LANGSOLV

Table 7.2: ECLIPSE property mnemonics

MPFA information

ECLIPSE 300 only

For the Multi-point flux approximation method, the MPFA region numbers and the 9-point forward transmissibilities will be output to the .INIT file for global cells only.

The MPFA regions numbers will be output under the header MPFANUM.

The 9-point forward transmissibilities will be written to the .INIT with the first 4 characters of the heading denoted by “MPFT”. The 5th character will denote the direction of the transmissibility, either “X” or “Y” or “Z”. The last 3 characters in the heading name (characters 6-8) describe the X, Y, and Z offsets in the natural direction to the transmissibility connection from cell (I,J,K) to cell (I+IXOFF, J+JYOFF, K +KZOFF) in the external direction. For example, an offset of -1 will be denoted by the single character “M”, an offset of 0 will be denoted by the single character “O” and an offset of +1 will be denoted by the single character “P”. So, output to the .INIT file could contain headings such as “MPFTXPOM” or “MPFTZPOP” for instance.

Tabular data in INIT files

TABDIMS array

The TABDIMS array defines the dimensions used in the TAB data array. It contains 100 integer values, of which the significant items are shown below.

Item	Keyword	Description
1	NTABDA	Total size of TAB data array
2	IBROCK	Base address for rock property table (ECLIPSE keyword ROCK)
3	NTROCK	Number of tables of rock properties
4	IBROCC	Base address of rock compaction data
5	NPROCC	Number of pressure nodes in rock compaction data table
6	NTROCC	Number of rock compaction data tables
7	IBPVTO	Base address for oil PVT property table
8	JBPVTO	Base address for array of oil pressure nodes
9	NRPVTO	No of composition nodes in oil PVT tables
10	NPPVTO	No of pressure nodes in oil PVT tables
11	NTPVTO	Number of tables of oil PVT properties
12	IBPVTW	Base address for water PVT property table
13	NTPVTW	Number of tables of water properties
14	IBPVTG	Base address for gas PVT property table
15	JBPVTG	Base address for array of gas pressure nodes
16	NRPVTG	No of composition nodes in gas PVT tables
17	NPPVTG	No of pressure nodes in gas PVT tables
18	NTPVTG	Number of tables of gas PVT properties
19	IBDENS	Base address for surface density table
20	NTDENS	Number of tables of surface densities
21	IBSWFN	Base address for water saturation tables
22	NSSWFN	Number of saturation nodes in water saturation functions
23	NTSWFN	Number of water saturation tables
24	IBSGFN	Base address for gas saturation function tables
25	NSSGFN	Number of saturation nodes in gas saturation functions
26	NTSGFN	Number of gas saturation tables
27	IBSOFN	Base address for oil saturation function tables
28	IBSWCO	Base address for array of connate water saturations
29	NSSOFN	Number of saturation nodes in oil saturation functions
30	NTSOFN	Number of oil saturation tables

Item	Keyword	Description
31-40		Reserved
41	IBVETB	Base pointer to VE table data
42	NSVETB	Number of items of VE table data
43	NTVETB	Number of tables of VE data
44	IBTHPR	Base pointer to threshold pressure array
45	IBSLIM	Pointer to SCALELIM data
46	NSENDP	Maximum number of endpoint versus depth nodes
47	NTENDP	Maximum number of endpoint versus depth tables
48	IBRTEM	Base pointer to reference temperature ZREFTEMP used in PVZG input tables
49	IBCTOL	Pointer to the value specified by the TOLCRIT keyword. This is a single value for all the saturation tables.
50		Reserved
51	IBLANG	Base pointer to LANGMUIR table
52	NCLANG	Number of columns of a LANGMUIR table
53	NSLANG	Number of items (rows) of a LANGMUIR table
54	NTLANG	Number of tables of LANGMUIR data
55	IBLNG2	Base pointer to a LANGSOLV table
56	IBCADP	Base pointer to a COALPP table
57	IBCADS	Base pointer to a COALADS table
58	IBROCP	Base pointer to a ROCKPAMA table
59	NTRPMA	Number of tables of ROCKPAMA data

Table 7.3: TABDIMS array values

The default value for all of the above items should be set to 1, as the array pointers and dimensions may be used in Fortran subroutine calls, even if the data are not required.

The rest of the TABDIMS array can be filled with zeros.

TAB array

The TAB array contains the tabular data. It consists of NTABDA double precision values, divided into tables according to the pointers defined in TABDIMS.

The ordering and contents of the data in TAB can be explained by considering it as a set of sub-arrays, equivalenced to multi-dimensional Fortran arrays.

For example, a sub-array with base pointer IBASE, dimensioned for NNODE nodes and NTAB tables, with NCOL columns per table, could be accessed by Fortran calls of the form:

```
CALL CALC( DTABD(IBASE), NNODE, NTAB, NCOL )
```

with the following declaration in subroutine CALC:

```
SUBROUTINE CALC( DTAB, NNODE, NTAB, NCOL )
DOUBLE PRECISION DTAB( NNODE,NTAB,NCOL )
```

Note that the array sizes are set to the maximum value for all tables. Missing values in incomplete arrays are set to a dummy number (that is <= -10.0E20 or >= 10.0E20).

The TAB data are accessed according to the phases present, as defined by the phase flag IPHS, which is item 15 of the INIT file header array INTEHEAD.

The phase flag can take the following values:

1. OIL ONLY
2. WATER ONLY
3. OIL AND WATER
4. GAS ONLY
5. OIL AND GAS
6. GAS AND WATER
7. OIL, WATER AND GAS

The following logical header flags should be set in the INIT file header array LOGIHEAD:

Item 1 Dissolved gas flag

Item 2 Vaporized oil flag

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RFT Vector Files

Output to the RFT file from ECLIPSE is initiated by the keywords `WRFT` and/or `WRFTPLT`. The user can request output of RFT data, PLT data and/or segment data for all wells or selected wells at specified times. Also, RFT data can be written for each well when the well is first opened.

The main categories of data that may be written to the RFT file are:

- RFT data - vector data defining depth, pressure and saturation values for grid blocks containing well connections.
- PLT data - the depth, pressure and oil, water and gas flows at each connection in the well, and also the tubing flows at each connection (that is the inflow rates at surface conditions through the connection and all upstream connections). For Friction Wells and Multisegment Wells, the length down the tubing to each connection is also given. For Multisegment Wells, the segment number containing the connection and its branch number are also given, for use in conjunction with the segment data.
- Segment data - the depth, tubing length, x- and y-location, pressure and oil, water and gas flow rates through each segment, for Multisegment Wells only. Information required to construct the multilateral well structure is also supplied, that is the branch number and its bounding segments and a pointer to the neighboring downstream segment.

See the *ECLIPSE Reference Manual* and *ECLIPSE Technical Description* for more information on Friction Wells and Multisegment Wells.

RFT file contents

The tables below describes the RFT file contents.

The following records are written for each well (NCON = number of connections):

Keyword	Number of Items	Data Type	Contents
`TIME`	1	REAL	Time at which data were recorded
`DATE`	3	INTE	Item 1 - calendar day (1-31) Item 2 - calendar month (1-12) Item 3 - calendar year (as four digits, for example 1952)

Keyword	Number of Items	Data Type	Contents
WELLETC	16	CHAR or C0nn	Well name and units data: Item 1 - units for time Item 2 - well name Item 3 - LGR name (or blank) Item 4 - units for depth Item 5 - units for pressure Item 6 - data being written: String contains R - RFT data String contains P - PLT data String contains S - Segment data For back compatibility, if this item is defaulted (not present), it should imply that RFT data alone are being written. 7 - well type: 'STANDARD' - a standard well 'FRICTION' - a Wellbore Friction well 'MULTISEG' - a Multisegment well 8 - units for oil and water flow rate 9 - units for gas flow rate 10 - units for local volumetric flow rate 11 - units for flow velocity 12 - reserved for developer use 13 - units for viscosity (ECLIPSE 100 only) 14 - units for polymer and brine concentration (ECLIPSE 100 only) 15 - units for polymer and brine flow rates (ECLIPSE 100 only) 16 - units for adsorbed polymer concentration (ECLIPSE 100 only) 17 - units for temperature (INTERSECT only) 18 - units for mass density (INTERSECT only) 19 - units for energy (INTERSECT thermal runs only)
CONIPOS	NCON	INTE	I grid index for connection
CONJPOS	NCON	INTE	J grid index for connection
CONKPOS	NCON	INTE	K grid index for connection

Keyword	Number of Items	Data Type	Contents
HOSTGRID	NCON	CHAR	Host LGR grid name (ECLIPSE only)

Table 8.1: RFT keywords for wells

The following records are written for each well when RFT data are output (NCON = number of connections for current well):

Keyword	Number of Items	Data Type	Contents
DEPTH	NCON	REAL	Depth values for each grid block in which the well has a connection
PRESSURE	NCON	REAL	Grid block pressure values at this time
SWAT	NCON	REAL	Grid block water saturation at this time
SGAS	NCON	REAL	Grid block gas saturation at this time
SOIL	NCON	REAL	Grid block oil saturation at this time (INTERSECT only)
DWAT	NCON	REAL	Grid block water density at this time (INTERSECT only)
DGAS	NCON	REAL	Grid block gas density at this time (INTERSECT only)
DOIL	NCON	REAL	Grid block oil density at this time (INTERSECT only)
TEMP	NCON	REAL	Grid block temperature at this time (INTERSECT only)
MFTAG	NCON	REAL	Tag indicating whether the grid block is in the matrix (1) or fracture (2) in dual porosity simulations (INTERSECT only)
CPLY	NCON	REAL	Grid block polymer concentration (ECLIPSE 100 only)
CPLAD	NCON	REAL	Grid block adsorbed polymer concentration (ECLIPSE 100 only)
CBRI	NCON	REAL	Grid block brine concentration (ECLIPSE 100 only)

Table 8.2: RFT keywords for well connection data

The following records are written for each well when PLT data are output:

Keyword	Number of Items	Data Type	Contents
CONDEPTH	NCON	REAL	Depth at the center of each connection in the well
CONLENST	NCON	REAL	Length down the tubing from the BH reference point to the start of the connection. (This record is NOT present for STANDARD wells.)
CONLENEN	NCON	REAL	Length down the tubing from the BH reference point to the far end of the connection. (This record is NOT present for STANDARD wells.)
CONMD	NCON	REAL	Measured depth at the center of each connection in the well (INTERSECT only)
CONOTUBL	NCON	REAL	Oil flow rate through the tubing at the start of the connection (+ve towards wellhead), at local conditions (INTERSECT only)

Keyword	Number of Items	Data Type	Contents
CONWTUBL	NCON	REAL	Water flow rate through the tubing at the start of the connection (+ve towards wellhead), at local conditions (INTERSECT only)
CONGTUBL	NCON	REAL	Gas flow rate through the tubing at the start of the connection (+ve towards wellhead), at local conditions (INTERSECT only)
CONOTUBD	NCON	REAL	Oil density in the tubing at the connection at local conditions (INTERSECT only)
CONWTUBD	NCON	REAL	Water density in the tubing at the connection at local conditions (INTERSECT only)
CONGTUBD	NCON	REAL	Gas density in the tubing at the connection at local conditions (INTERSECT only)
CONPRES	NCON	REAL	Pressure in the wellbore at the connection
CONORAT	NCON	REAL	Oil production rate of the connection at surface conditions (-ve if injecting)
CONWRAT	NCON	REAL	Water production rate of the connection at surface conditions (-ve if injecting)
CONGRAT	NCON	REAL	Gas production rate of the connection at surface conditions (-ve if injecting)
CONCRAT	NCON	REAL	Polymer production rate of the connection (-ve if injecting, ECLIPSE 100 only)
CONSRAT	NCON	REAL	Brine production rate of the connection (-ve if injecting, ECLIPSE 100 only)
CONSTRAT	NCON	REAL	Steam production rate of the connection at local conditions and converted to a cold water equivalent (-ve if injecting, INTERSECT only for thermal simulations)
CONHRAT	NCON	REAL	Enthalpy (heat) production rate of the connection (-ve if injecting, INTERSECT only for thermal simulations)
CONCCNC	NCON	REAL	Polymer concentration of the connection flow (ECLIPSE 100 only)
CONSCNC	NCON	REAL	Brine concentration of the connection flow (ECLIPSE 100 only)
CONOTUB	NCON	REAL	Oil flow rate through the tubing at the start of the connection (+ve towards wellhead), at surface conditions (that is CONORAT sum over this and all upstream connections, for producers)
CONWTUB	NCON	REAL	Water flow rate through the tubing at the start of the connection (+ve towards wellhead), at surface conditions
CONGTUB	NCON	REAL	Gas flow rate through the tubing at the start of the connection (+ve towards wellhead), at surface conditions
CONCTUB	NCON	REAL	Polymer flow rate through the tubing at the start of the connection (+ve towards wellhead) (ECLIPSE only)
CONSTUB	NCON	REAL	Brine flow rate through the tubing at the start of the connection (+ve towards wellhead) (ECLIPSE only)

Keyword	Number of Items	Data Type	Contents
CONVTUB	NCON	REAL	Volumetric flow rate of the mixture at the start of the connection (+ve towards wellhead), at local tubing conditions
CONFAC	NCON	REAL	Connection transmissibility factor
CONKH	NCON	REAL	Connection Kh value (in INTERSECT reported only when used in the simulation, e.g. in runs with dynamic D-factors)
WELLPLT	8	REAL	Item 1 - Oil flow rate of the well at surface conditions (+ve for production) Item 2 - Water flow rate of the well at surface conditions (+ve for production) Item 3 - Gas flow rate of the well at surface conditions (+ve for production) 4 - Well BHP 5 - Well's BHP reference depth 6 - Reservoir fluid volume rate of the well, at reservoir conditions 7 - Polymer flow rate of the well (+ve for production) 8 - Brine flow rate of the well (+ve for production)
CONNXT	NCON	INTE	Number of the neighboring connection towards the wellhead
CONSEGNO	NCON	INTE	Segment number containing the connection. (This record is output only for MULTISEG wells.)
CONBRNO	NCON	INTE	Branch number containing the connection. This record is output only for MULTISEG wells.)

Table 8.3: RFT keywords for PLT data

The following records are written for each well when segment data are output (NSEG = number of segments for current well; NBRN = number of branches):

Keyword	Number of Items	Data Type	Contents
SEGDIAM	NSEG	REAL	Hydraulic diameter of segment pipe
SEGDEPTH	NSEG	REAL	Depth at the far end of each segment
SEGLENST	NSEG	REAL	Length down the tubing from the zero tubing length reference point to the start of the segment
SEGLENEN	NSEG	REAL	Length down the tubing from the zero tubing length reference point to the far end of the segment
SEGXCORD	NSEG	REAL	X-coordinate at the far end of the segment (as entered with item 11 of its WELSEGS record) (ECLIPSE only)
SEGYCORD	NSEG	REAL	Y-coordinate at the far end of the segment (as entered with item 12 of its WELSEGS record) (ECLIPSE only)
SEGPRES	NSEG	REAL	Pressure in the wellbore at the far end of the segment

Keyword	Number of Items	Data Type	Contents
SEGORAT	NSEG	REAL	Oil flow rate through the segment at its near end (+ve towards wellhead) at surface conditions
SEGWRAT	NSEG	REAL	Water flow rate through the segment at its near end (+ve towards wellhead) at surface conditions
SEGGRAT	NSEG	REAL	Gas flow rate through the segment at its near end (+ve towards wellhead) at surface conditions
SEGCRAT	NSEG	REAL	Polymer flow rate through the segment at its near end (+ve towards wellhead) (ECLIPSE only)
SEGSRAT	NSEG	REAL	Brine flow rate through the segment at its near end (+ve towards wellhead) (ECLIPSE only)
SEGOVEL	NSEG	REAL	Free oil phase flow velocity through the segment
SEGWVEL	NSEG	REAL	Water flow velocity through the segment
SEGGVEL	NSEG	REAL	Free gas phase flow velocity through the segment
SEGOHF	NSEG	REAL	Free oil phase holdup fraction in the segment
SEGWHF	NSEG	REAL	Water holdup fraction in the segment
SEGGHF	NSEG	REAL	Free gas phase holdup fraction in the segment
SEGCCNC	NSEG	REAL	Polymer concentration in the segment (ECLIPSE only)
SEGSCNC	NSEG	REAL	Brine concentration in the segment (ECLIPSE only)
SEGOVIS	NSEG	REAL	Oil phase viscosity in the segment (ECLIPSE only)
SEGWVIS	NSEG	REAL	Pure water phase viscosity in the segment (ECLIPSE only)
SEGGVIS	NSEG	REAL	Gas phase viscosity in the segment (ECLIPSE only)
SEGEMVIS	NSEG	REAL	Polymer/water mixture viscosity in the segment (ECLIPSE only)
SEGTEM	NSEG	REAL	Temperature in the segment (ECLIPSE 300 THERMAL and INTERSECT only)
SEGPSAT	NSEG	REAL	Saturation pressure in the segment. Only output if SPSAT is present in the summary section (ECLIPSE 300 and INTERSECT only)
SEGHFR	NSEG	REAL	Enthalpy flow rate in the segment (ECLIPSE 300 THERMAL and INTERSECT only)
SEGENE	NSEG	REAL	Energy density in the segment (ECLIPSE 300 THERMAL and INTERSECT only)
SEGSQU	NSEG	REAL	Steam quality in the segment (ECLIPSE 300 THERMAL and INTERSECT only)
SEGBRNO	NSEG	INTE	Branch number of the segment
SEGNXT	NSEG	INTE	Number of the neighboring segment towards the wellhead
SEGSSTR	NSEG	REAL	Base strength of ICD on segment
SEGSFOPN	NSEG	REAL	Setting of ICD on segment
BRNST	NBRN	INTE	Segment number at the start of the branch

Keyword	Number of Items	Data Type	Contents
BRNEN	NBRN	INTE	Segment number at the end of the branch

Table 8.4: RFT keywords for well segment data

The following records are written for each river when reach data are output (NREA = number of reaches for current river; NBRN = number of branches):

Keyword	Number of Items	Data Type	Contents
READEPTH	NREA	REAL	River reach Depth
REALENST	NREA	REAL	Length down the tubing from the zero tubing length reference point to the start of the river reach
REALENEN	NREA	REAL	Length down the tubing from the zero tubing length reference point to the far end of the river reach
REAXCORD	NREA	REAL	X-coordinate at the far end of the river reach (as entered with item 9 of its REACHES record)
REAYCORD	NREA	REAL	Y-coordinate at the far end of the river reach (as entered with item 10 of its REACHES record)
REACHFLX	NREA	REAL	River reach Flux
REACHARE	NREA	REAL	River reach cross-sectional area
REACHDEP	NREA	REAL	River reach water depth
REACHEXG	NREA	REAL	River reach exchange flux
REAFRODE	NREA	REAL	River reach Froude number
REACHNBR	NREA	REAL	River reach number
REACHBRN	NREA	INTE	River branch number of the reach
REACHNXT	NREA	INTE	Number of the neighboring reach towards the river mouth
BRNST	NBRN	INTE	Reach number at the start of the branch
BRNEN	NBRN	INTE	Reach number at the far end of the branch
BRANNAME	NBRN	CHAR	Name of the branch

Table 8.5: RFT keywords for river data

Note: In dual porosity systems, matrix connections are output first and then fracture connections.

Use of RFT data in Petrel

When data from the RFT file are loaded into Petrel, the vectors are named according to the following convention:

WRxn or LWRxn (RFT data)

WCxn or LWCxn (Connection data)

WSxn or LWSxn (Segment data)

where x is a mnemonic of 1 or 2 characters

and n is the RFT test number for the well (1,2,3,4...).

Vectors beginning with W have an associated well name, and vectors beginning with LW are identified by a well name and LGR name.

The RFT file mnemonics and their corresponding vector names are shown in the following table:

Mnemonic	Description	Vector
DEPTH	Grid block depth values	WRDn
PRESSURE	Grid block pressures	WRPRn
SWAT	Grid block water saturations	WRSWn
SGAS	Grid block gas saturations	WRSGn
CONDEPTH	Connection depths	WCDn
CONLENST	Tubing length to start of connections	WCLSn
CONLENEN	Tubing length to end of connections	WCLEn
CONPRES	Connection wellbore pressures	WCPRn
CONORAT	Connection oil production rates	WCORn
CONWRAT	Connection water production rates	WCWRn
CONGRAT	Connection gas production rates	WCGRn
CONOTUB	Connection tubing total oil flow rates	WCOTn
CONWTUB	Connection tubing total water flow rates	WCWTn
CONGTUB	Connection tubing total gas flow rates	WCGTn
CONVTUB	Connection tubing total flow rates	WCVTn
CONFAC	Connection transmissibility factor	WCCFn
CONKH	Connection Kh value	WCKHn
CONBRNO	Connection well branch numbers	WCBRn
SEGDEPTH	Segment depths	WSDn
SEGLENST	Tubing length to start of segments	WSLSn
SEGLENEN	Tubing length to end of segments	WSLEn
SEGPRES	Segment pressures	WSPRn
SEGORAT	Segment oil flow rates	WSORn
SEGWRAT	Segment water flow rates	WSWRn
SEGGRAT	Segment gas flow rates	WSGRn
SEGOVEL	Segment oil velocity	WSOVn
SEGWVEL	Segment water velocity	WSWVn
SEGGVEL	Segment gas velocity	WSGVn
SEGOHF	Segment oil holdup fraction	WSOHn
SEGWHF	Segment water holdup fraction	WSWHn

Mnemonic	Description	Vector
SEGGHF	Segment gas holdup fraction	WSGHn
SEGBRNO	Segment well branch numbers	WSBRn

Table 8.6: RFT mnemonics and vector names

9

Optimization State Files

The optimization data specifies the optimization state at each iteration during Reservoir Optimization. See the *ECLIPSE Technical Description* for more information on Reservoir Optimization.The data can be output in separate files, or in a single, unified file.

- For separate files, ECLIPSE creates one optimization state file for each reservoir optimization iteration. For formatted output the file suffix is in the form `Knnnn` and for unformatted output the suffix is of the form `Jnnnn` where `nnnn` is between 0000 and 9999.
- For unified file output, data for all optimization iterations are written to the same file, with a new header for each iteration. This file has a suffix `FOPT` for formatted output and `OPT` for unformatted output.

The file naming convention is described in "ECLIPSE File Names".

The optimization state file contents for each iteration are as follows:

Keyword	No. of Items	Data Type	Contents
`NOPITS`	1	INTE	Header defining the start of the data for an iteration (and also the iteration number)
`NTOTRS`	1	INTE	Number of report steps for this optimization state data

Keyword	No. of Items	Data Type	Contents
SOPP	NPARS*9	DOUB	This record contains the following items of data for each parameter: 1. Parameter value for this iteration 2. Parameter search direction value for this iteration 3. Change in parameter value for this iteration 4. Upper limit on the parameter value 5. Lower limit on the parameter value 6. Parameter value associated with the best valid simulation so far 7. Upper limit on the secondary value of the parameter (that is, gas in a WAG injection parameter) 8. Lower limit on the secondary value of the parameter (that is, gas in a WAG injection parameter) 9. Well control target for SCSA (Segment Cross Sectional Area) parameters

Keyword	No. of Items	Data Type	Contents
IOPP	NPARS*14	INTE	This record contains 14 items of data for each parameter: 1. Parameter type. For field/group parameters: • 1 = group oil production target rate • 2 = group water production target rate • 3 = group gas production target rate • 12 = group oil injection target rate • 13 = group water injection target rate • 14 = group gas injection target rate For well parameters: • 3 = well oil target rate • 4 = well water target rate • 5 = well gas target rate • 7 = well target bottom hole pressure For segment parameters: • 15 = segment cross sectional area 2. Parameter status • 1 = Inactive • 2 = Active • 3 = Lower bounded • 4 = Upper bounded 3. Parameter domain type • 0 = Constant • 1 = Group • 2 = Well • • 3 = Segment 4. Parameter domain index (position in internal data structures) 5. Report index for this parameter 6. Parameter segment index (position in internal data structures) 7. Calculated index (position in internal data structures)

Keyword	No. of Items	Data Type	Contents
IOPP	NPARS*14	INTE	1. Secondary calculated index (position in internal data structures) — only for WAG injection parameters 2. 3. Required mode index • -1 = Not required for segments • 1 = Oil rate • 2 = Water rate • 3 = Gas rate • 5 = Well bottom hole pressure 4. Secondary required mode index for this parameter — only for WAG injection parameters 5. Fluid type • 0 = Undefined • 1 = Produced phase • 2 = Injected phase 6. Fluid index • 0 = Undefined • 1 = Oil • 2 = Water • 3 = Gas 7. Previous parameter status 8. Well control mode — only for segment parameters
ZOPP	NPARS*2	CHAR	This record contains 2 items of data for each parameter: 1. Parameter name mnemonic 2. Parameter domain name

Keyword	No. of Items	Data Type	Contents
IOPF	NFUNC*7	INTE	This record contains 7 items of data for each function: 1. Function type • 1 = Objective function • 2 = Simple inequality constraint • 3 = Complex GOR constraint • 4 = Complex WCT constraint 2. Function status (0=inactive, 1=active) 3. Number of sub-functions 4. First sub-function index 5. Second sub-function index 6. Function start time report index 7. Function end time report index
SOPF	NFUNC*4	DOUB	This record contains 4 items of data for each function: 1. Function value 2. Previous function value 3. Function multiplier 4. Normalizing factor when checking constraint violation
SOPG	NPARS or NFUNC *NPARS based on OPTIONS3 item 77	DOUB	This record contains: NPARS items of data if OPTIONS3(77) = 0: Gradient of the objective function with respect to each parameter NFUNC*NPARS items if OPTIONS3(77) > 0: Gradient of the objective function and all constraints with respect to parameter 1 Gradient of the objective function and all constraints with respect to parameter 2 ..., etc.

Keyword	No. of Items	Data Type	Contents
IOPS	NSUBF*11	INTE	This record contains 11 items of data for each sub-function: 1. Sub-function type • 0 = constant • 1 = O(1)... 2. Domain type • 0 = Constant • 1 = Group • 2 = Well • 3 = Segment 3. Sub-function domain index (position in internal data structures) 4. Sub-function segment index (position in internal data structures)

Keyword	No. of Items	Data Type	Contents
IOPS	NSUBF*11	INTE	1. Fluid type • 0 = Undefined • 1 = Produced phase • 2 = Injected phase 2. Fluid index • 0 = Undefined • 1 = Oil • 2 = Water • 3 = Gas 3. Calculation index. For field and group domains: • 45 = group water production rate • 44 = group oil production rate • 46 = group gas production rate • 68 = group oil injection rate • 69 = group water injection rate • 70 = group gas injection rate For well domains: • 12 = well actual oil rate • 13 = well actual water rate • 14 = well actual gas rate • 16 = well actual bottom hole pressure For segment domains: • 15 = segment profile factor coefficient A Discount flag • 0 = No discounting • 1 = Discounting Time integral flag • 0 = Rate • 1 = Total 4. Sub-function start time report index 5. Sub-function end time report index

Keyword	No. of Items	Data Type	Contents
SOPS	NSUBF*2	DOUB	This record contains 2 items of data for each sub-function: 1. Sub-function coefficient 2. Sub-function discount rate
ZOPS	NSUBF*2	CHAR	This record contains 2 items of data for each sub-function: 1. Sub-function mnemonic 2. Sub-function domain name
CGGV	NPARS	DOUB	This record contains 1 item of data for each parameter: 1. Work vector for the conjugate gradient optimizer
CGHV	NPARS	DOUB	This record contains 1 item of data for each parameter: 1. Work vector for the conjugate gradient optimizer
END	1	MESS	This record indicates the end of the optimization state file.

Table 9.1: Optimization state file data

10

User Data Files

User data files may be used to enter data vectors, solution data and well information into Petrel. There are two main types of user data file:

Keyword-based data

A keyword-based user data file consists of a formatted text file, which contains numerical data delimited by keywords. The files may be created using a text editor or output from a simulation program or other package.

Blank lines and comments are allowed. Comment lines should begin with `--` in the first two character positions. Each data line consists of a keyword followed by some associated data, or a list of real numbers. Real numbers may be entered without a decimal point and E or D floating-point format may be used. Character data such as vector names should be 1-8 characters and any lower case characters will be converted to upper case on input.

Column-format data

Column-format data files can be used to enter vector data into post-processing software. For example, data can be read from a Run Summary file, or from a formatted file created by a spreadsheet package. See "User files in column format" for more information about the file layout.

Vector data in user files

Vector data read from user files are handled in some post-processing software in the same way as vector data read from summary files. However, summary files must be used if there is a requirement to sequence restarted runs. The keyword `VECTOR` denotes the start of a set of vector data. It should be followed by additional keywords specifying origin, units, well name and so on, depending on vector type (see "Vector naming convention"). The vector values are input on one or more lines, delimited by the keywords `VECTOR`, `SOLUTION`, `WELLINFO`, `END` or the end of the file. You should ensure that a suitable reference vector (for example `TIME`) with the correct number of points is available for plotting vectors.

Keyword	Associated Data	Description
`VECTOR`	Vector mnemonic	Indicates the start of data for a vector and defines its mnemonic.
`ORIGIN`	Data origin	Origin mnemonic to be used
`UNITS`	Units name	The units for this vector, used to assign axes to a line graph.

Keyword	Associated Data	Description
WELL	Well name	Well name, required for well and completion data (vector mnemonic initial letter C or W).
GROUP	Group name	Group name, required for group data (vector mnemonic with initial letter G).
NODE	Node name	Node name, required for network node data (vector mnemonic with initial letter N).
AQUIFER	Aquifer number	Aquifer index number for vector mnemonic with initial letter A.
BLOCK	Block indices	Grid block I,J,K indices (integers separated by blank spaces).
REGION	Region number	Region number for vector mnemonic starting with R.
TO	Region number	Destination region for region to region flows (mnemonic starting R*F where * is any letter).
LGR	LGR name	Local grid name, required for LGR data (initial letters of mnemonic LB, LC or LW).
LOCAL	Block indices	Local grid block I,J,K indices
SEGMENT	Well segment no.	Well segment number (vector mnemonic with initial letter S)
GPNAME	Gradient parameter name	Gradient parameter name, used with special history matching vectors (for example TCPUH)
GPNUMBER	Gradient parameter number	Gradient parameter number, used with special history matching vectors (for example TCPUH)

Table 10.1: Vector Keywords

Solution data in user files

The start of a set of solution data in a user data file is denoted by the SOLUTION keyword, which is followed by additional keywords specifying time, origin and so on, then a list of real numbers corresponding to the solution value for each active cell of the associated grid. It is your responsibility to ensure that the number and ordering of the solution values are correct for the grid with the same origin. The end of a set of solution data is indicated by the next VECTOR, SOLUTION, WELLINFO or END keyword, or the end of the file.

Keyword	Associated Data	Description
SOLUTION	Solution mnemonic	Indicates the start of a set of solution data and defines its mnemonic.
DATE	Date in the form dd/mm/yy	Calendar date to be displayed in the index of solution data.
DAYNUMBER	Real number	Day number corresponding to report step for this solution (shown on solution displays).
TIMESTEP	Integer	Report step number for this solution.
ORIGIN	Origin mnemonic	Origin mnemonic used to identify the grid associated with this solution.
UNITS	Units name	Optional.
NLGR	Integer	Number of LGRs for this solution.

Keyword	Associated Data	Description
LGRSOL	LGR name	Indicates start of LGR data associated with the current solution. Note: LGR solution data must be specified in the same order as they are defined in the GRID file.

Table 10.2: Solution keywords

Well data in user files

A set of well data is started with the WELLINFO keyword, followed by ORIGIN, TYPE and WELLHEAD keywords, then one or more TIMESTEP keywords together with BLOCK keywords indicating the grid cells in which the well is completed at each Timestep.

By default, up to 50 wells and 10 completions per well may be defined. These limits may be overwritten using the MAXWELL keyword followed by the new maximum numbers of wells and completions, for example MAXWELL 100 12.

Keyword	Associated Data	Description
WELLINFO	Well name	Indicates start of well data
ORIGIN	Origin mnemonic	Used to associate well data with grid and solution data
TYPE	Well type and status	Well type defined by a single character: P = producer O = oil injection W = water injection G = gas injection Followed by status keyword: OPEN or SHUT
WELLHEAD	Wellhead indices	The wellhead location is defined by its grid-block I,J position, specified by two integers, separated by a blank space.
TIMESTEP	Integer	The report step for which the well completion data are defined.
BLOCK	Block indices and status	Grid block I,J,K indices (integers separated by blank spaces), for a well connection. There should be one block keyword for each cell in which the well is completed at a given timestep. The completion status is defined by a keyword (OPEN/SHUT) on the same line.

Table 10.3: Well keywords

User files in column format

The default layout for a column-format file is based on the format used to write out a Run Summary (RSM) file from some pre-processing software. The data file should start with a header section, identifying the contents of the data columns. This should include a line defining the vector MNEMONICS and, optionally, further lines defining the units for the data, the scale factors to be applied to the data values, the well and group names, the region names, LGR names and block numbers, and the local cell numbers. The naming convention for vector mnemonics applies (see "Vector naming convention").

If the file is in RSM format, you must describe the file layout by indicating which lines contain the required header information and the position of the first line of data.

A column-format file can also be loaded using a GRF file (using the LOAD USER command).

Notes

- If data are missing from any column or header line, then the width of each data column must be consistent throughout the file. If all data columns and headers are complete in every row, then the column widths may be variable.
- The header lines need not appear in any particular order, provided that they precede the data. Rows of header data may be skipped, if required.
- It is not possible to skip over selected columns of data.
- A standard run summary file may contain more than one ‘page’, that is new header information and further data. Other user files can be defined with more than one page by inserting the following two lines before each header (including the first): PAGE <page number>
ORIGIN <origin> where <*page number*> is the current page number <*origin*> is the origin mnemonic (for example, CHAP).
- Files containing tab characters will be expanded, assuming default tab positions at 9,17,25,33, and so on. (If other tab positions were set for some reason, you should expand the file before loading the data into post-processing software.)
- Any data following a comment symbol ‘--’ will be ignored. This allows comments to be appended at the end of a line. (Note that files containing embedded comment symbols ‘--’ followed by valid data will have to be edited before reading into post-processing software.)
- Date vectors in the form `dd-mmm-yy` or `dd/mmm/yy` can be read. The month may be represented by a 2-digit number or a 3-character abbreviation. The year may be a 2-digit number or a 4-digit number.
- Character data are also allowed for well control mode data used for ECLIPSE control mode vectors.
- All other data values must be valid numbers. Integer values will be handled as reals.

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FrontSim Streamline Output Files

The streamline file format consists of one SLNxxxx file for every report step and one SLNSPEC file. The SLNxxxx file holds the geometry and properties of the streamlines, while the SLNSPEC file holds information that is valid for all the report steps. The xxxx designates a report step number from 0001 to 9999. Together the files will contain enough information for effective streamline visualization, without any other geometry or property data needed.

See "File Format Example" for an example of the streamline file format.

ECLIPSE Standard

The files are UNIX-Fortran unformatted binary files, even on the Windows platform, according to the general ECLIPSE standard, to ensure platform independence. Furthermore, all keywords defined in this document that have indexes use base 1 in order to be compatible with all other ECLIPSE output formats.

See "ECLIPSE Output Files" for details of the keyword formats.

Nomenclature

Constants used in the rest of the document.

Symbols	
NNAME	Number of distinctive names for source/sinks.
NSTRL	Number of streamlines in a bank.
NSTRS	Number of streamline segments in a bank of streamlines.
NSTRN	Number of streamline nodes in a bank of streamlines.

Table 11.1: Nomenclature

SLNSPEC File Format

For each run there is one SLNSPEC file. The file contains information that is valid over all timesteps.

```
RESTART   9   CHAR
```

Root name of the restart file from which this run originated, up to 72 characters divided into 8-character words. The keyword is always written, defaulted to 9*8 blanks.

```
EXTENT   6   DOUB
```

This record stores the geometry extent of active cells in the grid. The record contains six numbers in the order xmin, xmax, ymin, ymax, zmin, zmax.

```
NAMES   NNAME   CHAR
```

The names of all sources and sinks over all timesteps. The maximum size of a name is as usual eight characters (padded with blanks).

```
MAPAXES   6   REAL (optional)
```

Axes defining grid position relative to map coordinates

```
GRIDUNIT   2   CHAR (optional)
```

Units used for x, y, z data, with flag indicating whether these were output in a map of grid coordinates.

```
MAPUNITS   1   CHAR (optional)
```

Units used for MAPAXES data (for example METRES).

```
RADIAL   1   CHAR (optional)
```

Set to TRUE or FALSE to indicate whether the grid is radial.

SLNxxxx File Format

The SLN file format supports streamline data being broken into recurring banks of data. Each bank contain streamline data for any number of streamlines. Header keywords occur only once in the beginning.

The main layout of the file is:

<File header keywords>

<Streamline bank keywords>

:

<Streamline bank keywords>

Keyword Records

File header records

INTEHEAD 10 INTE

Each file contains this header record first.

1. Version number for the SLN file. The version number starts from 1.

2. Unit to use for geometry and properties. 1 for METRIC and 2 for FIELD.
3. Phase indicator: 1=oil, 2=water, 3=oil/water, 4=gas, 5=oil/gas, 6=gas/water, 7=oil/water/gas
4. Report step number, integer between 0001 and 9999.
5. Day (1-31)
6. Month (1-12)
7. Year (as four digits, for example 1952)
8. Hour (0-23)
9. Minute (0-59)
10. Second (0-59)

Recurrent banks

GEOMETRY 3*NSTRN DOUB

This record stores the geometry data of the streamlines. The geometry is stored as a contiguous list of (x,y,z) points for any number of streamlines. The keyword starts a new bank of streamline records.

GEOMINDX NSTRL+1 INTE

This record stores the start and implicitly the stop indices for the streamlines in the GEOMETRY record. Note that the indices stored are the location of the x-coordinate value of a node point, immediately followed by the y and z coordinates.

<PROPERTY> (NSTRS/NSTRN/NSTRL) (INTE/DOUB)

The `<PROPERTY>` names are application defined.

`NSTRL` Record holds scalar properties for the streamlines in the bank.

`NSTRS` Record holds segment properties for the streamlines in the bank.

`NSTRN` Record holds nodal properties for the streamlines in the bank.

Note that `NSTRS = NSTRN-NSTRL`.

The bank of streamline records ends when either the end of file is reached, or when the next GEOMETRY keyword is read.

Reserved Property Names

Although the properties in general are application defined, a few property names are reserved. These are:

1. `ID_BEG/END`: Scalar property defining the source/sink number, that is index into the NAMES keyword record in the SLNSPEC file.
2. `ID_CELL`: Segment property holding the cell numbers along the streamline.
3. `TIME_BEG/END`: Node property that holds the time of flight from the first node to any node along the streamline.

File Format Example

Assume a water oil case with three streamlines, as seen in Figure 11.1 for report step 1. Two streamlines starts at the injector "INJ1" and terminate in producer "PROD1". The third streamline starts at a boundary condition "PSIDE" and terminates in "PROD1". The date for the report step is the 20th October 1997 and the time of the report step is 23:50:41.

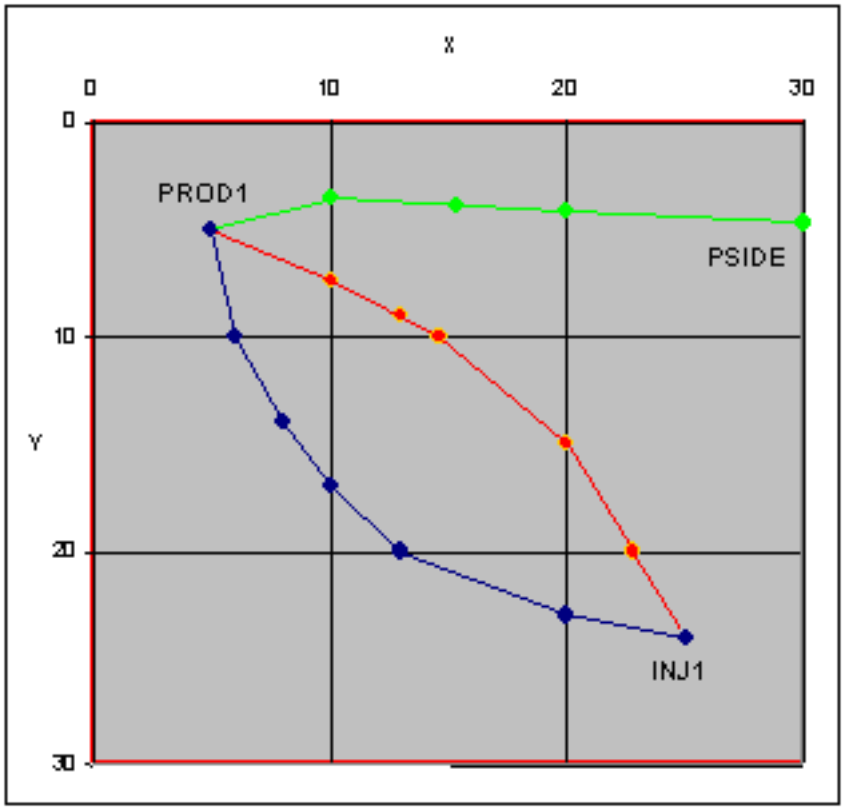

Figure 11.1. Streamlines computed by FrontSim.

Below is an ASCII converted listing of how the SLNSPEC and SLN0001 file will look if Streamline 1 and Streamline 2 are banked together and Streamline 3 represents the second bank.

Streamline 1			Streamline 2			Streamline 3		
X	Y	Z	X	Y	Z	X	Y	Z
25.	24.	2000.	25.	24.	2000.	30.	5.	2000.
20.	23.	2000.	22.	20.	2000.	20.	4.	2000.
13.	20.	2000.	20.	15.	2000.	16.	3.	2000.
10.	17.	2000.	15.	10.	2000.	10.	2.	2000.
8.	14.	2000.	14.	9.	2000.	5.	5.	2000.
6.	10.	2000.	10.	7.	2000.			
5.	5.	2000.	5.	5.	2000.			

Table 11.2: Streamline node points

SLNSPEC file

```
RESTART           9                         CHAR

EXTENT            6                         DOUB
0.         30.    0.           30.          1990.    2010.
NAMES             3.                        CHAR
PROD1      INJ1   PSIDE
```

SLN0001 file

```
INTEHEAD     10     INTE
2   1   3    1    20    10    1997    23    50    41
GEOMETRY     42     DOUB
25. 24. 2000. 20. 23. 2000. 13. 20. 2000. 10. 17. 2000. 8. 14. 2000.   6. 10. 2000.
 5.  5. 2000. 25. 24. 2000. 22. 20. 2000. 20. 15. 2000. 15. 10. 2000. 14.  9. 2000.
10.  7. 2000.  5.  5.  2000.
GEOMINDX     3      INTE
1 22 43
ID_BEG       2      INTE
2 2
ID_END       2      INTE
1 1
ID_CELL      12     INTE
9 8 5 4 4 1 9 6 5 2 2 1
TIME_BEG     14     DOUB
4.2333 7.33 18.84 24.7 29.13 34.25 41. 4. 7. 17.84 20.7 23.3300 31.05 40.
SWAT         12     DOUB
0.75 0.575 0.5 0.4 0.225 0.05 0.5 0.575 0.4 0.3 0.225 0.35
GEOMETRY     15     DOUB
30.  5. 2000. 20. 4. 2000. 16. 3. 2000. 10. 2. 2000. 5.  5. 2000.
GEOMINDX     2      INTE
1 16
ID_BEG       1      INTE
3
ID_END       1      INTE
1
ID_CELL      4      INTE
3 2 2 1
TIME_BEG     5      DOUB
4.2333 7.3300 18.8400 24.7000 29.1300
SWAT         4      DOUB
0.7500 0.5750 0.5000 0.4000
```

A

ECLIPSE File Names

In general, file names are of the form `<directory>root.suffix` where `<directory>` is the optional directory name, `root` is the root name for the data set and `suffix` is an extension depending on the file type.

The suffix type can be selected via the configuration file as UNIX or ANSI. The default is generally UNIX, which means that file names can use full-length extensions (for example `CHAP.SMSPEC`, `CHAP.S0001`,...). Models originating from older VAX or PC systems may use the ANSI suffix (for example `CHAP.SMS`, `CHAP.S01`,...). File names may be in upper or lower case, depending on the installation.

The main file suffixes used with ECLIPSE on each system are defined in the following table. For more information, or for details of file names used with programs other than ECLIPSE, please refer to Schlumberger.

UNIX	ANSI	Description
`DATA`	`DAT`	data input file
`PRT`	`PRT`	main printer output
`DBG`	`DBG`	debug output
`MSG`	`MSG`	message output
`Xnnnn` (`nnnn` <10,000) `Ynnnn` (9999< `1nnnn` <20,000) `Znnnn` (19,999< `2nnnn` <30,000)	`Xnn` (`nn` <100) `Ynn` (99< `1nn` <200) `Znn` (199< `2nn` <300)	unformatted restart file
`SMSPEC`	`SMS`	unformatted summary specification file
`Snnnn` (`nnnn` <10,000) `Tnnnn` (9999< `1nnnn` <20,000) `Unnnn` (19,999< `2nnnn` <30,000)	`Snn` (`nn` <100) `Tnn` (99< `1nn` <200) `Unn` (199< `2nn` <300)	unformatted summary file
`GRID`	`GRD`	unformatted grid file
`INIT`	`INI`	unformatted initial file
`Jnnnn` (`nnnn` <10,000)	`Jnn` (`nn` <100)	unformatted optimization state file
`OPT`	`OPT`	unformatted unified optimization state file

UNIX	ANSI	Description
LOG	LOG	log file
UNRST	URS	unformatted unified restart file
UNSMRY	USY	unformatted unified summary file
SAVE	SAV	unformatted save file (quick restart file)
Vnnnn (nnnn <10,000) Wnnnn (9999< 1nnnn <20,000) Knnnn (19,999< 2nnnn <30,000)	Vnn (nn <100) Wnn (99< 1nn <200) Knn (199< 2nn <300)	unformatted ECLIPSE 300 save file (quick restart file)
FLUX	FLX	unformatted flux data file
LGR	LGR	unformatted LGR vector data file
RFT	RFT	unformatted RFT vector data file
HMD	HMD	unformatted well gradients file
GRFT	GFT	unformatted RFT gradients file
RSSPEC	RSS	unformatted index for restart files
INSPEC	ISS	unformatted index for initial file
Fnnnn (nnnn <10,000) Gnnnn (9999< 1nnnn <20,000) Hnnnn (19,999< 2nnnn <30,000)	Fnn (nn <100) Gnn (99< 1nn <200) Hnn (199< 2nn <300)	formatted restart file
FSMSPEC	FSM	formatted summary specification file
Annnn (nnnn <10,000) Bnnnn (9999< 1nnnn <20,000) Cnnnn (19,999< 2nnnn <30,000)	Ann (nn <100) Bnn (99< 1nn <200) Cnn (199< 2nn <300)	formatted summary file
FGRID	FGR	formatted grid file
FINIT	FIN	formatted initial file
FUNRST	FUR	formatted unified restart file
FUNSMRY	FUS	formatted unified summary file
FSAVE	FSA	formatted save file (quick restart file)
Dnnnn (nnnn <10,000) Ennnn (9999< 1nnnn <20,000) Innnn (19,999< 2nnnn <30,000)	Dnn (nn <100) Enn (99< 1nn <200) Inn (199< 2nn <300)	formatted ECLIPSE 300 save file (quick restart file)
FFLUX	FFX	formatted flux data file
FLGR	FLG	formatted LGR vector data file
FRFT	FRT	formatted RFT vector data file
FHMD	FHM	formatted well gradients file
FGRFT	FGF	formatted RFT gradients file
FRSSPEC	FRS	formatted index for restart files

UNIX	ANSI	Description
FINSPEC	FIS	formatted index for initial file
Knnnn (nnnn <10,000)	Knn (nn <100)	formatted optimization state file
FOPT	FOP	formatted unified optimization state file
ECLEND	END	file created on simulator exit
dbprtx	(not applicable)	message service database file

Table 12.1: ECLIPSE file names

For the UNIX naming convention, the non-unified summary and restart file names include the report step, nnnn, as a four-digit integer (0000 to 9999), calculated as “report step”,mod(10,000)

For the ANSI naming convention, the report step is encoded as nn, a two-digit integer which is calculated as nnnn,mod(100).

B

FrontSim Files

The files used with FrontSim are shown in the following table. Streamline file formats are described in "FrontSim Streamline Output Files".

For more details on this simulator, refer to the *FrontSim User Guide*.

File Type	Description
ALLOC	additional print file, containing allocation factors and pore volumes (drainage areas) for wells and injector-producer pairs
ALN	multiple formatted bundle allocation for better connectivity with OFM or MS EXCEL
DATA	data input file
FSCAT	well points data for producing maps in Petrel
GRID	unformatted grid file
INSPEC	index file for initial
INIT	unformatted initial file
MSG	xml message file
PFM_SCHED	well rates (specified using WCONINJEWCONPROD) from a PFM run
PRT	main printer output from the simulation
RFT	data for fluid conditions in the wellbore or the connecting grid blocks at selected times in the run
RSM	run summary file
RSSPEC	index file for restart files
SLNnnnn	geometry and properties of the streamlines at report step number nnnn (from 0001 to 9999) - output from 2003a and later version
SLNSPEC	streamline information valid for all timesteps (used with SLNnnnn files) - output from 2003a and later versions
SMSPEC	unformatted summary specification file
Snnnn	unformatted summary file
_TOF.TXT	time of flight data
UALN	unified formatted bundle allocation for better connectivity with OFM or MS EXCEL

File Type	Description
UNRST	unformatted unified
UNSMRY	unformatted unified
Xnnnn	unformatted restart
Bnnnn	additional timestep file containing streamlines (used with FloViz) - output from 2002a and earlier versions

Table 13.1: Files used with FrontSim