ICON Database Reference Manual

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Contents

Chapter 1

Available output fields in GRIB2-format

In GRIB2, a variable is uniquely defined by the following set of metadata:

- *Discipline* (see GRIB2 code table 4.2)
- *ParameterCategory* (see GRIB2 code table 4.2)
- *ParameterNumber* (see GRIB2 code table 4.2)
- *typeOfFirstfixedSurface* and *typeOfSecondFixedSurface* (see GRIB2 code table 4.5)
- *stepType* (instant, accum, avg, max, min, diff, rms, sd, cov, ...)

In the following, *typeOfFirstFixedSurface* and *typeOfSecondFixedSurface* will be abbreviated by *LevTyp 1/2*.

1.1 Deprecated output fields

With the launch of ICON, the following output fields will no longer be available:

- **OMEGA** [Pa/s]: Vertical velocity in pressure coordinates $\omega = \frac{\mathrm{d}p}{\mathrm{d}t}$
- **BAS_CON** [–]: Level index of convective cloud base
- **TOP_CON** [–]: Level index of convective cloud top
- **T_S** [K]: Temperature at the soil-atmosphere-, or soil-snow-interface. Note that T_S = T_SO(0), thus T_S is redundant.
- **W_G1** [mm H2O]: Soil water content in upper layer (0 to 10 cm)
- **W_G2** [mm H2O]: Soil water content in middle layer (10 to 100 cm)

1.2 New output fields

New output fields that will become available with the launch of ICON are:

- **W** $[m/s]$: vertical velocity in height coordinates $w = \frac{\mathrm{d}z}{\mathrm{d}t}$
- **DEN** $[kg/m^3]$: density of moist air

1.3 Available output fields listed in tabular form

Table 1.1: *Hybrid multi-layer forecast ($VV > 0$) and initialised analysis ($VV = 0$) products*

ShortName	Description	Discipline	Category	Number	Lev-Typ	stepType	Unit
U	Zonal wind	0	2	2	105	inst	$\mathrm{m\,s^{-1}}$
V	Meridional wind	0	2	3	105	inst	$\mathrm{m\,s^{-1}}$
W	Vertical wind	0	2	9	105	inst	$\mathrm{m\,s^{-1}}$
T	Temperature	0	0	0	105	inst	K
DEN	Density of moist air	0	3	10	105	inst	$\mathrm{kg\,m^{-3}}$
QV	Specific humidity	0	1	0	105	inst	$\mathrm{kg\,kg^{-1}}$
QC	Cloud mixing ratio[1]	0	1	22	105	inst	$\mathrm{kg\,kg^{-1}}$
QI	Cloud ice mixing ratio[1]	0	1	82	105	inst	$\mathrm{kg\,kg^{-1}}$
QR	Rain mixing ratio[1]	0	1	24	105	inst	$\mathrm{kg\,kg^{-1}}$
QS	Snow mixing ratio[1]	0	1	25	105	inst	$\mathrm{kg\,kg^{-1}}$
CLC	Cloud cover	0	6	22	105	inst	%
O3	Ozone mixing ratio[2]	0	14	1	105	inst	$\mathrm{kg\,kg^{-1}}$

Table 1.2: Single-layer forecast ($VV > 0$) and initialised analysis ($VV = 0$) products

ShortName	Description	Discipline	Category	Number	Lev-Typ	stepType	Unit
PS	Surface pressure (not reduced)	0	3	1	1	inst	Pa
T_SNOW	Temperature of the snow surface	0	0	18	1	inst	K
T_G	Ground temperature (temperature at sfc-atm interface)	0	0	0	1	inst	K
QV_S	Surface specific humidity	0	1	0	1	inst	$\mathrm{kg\,kg^{-1}}$
W_SNOW	Snow depth water equivalent	0	1	60	1	inst	$\mathrm{kg\,m^{-2}}$
W_I	Plant canopy surface water	2	0	13	1	inst	$\mathrm{kg\,m^{-2}}$

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[1] for the time being, erroneously encoded as mixing ratios instead of specific quantities
[2] not clear yet, whether ozone will be provided as output field

Table 1.2: *continued*

TCM	Turbulent transfer coefficient for momentum (surface)	0	2	29	1	inst	$--$
TCH	Turbulent transfer coefficient for heat and moisture (surface)	0	0	19	1	inst	$--$
ASOB_S	Net short-wave radiation flux at surface (average since model start)	0	4	9	1	avg	$\mathrm{W\,m^{-2}}$
ATHB_S	Net long-wave radiation flux at surface (average since model start)	0	5	5	1	avg	$\mathrm{W\,m^{-2}}$
ASOB_T	Net short-wave radiation flux at TOA (average since model start)	0	4	9	8	avg	$\mathrm{W\,m^{-2}}$
ATHB_T	Net long-wave radiation flux at TOA (average since model start)	0	5	5	8	avg	$\mathrm{W\,m^{-2}}$
ALB_RAD	Surface albedo for visible range, diffuse	0	19	1	1	inst	%
RAIN_GSP	Large scale rain (accumulated since model start)	0	1	77	1	accu	$\mathrm{kg\,m^{-2}}$
SNOW_GSP	Large snowfall water equivalent (accumulated since model start)	0	1	56	1	accu	$\mathrm{kg\,m^{-2}}$
RAIN_CON	Convective rain (accumulated since model start)	0	1	76	1	accu	$\mathrm{kg\,m^{-2}}$
SNOW_CON	Convective snowfall water equivalent (accumulated since model start)	0	1	55	1	accu	$\mathrm{kg\,m^{-2}}$
TOT_PREC	Total precipitation (accumulated since model start)	0	1	52	1	accu	$\mathrm{kg\,m^{-2}}$
RUNOFF_S	Surface water runoff (accumulated since model start)[3]	2	0	5	1	accu	$\mathrm{kg\,m^{-2}}$
RUNOFF_G	Soil water runoff (accumulated since model start)[3]	2	0	5	1	accu	$\mathrm{kg\,m^{-2}}$
U_10M	Zonal wind at 10m above ground	0	2	2	103	inst	$\mathrm{m\,s^{-1}}$
V_10M	Meridional wind at 10m above ground	0	2	3	103	inst	$\mathrm{m\,s^{-1}}$
T_2M	Temperature at 2m above ground	0	0	0	103	inst	K
TD_2M	Dew point temperature at 2m above ground	0	0	6	103	inst	K
Z0	Surface roughness (above land and water)	2	0	1	1	inst	m
CLCT	Total cloud cover	0	6	1	1	inst	%

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Table 1.2: *continued*

CLCH	High level clouds[3]	0	6	1	100	inst	%
CLCM	Mid level clouds[3]	0	6	1	100	inst	%
CLCL	Low level clouds[3]	0	6	1	100	inst	%
TQV	Total column integrated water vapour	0	1	64	1	inst	$\mathrm{kg\,m^{-2}}$
TQC	Total column integrated cloud water	0	1	69	1	inst	$\mathrm{kg\,m^{-2}}$
TQI	Total column integrated cloud ice	0	1	70	1	inst	$\mathrm{kg\,m^{-2}}$
TQR	Total column integrated rain[3]	0	1	45	1	inst	$\mathrm{kg\,m^{-2}}$
TQS	Total column integrated snow[3]	0	1	46	1	inst	$\mathrm{kg\,m^{-2}}$
HBAS_CON	Height of convective cloud base above msl	0	6	26	2	inst	m
HTOP_CON	Height of convective cloud top above msl	0	6	27	3	inst	m
HZEROCL	Height of 0 degree Celsius isotherm above msl	0	3	6	4	inst	m
ASHFL_S	Sensible heat net flux at surface (average since model start)	0	0	11	1	avg	$\mathrm{W\,m^{-2}}$
ALHFL_S	Latent heat net flux at surface (average since model start)	0	0	10	1	avg	$\mathrm{W\,m^{-2}}$
FR_ICE	Sea ice cover (possible range: $[0, 1]$)	10	2	0	1	inst	–
T_ICE	Sea ice temperature (at ice-atm interface)	10	2	8	1	inst	K
H_ICE	Sea ice thickness (Max: 3 m)	10	2	1	1	inst	m
FRESHSNW	Fresh snow factor (weighting function for albedo indicating freshness of snow)	0	1	203	1	inst	–
RHO_SNOW	Snow density	0	1	61	1	inst	$\mathrm{kg\,m^{-3}}$
H_SNOW	Snow depth	0	1	11	1	inst	m

[3]Output fields not yet available, but planned.

Table 1.4: *Soil model: vertical distribution of levels and layers*

level no.	depth [cm]	layer no.	upper/lower bounds [cm]
0	0.0		
1	0.5	1	0.0 — 1.0
2	2.0	2	1.0 — 3.0
3	6.0	3	3.0 — 9.0
4	18.0	4	9.0 — 27.0
5	54.0	5	27.0 — 81.0
6	162.0	6	81.0 — 243.0
7	486.0	7	243.0 — 729.0
8	1458.0	8	729.0 — 2187.0

Table 1.3: Multi-layer forecast ($VV > 0$) and initialised analysis ($VV = 0$) products of the soil model

ShortName	Description	Discipline	Category	Number	Lev-Typ	stepType	Unit
T_SO	Soil temperature	2	3	18	106	inst	K
W_SO	Soil moisture integrated over individual soil layers (ice + liquid)	2	3	20	106	inst	$\mathrm{kg\,m^{-2}}$
W_SO_ICE	Soil ice content integrated over individual soil layers	2	3	22	106	inst	$\mathrm{kg\,m^{-2}}$

Soil temperature is defined at the soil depths given in Table 1.4 (column 2). Levels 1 to 8 define the full levels of the soil model. A zero gradient condition is assumed between levels 0 and 1, meaning that temperatures at the surface-atmosphere interface are set equal to the temperature at the first full level depth. (0.5 cm). Temperatures are prognosed for levels 1 to 7. At the lowermost level (1458 cm) the temperature is fixed to the climatological average 2 m-temperature.

Soil moisture W_SO is prognosed for layers 1 to 6. In the two lowermost layers W_SO is time constant.