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# **Marine observations suite**

***Release v1.1+***

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## INDICES AND TABLES

- `genindex`
- `modindex`
- `search`



## INTRODUCTION

The Marine Observations Suite is part of the code implemented to produce the data deliveries for the C3S Marine In Situ Component. Instructions to run the full set of suites, including this one, are available in the C3S Technical Service Document. The present manual includes the set of instructions needed to run the observations suite, and also more detailed information on this branch of the marine code.

The Observation Suite is a set of python and shell scripts to harmonize and convert input observational data sources to CDM formatted files. This includes merging the CDM files with the output from the metadata and qc suites.

It is based on a set of chained processes, each step feeding into the next one and with the initial dataset (previously prepared for inclusion in the marine processing) transitioning through a series of levels from the first mapping to the CDM in level1a to the final set of curated observational CDM compatible files in level2 (header and observations-\*). Some levels are fed with data from additional external datasets or with the output of dedicated suites that run concurrently to the overall scheme (see figure below).

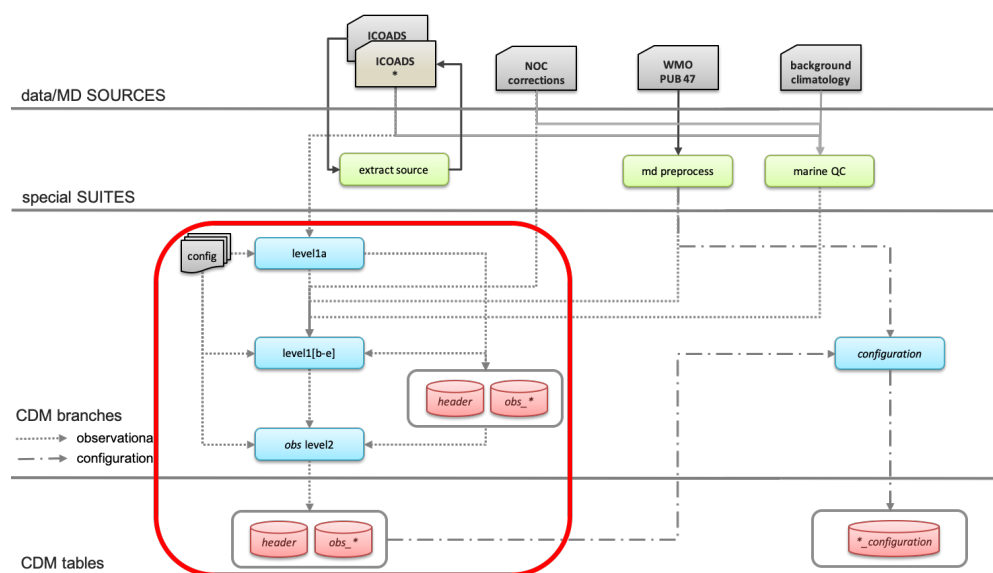


Fig. 1: General marine data flow. The Observations Suite is highlighted in the red box.

## 2.1 Note on versions

This manual was written at the time of transition between glamod-marine-processing v1.1 and its migration to the SLURM scheduler.

Consequently, this manual describes the Observations Suite as available in the HEAD of the repository (hence v1.1+), not in the last tagged version at that time (v1.1).



## PROCESSING LEVELS

As shown in the diagram below, the Observations Suite is a set of chained processes in which the source dataset transitions through the following levels:

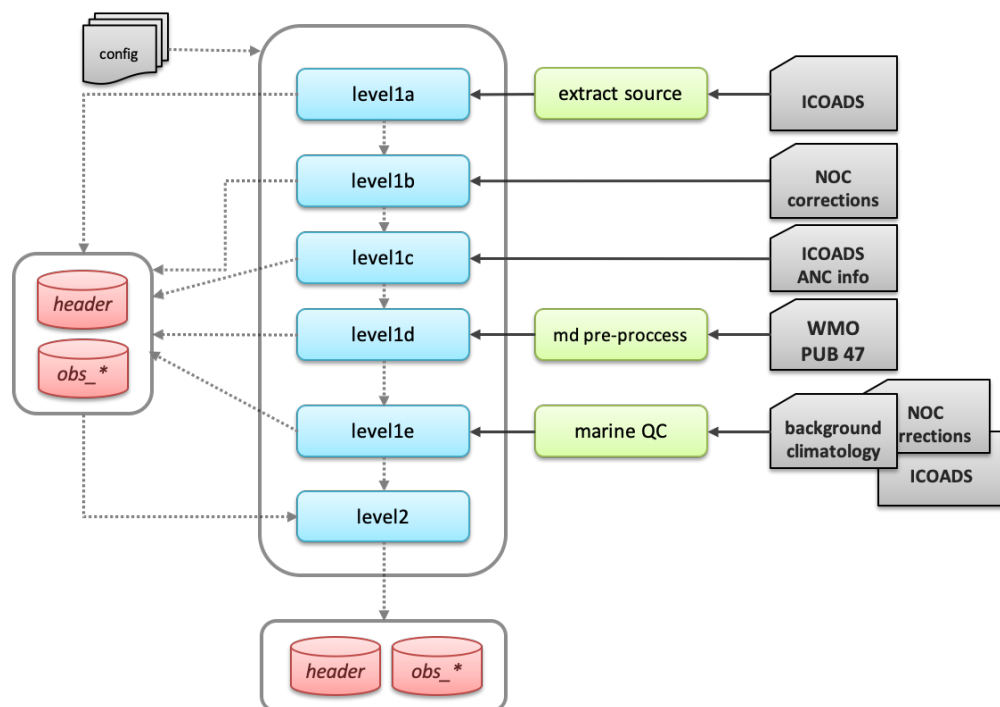


Fig. 1: Observations Suite processing levels

- level1a: is the first mapping of the dataset to the CDM. Prior to mapping, the input data files are validated against the schema / data model and code tables defining the input. Reports failing this validation are discarded. For ICOADS, this includes also the rescue of any additional information from the supplemental attachment that has been identified as adding value. At this level the data are partitioned by date (monthly files), ICOADS source and card deck information and observed parameter. For each month a set of files is created containing the header and observation tables (header and observations-[atlsstldptlwbtlslplwslwd]).
- level1b: is the data improved with corrections and/or additional information resulting from the linkage and duplicate identification process. Reassignment of reports to different monthly files can result from this process after datetime corrections.
- level1c: is the data with metadata (currently primary station identification and datetime) validation performed and applied.

- level1d: data is enriched with external meta-data where available. For ship data the additional meta data source is WMO Publication 47 metadata.
- level1e: final quality control flags are added at this level, resulting from the position, parameter and tracking quality control processes.
- level2: data ready to ingest in the database. Data in level1e is inspected as data filtering might apply and part of the initial data set might be rejected to be inserted in the CDS database.

## MARINE FILE SYSTEM

The Observations Suite code is integrated in the file system designed for the C3S data deliveries. The general directory structure that holds this file system is shown in the figure.

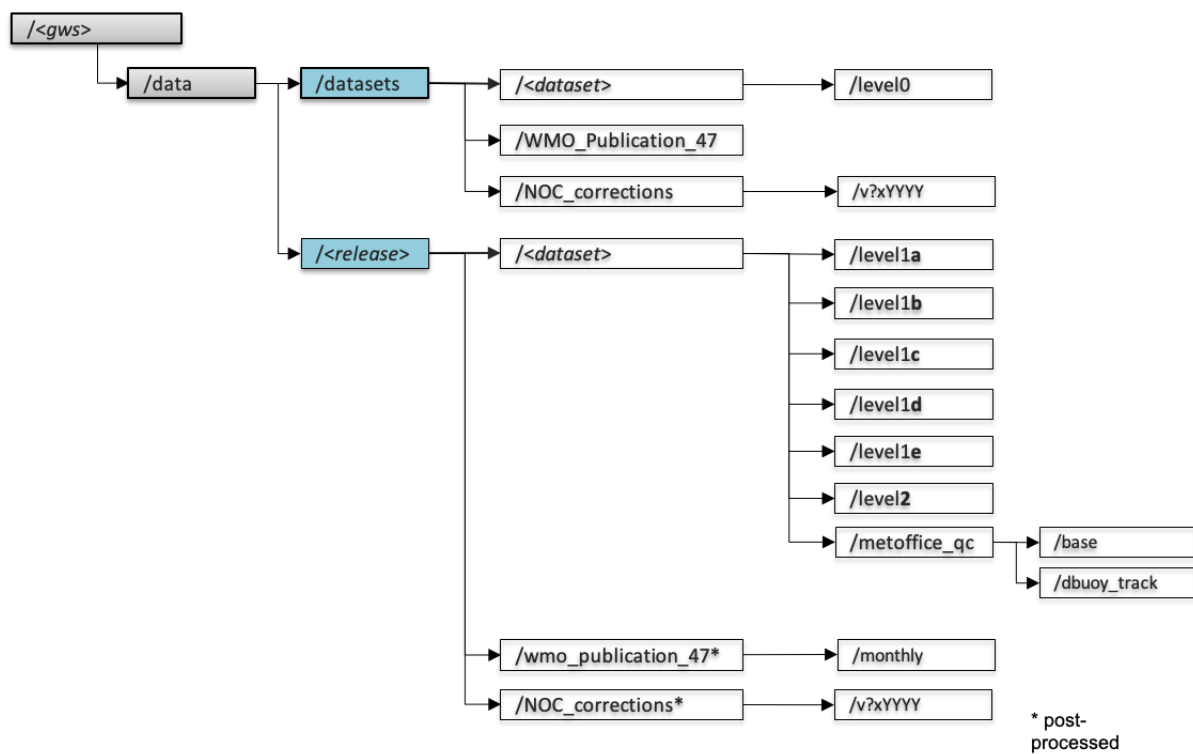


Fig. 1: General marine directory structure



## TOOL SET-UP

### 5.1 Code repository

The full set of suites that make up the marine code are integrated in the glamod-marine-processing repository. Thus, to install the observations suite, the repository needs to be cloned:

```
git clone git@git.noc.ac.uk:iregon/glamod-marine-processing.git --branch version
```

where:

- version: see repository tags. Last tagged version is v1.1, with this manual currently describing the HEAD of the repository (See *Note on versions*).

### 5.2 Setting paths and environments

Script obs-suite/setpaths.sh sets the paths for the processing software and data files, including a scratch directory for the user running the software. Edit the script file and set the environment variables as indicated below:

- code\_directory: full path to the obs-suite code.
- home\_directory\_smf: full path to the obs-suite configuration.
- data\_directory: full path to marine data file system.
- scratch\_directory: this is system dependent and is currently set as available in CEDA-JASMIN

The obs-suite/setenv0.sh script initialises the processing environment. It needs to be edited and the pyEnvironment\_directory environmental variable set to the path of the corresponding python environment installation (obs-suite/pyenvs/env0). It also needs to be modified to include the path to the system python libraries in the LD\_LIBRARY\_PATH variable.

Once the these scripts have been modified, the python virtual environment needs to be initialised with the following block of code:

```
cd obs-suite/env
module load jasper/3.7
virtualenv --system-site-packages env0
source env0/bin/activate
pip install -r requirements_env0.txt
```

## 5.3 Adding modules

Four additional python modules have been developed for this suite. The table below lists these modules and which versions are compatible with the current marine code version (v1.1 and HEAD).

Table 1: Title

module	module_local	module_repo_url	version
CDM mapper	cdm	<a href="https://git.noc.ac.uk/iregon/cdm-mapper.git">git@git.noc.ac.uk:iregon/cdm-mapper.git</a>	v1.2
Data reader	mdf_reader	<a href="https://git.noc.ac.uk/iregon/mdf_reader.git">git@git.noc.ac.uk:iregon/mdf_reader.git</a>	v1.2
Metadata fixes	metmetpy	<a href="https://git.noc.ac.uk/iregon/metmetpy.git">git@git.noc.ac.uk:iregon/metmetpy.git</a>	v1.0
Pandas operations	pandas_operations	<a href="https://git.noc.ac.uk/iregon/pandas_operations.git">git@git.noc.ac.uk:iregon/pandas_operations.git</a>	v1.2

For each module listed the following needs to be run:

```
cd obs-suite/modules/python
git clone module_repo_url --branch version --single-branch module_local
```

## COMMON PATHS

The following path names are used throughout this manual:

- *obs-suite*: path of the observations suite in the marine processing repository
- *config\_directory*: path to the obs-suite directory in the configuration repository
- *data\_directory*: path to general data directory in the marine file system
- *release\_config\_dir*: full path to the configuration of a specific data release within *config\_directory*





## INITIALIZING A NEW DATA RELEASE

### 7.1 Configuration repository

The glamod-marine-config repository serves as container for the configuration used to create the different data releases for C3S. The Observations Suite configuration files are stored in `obs-suite/release-update/dataset` directories within this repository.

Currently, the following configuration sets are available:

Table 1: Title

Data release	Path in repo/obs-suite	Marine code version
r092019	r092019-000000/ICOADS_R3.0.0T	v1.0
release_2.0	release_2.0-000000/ICOADS_R3.0.0T	v1.1
Demo release	release_demo-000000/ICOADS_R3.0.0T	v1.1+ (HEAD)

Up until v1.1 (release\_2.0), the configuration files were not maintained in the configuration repository, but in the code repository. They have been now included in the configuration repository for traceability. It is also worth noting, that some changes have been made to the configuration files after v1.1: the format in the Demo release files must be applied when running the observations suite.

### 7.2 Create the configuration files for the release and dataset

Every data release is identified in the file system with the following tags:

- release: release name (eg. release\_2.0)
- update: update tag (eg. 000000)
- dataset: dataset name (eg. ICOADS\_R3.0.0T)

Create a new directory `release-update/dataset/` in the obs-suite configuration directory (`config_directory`) of the configuration repository (note the hyphen as field separator between `release` and `update`). We will now refer to this directory as `release_config_dir`.

## 7.2.1 Release periods file

Create file *release\_config\_dir/source\_deck\_periods.json*

This file is a json file with each of the source-deck partitions to be included in the release, and the associated periods (year resolution) to process.

The figure below shows a sample of this file:

```
{
  "001-110": {
    "year_init": 1948,
    "year_end": 1951
  },
  "063-714": {
    "year_init": 2007,
    "year_end": 2009
  },
  "171-711": {
    "year_init": 1889,
    "year_end": 1899
  }
}
```

## 7.2.2 Process list file

Create file *release\_config\_dir/source\_deck\_list.txt*

This is a simple ascii file with the list of source-deck partitions to process. Create the master list with the keys of file *source\_deck\_periods.json*. This file can later be subsetted if a given process is to be run in batches.

The figure below shows a sample of this file:

```
001-110
063-714
171-711
```

## 7.2.3 Level 1a configuration file

Create file *release\_config\_dir/level1a.json*. This file includes information on the initial dataset files data model(s), filters used to select reports and mapping to apply convert the data to the CDM.

The figure below shows a sample of this file:

```
{
  "job_memo_mb": 4000,
  "job_time_hr": "01",
  "job_time_min": "30",
  "data_model": "imma1",
  "read_sections": ["core", "c1", "c98"],
  "filter_reports_by": {
    "c1.PT": ["0", "1", "2", "3", "4", "5"]
  },
  "cdm_map": "icoads_r3000"
,
```

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```

"063-714":
{
  "job_memo_mb": 16000,
  "job_time_hr": "03",
  "job_time_min": "30",
  "data_model": "imma1_d714",
  "read_sections": ["core", "c1", "c98", "c99"],
  "filter_reports_by":
  {
    "c1.PT": ["7"]
  },
  "cdm_map": "icoads_r3000_d714"
}
}

```

This file has its default configuration parameters in the outer keys. Source-deck specific configuration can be applied by specifying a configuration parameter under a *sid-deck* key. In the sample given, all the source and decks will be processed with the default configuration, but 063-714, that will use its own parameters.

Configuration parameters *job\** are only used by the slurm launchers, while the rest by the corresponding *levell1a.py* script.

## 7.2.4 Level 1b configuration file

Create file *release\_config\_dir/level1b.json*. This file contains information on the NOC corrections version to be used and the correspondences between the CDM tables fields on which the corrections are applied and the subdirectories where these corrections can be found. The CDM history stamp for every correction is also configured in this file.

The figure below shows a sample of this file:

```

{
  "job_memo_mb": 4000,
  "job_time_hr": "01",
  "job_time_min": "30",
  "correction_version": "v1x2019",
  "corrections":
  {
    "header":
    {
      "id": "primary_station_id",
      "timestamp": "report_timestamp",
      "duplicate_flags": "duplicate_status",
      "duplicates": "duplicates",
      "longitude": "longitude",
      "latitude": "latitude"
    },
    "observations-at":
    {
      "timestamp": "date_time",
      "longitude": "longitude",
      "latitude": "latitude"
    }
  },
  "histories":
  {
    "id": "Corrected primary_station_id",

```

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```

    "timestamp": "Corrected report_timestamp and date_time",
    "longitude": "Corrected longitude",
    "latitude": "Corrected latitude",
    "duplicate_flags": "Added duplicate information - flag",
    "duplicates": "Added duplicate information - duplicates"
  }
}

```

This file has its default configuration parameters in the outer keys. Source-deck specific configuration can be applied by specifying a configuration parameter under a *sid-dck* key. In the sample above, only the default configuration is applied.

Configuration parameters *job\** are only used by the slurm launchers, while the rest by the corresponding *level1b.py* script.

## 7.2.5 Level 1c configuration file

Create file *release\_config\_dir/level1c.json*. The only configuration parameters required in this file are those related to the slurm launchers, as the rest of the configuration of this process is basically hardcoded in the *level1c.py* script.

The figure below shows a sample of this file:

```

{
  "job_memo_mb": 4000,
  "job_time_hr": "01",
  "job_time_min": "30",
}

```

This file has its default configuration parameters in the outer keys. Source-deck specific configuration can be applied by specifying a configuration parameter under a *sid-dck* key. In the sample above, only the default configuration is applied.

## 7.2.6 Level 1d configuration file

Create file *release\_config\_dir/level1d.json*. This file contains information on the metadata sources that are merged into the *level1c* data. Currently the only MD source is *wmo\_publication\_47* and the full process is basically tailored to *Pub47* as pre-processed in *NOC*.

This file contains information of the subdirectory in the release data directory where the metadata can be found (“*md\_subdir*”) and the name of the mapping within the Common Data Model mapper module used to map *pub47* to the CDM (“*md\_model*”).

The *level1d* process will fail if it doesn’t find a metadata file for a month partition. To account for periods where metadata are not available, the following optional keys can be used:

- “*md\_not\_avail*”: true indicates the process that for the full release period, there is not metadata available. Defaults to false.
- “*md\_first\_yr\_avail*”: indicates the first year for which metadata files should be available in the release period. Defaults to first year in the release period.
- “*md\_last\_yr\_avail*”: indicates the last year for which metadata files should be available in the release period. Defaults to last year in the release period.

By using the above keys, the process is indicated to securely progress data files to the next processing level without merging any metadata when it is not available.

The figure below shows a sample of this file:

```
{
  "job_memo_mb": 4000,
  "job_time_hr": "01",
  "job_time_min": "30",
  "md_model" : "pub47_noc",
  "md_subdir" : "wmo_publication_47",
  "md_first_yr_avail" : 1956,
  "md_last_yr_avail" : 2010
}
```

This file has its default configuration parameters in the outer keys. Source-deck specific configuration can be applied by specifying a configuration parameter under a *sid-dck* key. In the sample above, only the default configuration is applied.

## 7.2.7 Level 1e configuration file

Create file *release\_config\_dir/level1e.json*. The level1e specific parameters included in this file are:

- “qc\_first\_date\_avail” : first monthly quality control file the process can expect to find. If the data files to process are prior to this date, then the data files will progress to the next level without quality flag merging and without raising an error.
- “qc\_last\_date\_avail” : last monthly quality control file the process can expect to find. If the data files to process are later to this date, then the data files will progress to the next level without quality flag merging and without raising an error.
- “history\_explain” : text added to the header file history field when flags are merged.

The figure below shows a sample of this file:

```
{
  "job_memo_mb": 4000,
  "job_time_hr": "01",
  "job_time_min": "30",
  "qc_first_date_avail" : "1850-02",
  "qc_last_date_avail" : "2010-11",
  "history_explain" : "Position, tracking and parameter QC flags added"
}
```

This file has its default configuration parameters in the outer keys. Source-deck specific configuration can be applied by specifying a configuration parameter under a *sid-dck* key. In the sample above, only the default configuration is applied.

## 7.3 Set up the release data directory

Every new release or new dataset in a release needs to have its corresponding directory structure initialised in the file system:

```
cd obs-suite
source setpaths.sh
source setenv0.sh
cd scripts
python make_release_source_tree.py $data_directory $config_directory release update_
↳dataset
```

where:

- release: release identifier in file system
- update: release update identifier in file system
- dataset: dataset identifier in file system

This script does not overwrite existing directories and is safe to run on an existing directory structure if new source-decks have to be added.

## LEVEL 1A

Level 1a contains the initial data converted from the input data sources (level0) to files compatible with the CDM.

Every monthly file of the individual source-deck ICOADS dataset partitions is converted with the following command:

```
cd obs-suite
source setpaths.sh
source setenv0.sh
cd scripts
python levella.py $data_directory release update dataset levella_config sid-dck year_
↪month
```

where:

- release: release identifier in file system
- update: release update identifier in file system
- dataset: dataset identifier in file system
- levella\_config: path to the levella configuration file ( *Level 1a configuration file* )
- sid-dck: source-deck identifier
- year: file year, format yyyy
- month: file month, format mm

To facilitate the processing of a large number of files levella.py can be run in batch mode:

```
cd obs-suite
source setpaths.sh
source setenv0.sh
cd lotus_scripts
python levella_slurm.py release update dataset $config_directory process_list --
↪failed_only yes|no
```

where:

- release: release identifier in file system
- update: release update identifier in file system
- dataset: dataset identifier in file system
- process\_list: full path to file with the list of source-deck partitions to process. This file can be either *Process list file* or a subset of it.
- failed\_only: optional (yes/no). Defaults to no. Setting this argument to 'yes' means that only the monthly files with a \*.failed log file will be processed.

This script executes an array of monthly subjobs per source and deck included in the `process_list`. The configuration for the process is directly accessed from the release configuration directory: the data period processed is as configured per source and deck in the release periods file ( *Release periods file*) and the level1a configuration is retrieved from *Level 1a configuration file*.

This script logs to `data_dir/release/dataset/level1a/log/sid-dck/`. Log files are `yyyy-mm-<release>-<update>.ext` with ext either ok or failed depending on the subjob termination status.

List \*.failed in the sid-dck level1a log directories to find if any went wrong.



## LEVEL 1B

Level 1b integrates external files containing enhanced information on the duplicate status of the observations, corrected date/time and locations, and linked station IDs with the level1a data. As part of the integration a weather report may move between months if an error in the date had previously been identified and the correct data is for a different month. A description of the processing used to generate these external files is described in the marine duplication identification document (available upon request, to be published shortly). It should be noted that this processing is currently external to C3S311a\_lot2 but will be integrated in a future release.

The external files need to be copied to the datasets directory in the marine data directory prior to processing (datasets/NOC\_corrections/cor\_version). Once copied to the required directory structure the files need to be reformatted for integration with the level1a files. This processing is done via python and shell scripts using the SLURM scheduler. The following block needs to be run once for each of the options id, datepos or duplicates:

```
cd obs-suite
source setpaths.sh
source setenv0.sh
cd scripts
option=option
sbatch -J $option -o $option.out -e $option.out -p short-serial -t 03:00:00 --mem_
↪1000 --open-mode truncate --wrap="./noc_corrections_postprocess.sh release cor_
↪version $option year_init year_end"
```

where:

- release: release tag
- option: id, datepos or duplicates
- cor\_version: NOC correction version (v1x2019 for release 1 and release 2)
- year\_initlend: first/last year of data release.

This step places the reformatted correction files in the release directory in the marine data directory (release/NOC\_corrections/cor\_version) ready to be merged with the CDM data files. The time needed will depend on the period pre-processed. However if the job terminates due to insufficient time allocation, the period remaining to be pre-processed can be launched independently, and it will not affect the files already processed.

The reformatted files are merged with the level1a data by the following command:

```
cd obs-suite
source setpaths.sh
source setenv0.sh
cd scripts
python level1b.py $data_directory release update dataset level1b_config sid-dck year_
↪month
```

where:

- release: release identifier in file system
- update: release update identifier in file system
- dataset: dataset identifier in file system
- level1b\_config: path to the level1b configuration file ( *Level 1b configuration file*)
- sid-dck: source-deck identifier
- year: file year, format yyyy
- month: file month, format mm

To facilitate the processing of a large number of files level1b.py can be run in batch mode:

```
cd obs-suite
source setpaths.sh
source setenv0.sh
cd lotus_scripts
python level1b_slurm.py release update dataset $config_directory process_list --
↪failed_only yes|no
```

where:

- release: release identifier in file system
- update: release update identifier in file system
- dataset: dataset identifier in file system
- process\_list: full path to file with the list of source-deck partitions to process. This file can be either *Process list file* or a subset of it.
- failed\_only: optional (yes/no). Defaults to no. Setting this argument to ‘yes’ means that only the monthly files with a \*.failed log file will be processed.

This script executes an array of monthly subjobs per source and deck included in the process\_list. The configuration for the process is directly accessed from the release configuration directory: the data period processed is as configured per source and deck in the release periods file ( *Release periods file*) and the level1b configuration is retrieved from *Level 1b configuration file*.

This script logs to *data\_dir/release/dataset/level1b/log/sid-dck/*. Log files are yyyy-mm-<release>-<update>.ext with ext either ok or failed depending on the subjob termination status.

List \*.failed in the sid-dck level1b log directories to find if any went wrong.

## LEVEL 1C

Level1c files contain reports from level1b that have been further validated following corrections to the date/time, location and station ID. Those failing validation are rejected and archived for future analysis. Additionally, datetime corrections applied previously in level1b, can potentially result in reports being relocated to a different month. These reports are moved to their correct monthly file in this level.

To generate level1c files, the individual sid-dck monthly files in level1b are processed with:

```
cd obs-suite
source setpaths.sh
source setenv0.sh
cd scripts
python level1c.py $data_directory release update dataset level1c_config sid-dck year_
↪month
```

where:

- release: release identifier in file system
- update: release update identifier in file system
- dataset: dataset identifier in file system
- level1c\_config: path to the level1c configuration file (*Level 1c configuration file*)
- sid-dck: source-deck identifier
- year: file year, format yyyy
- month: file month, format mm

To facilitate the processing of a large number of files level1c.py can be run in batch mode:

```
cd obs-suite
source setpaths.sh
source setenv0.sh
cd lotus_scripts
python level1c_slurm.py release update dataset $config_directory process_list --
↪failed_only yes|no --remove_source yes|no
```

where:

- release: release identifier in file system
- update: release update identifier in file system
- dataset: dataset identifier in file system
- process\_list: full path to file with the list of source-deck partitions to process. This file can be either *Process list file* or a subset of it.

- `failed_only`: optional (yes/no). Defaults to no. Setting this argument to 'yes' means that only the monthly files with a \*.failed log file will be processed.
- `remove_source`: optional (yes/no). Defaults to no. Setting this argument to 'yes' implies removal of the source level (level1b) data files if the full set of monthly data files of a given source-deck is successfully processed.

This script executes an array of monthly subjobs per source and deck included in the `process_list`. The configuration for the process is directly accessed from the release configuration directory: the data period processed is as configured per source and deck in the release periods file ( *Release periods file*) and the level1c configuration is retrieved from *Level 1c configuration file*.

This script logs to `data_dir/release/dataset/level1c/log/sid-dck/`. Log files are `yyyy-mm-<release>-<update>.ext` with ext either ok or failed depending on the subjob termination status.

List \*.failed in the sid-dck level1c log directories to find if any went wrong.

## LEVEL 1D

The level1d files contain the level1c data merged with external metadata (where available). In the current marine processing implementation, the level1c are merged with WMO Publication 47 metadata to set instrument heights, station names and platform sub types (i.e. type of ship). Prior to merging, the WMO Publication 47 metadata are harmonised, quality controlled and pre-processed in a process that run independently to this data flow (add ref). After pre-processing, this info needs to be made available to the release in directory *data\_directory/release/wmo\_publication\_47/monthly/*.

To generate level1d files, the individual sid-dck monthly files in level1c are processed with:

```
cd obs-suite
source setpaths.sh
source setenv0.sh
cd scripts
python level1d.py $data_directory release update dataset level1d_config sid-dck year_
↪month
```

where:

- release: release identifier in file system
- update: release update identifier in file system
- dataset: dataset identifier in file system
- level1d\_config: path to the level1d configuration file (*Level 1d configuration file*)
- sid-dck: source-deck identifier
- year: file year, format yyyy
- month: file month, format mm

To facilitate the processing of a large number of files level1d.py can be run in batch mode:

```
cd obs-suite
source setpaths.sh
source setenv0.sh
cd lotus_scripts
python level1d_slurm.py release update dataset $config_directory process_list --
↪failed_only yes|no --remove_source yes|no
```

where:

- release: release identifier in file system
- update: release update identifier in file system
- dataset: dataset identifier in file system

- `process_list`: full path to file with the list of source-deck partitions to process. This file can be either *Process list file* or a subset of it.
- `failed_only`: optional (yes/no). Defaults to no. Setting this argument to 'yes' means that only the monthly files with a \*.failed log file will be processed.
- `remove_source`: optional (yes/no). Defaults to no. Setting this argument to 'yes' implies removal of the source level (level1c) data files if the full set of monthly data files of a given source-deck is successfully processed.

This script executes an array of monthly subjobs per source and deck included in the `process_list`. The configuration for the process is directly accessed from the release configuration directory: the data period processed is as configured per source and deck in the release periods file ( *Release periods file* ) and the level1d configuration is retrieved from *Level 1d configuration file*.

This script logs to `data_dir/release/dataset/level1d/log/sid-dck/`. Log files are `yyyy-mm-<release>-<update>.ext` with ext either ok or failed depending on the subjob termination status.

List \*.failed in the sid-dck level1d log directories to find if any went wrong.

## LEVEL 1E

The levelle processing merges the data quality flags from the Met Office QC suite (add ref) with the data from level 1d. The QC software generates two sets of QC files, one basic QC of the observations from all platforms and an enhanced track and quality check for drifting buoy data. The basic QC flags are stored in *data\_directory/release/dataset/metoffice\_qc/base/* and merged with the following script:

```
cd obs-suite
source setpaths.sh
source setenv0.sh
cd scripts
python levelle.py $data_directory release update dataset levelle_config sid-dck year_
↪month
```

where:

- release: release identifier in file system
- update: release update identifier in file system
- dataset: dataset identifier in file system
- levelle\_config: path to the levelle configuration file (*Level 1e configuration file*)
- sid-dck: source-deck identifier
- year: file year, format yyyy
- month: file month, format mm

To facilitate the processing of a large number of files levelle.py can be run in batch mode:

```
cd obs-suite
source setpaths.sh
source setenv0.sh
cd lotus_scripts
python levelle_slurm.py release update dataset $config_directory process_list --
↪failed_only yes|no --remove_source yes|no
```

where:

- release: release identifier in file system
- update: release update identifier in file system
- dataset: dataset identifier in file system
- process\_list: full path to file with the list of source-deck partitions to process. This file can be either *Process list file* or a subset of it.

- `failed_only`: optional (yes/no). Defaults to no. Setting this argument to 'yes' means that only the monthly files with a \*.failed log file will be processed.
- `remove_source`: optional (yes/no). Defaults to no. Setting this argument to 'yes' implies removal of the source level (level1d) data files if the full set of monthly data files of a given source-deck is successfully processed.

This script executes an array of monthly subjobs per source and deck included in the `process_list`. The configuration for the process is directly accessed from the release configuration directory: the data period processed is as configured per source and deck in the release periods file ( *Release periods file*) and the level1d configuration is retrieved from *Level 1e configuration file*.

This script logs to `data_dir/release/dataset/level1e/log/sid-dck/`. Log files are `yyyy-mm-<release>-<update>.ext` with ext either ok or failed depending on the subjob termination status.

List \*.failed in the sid-dck level1e log directories to find if any went wrong.

After the basic QC flags have been merged the enhanced drifting buoy flags need to be merged with the level1e data. This process is described under Quality control in 4.4.6 in the C3S Marine User Guide (but will be moved to the level1e processing in a future update).

Once the drifting buoy flags have been merged the data files will no longer change and summary data reports need to be generated prior to the data moving to level2.



## LEVEL 2

After visual inspection of the reports generated in level1e, only observation tables reaching a minimum quality standard proceed to level2: this might imply rejecting a full sid-dck dataset or an observational table or change the period of data to release. The level1e data composition that has been used to generate the level2 product of every release is configured in level2.json file available in the release configuration directory. Prior to first use this file needs to be created. This can be done using the following commands:

```
cd obs-suite
source setpaths.sh
source setenv0.sh
cd scripts
python level2_config.py release_period_file year_ini year_end
```

where:

- release\_periods\_file: full path to the release periods file ( *Release periods file* )
- year\_ini: first year in data release period.
- year\_end: last year in data release period.

This script creates the selection file level2.json in the execution directory. The parameters year\_init and year\_end are used to set the final period of data release, that might be different to that initially processed. The data period of each of the individual source-deck data partitions is adjusted in the level2.json file according to these arguments.

After checking data quality on the level1e reports, edit the data selection file as needed to create the final dataset composition:

- Remove a full sid-dck from level2 by setting to true the sid-dck 'exclude' tag.
- Remove an observation table from the full dataset by adding it to the list under the general 'params\_exclude' tag.
- Remove an observation table from a sid-dck by adding it to the list under the sid-dck 'params\_exclude' tag.
- Adjust the release period of a sid-dck by modifying the 'year\_initlend' tags of the sid-dck
- Observation tables to be removed have to be named as observations-[at|sst|dpt|wbt|wd|wsl|lp]
- All edits need to be consistent with JSON formatting rules.

Once file level2.json has been edited the file needs to be copied to its directory in the configuration repository to be version controlled.

In the file sample below, all observations-wbt table files will be retained for level2, while observations-at will be dropped from level2 only in source-deck 063-714.

```
{
  "001-110": {
    "year_init": 1948,
    "year_end": 1951,
    "exclude": false,
    "params_exclude": []
  },
  "063-714": {
    "year_init": 2007,
    "year_end": 2009,
    "exclude": false,
    "params_exclude": ["observations-at"]
  },
  "171-711": {
    "year_init": 1889,
    "year_end": 1899,
    "exclude": false,
    "params_exclude": []
  },
  "params_exclude": ["observations-wbt"],
  "year_init": 1889,
  "year_end": 2010
}
```

The level 2 processing is then run using:

```
cd obs-suite
source setpaths.sh
source setenv0.sh
cd scripts
python level2.py data_directory release update dataset level2_config sid-dck
```

where:

- release: release identifier in file system
- update: release update identifier in file system
- dataset: dataset identifier in file system
- level2\_config: path to the level2 configuration file
- sid-dck: source-deck identifier

The launcher script for level2 is run with:

```
cd obs-suite
source setpaths.sh
source setenv0.sh
cd lotus_scripts
python level2_slurm.py release update dataset $config_directory process_list
```

where:

- release: release identifier in file system
- update: release update identifier in file system
- dataset: dataset identifier in file system
- process\_list: full path to file with the list of source-deck partitions to process. This file can be either *Process list file* or a subset of it.

This script executes a job per source and deck included in the `process_list`. The configuration file for the process (`level2.json`) is directly accessed from the release configuration directory.

This script logs to `data_dir/release/dataset/level2/log/sid-dck/`. Log files are *sid-dck-release-update*.ext with ext either ok or failed depending on the subjob termination status.

List \*.failed in the sid-dck level2 log directories to find if any went wrong.