DESTINATION EARTH (DESTINE)

Tools for HARP Point Verifications in DEODE

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Outline

0. Introduction
1. Observation collection & processing
2. Extraction of interpolated data from the reference models
3. Plugin for HARP point verification.
    a. Operational list of stations.
    b. Operational selections of stations.
4. Plugin for score aggregation
5. Visualization
6. Summary and conclusions

0. Introduction

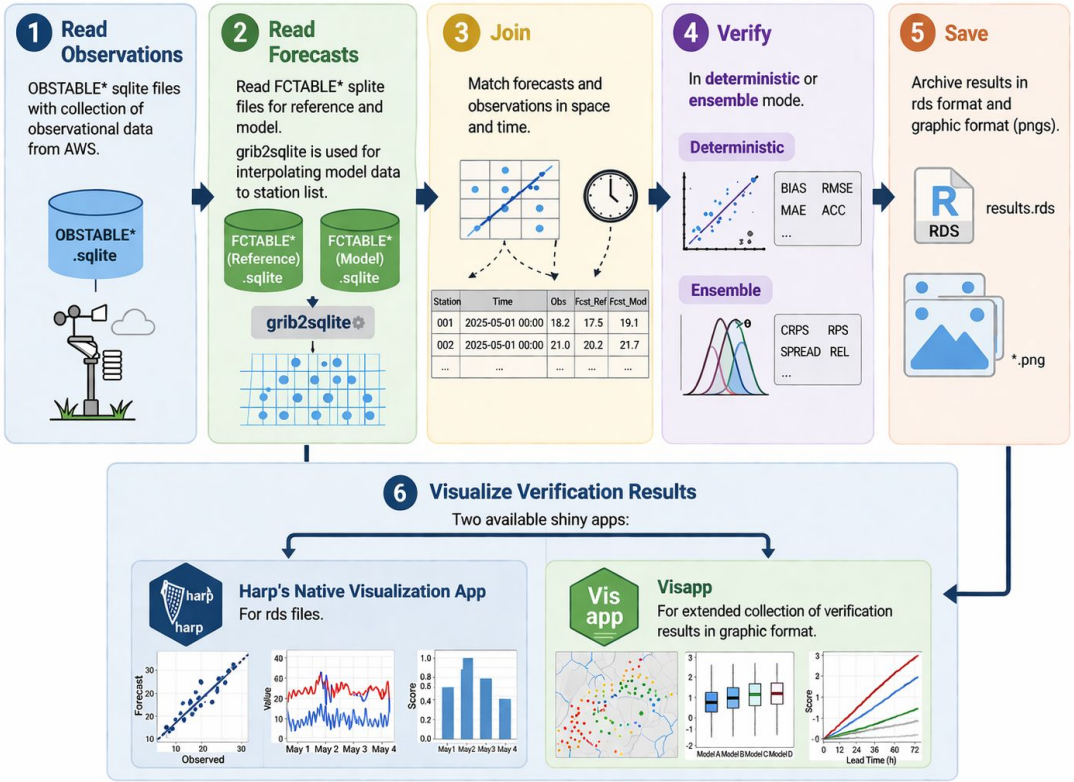
- Content: work developed during Phase 2 of the DEODE project to produce HARP point verifications of the DEODE system
- Objectives: Communicate these developments to ACCORD staff involved in MQA tasks
- Motivation: From DEODE to ACCORD
    - Importing tools and practices from DEODE might be useful for the verification activities of ACCORD members …
    - …specially in the context of the new “deployment releases” discussed on Tuesday in the topical session on “Common deployment”

0. Introduction: HARP in DEODE operations

- In DEODE, two types of point verifications are produced using HARP:
  - “Operational” verification of the daily On-Demand runs, in deterministic or ensemble mode, compared against deterministic (Global DT, IFS) or ensemble (IFSENS) global models
  - Periodic “validation rounds” to study the evolution of the Deode-Workflow system and compare the performance of the 3 CSCs and against the global references (Global DT & IFS):
    - “case studies” runs
    - month-long runs over 4 “static” domains (Denmark, France, Austria, Croatia) …

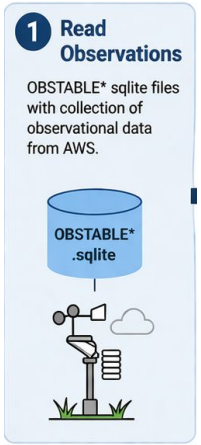
0. Introduction: Quick overview of HARP

- harpPoint: Part of harphub, provides the basic functionality for point verification
- oper-harp-verif: wrappers in R to harp functions to run the full verification workflow:



1. Observation collection & processing

- A collaborative task between WP9.4 (observations) and WP9.3 (verification)
- SYNOP and TEMP obs in bufr, OBSOUL & vobs merged into OBSTABLES
- Deode_obs for NRT data, vobs2sql_plugin for adding extra obs & data cleaning



Data format	Data Source	Conversion to OBSTABLES	Final merge and data cleaning
BUFR	ECMWF	Merged into OBSTABLES by DE_obs e-suite (WP9.4) Runs hourly Used for NRT monitoring	• Also by vobs2sql_plugin (WP9.3) • Data cleaning and de-duplication • Maximize number of available variables for every station and valid_time • Fill the longer range pcp accumulations with shorter range when possible Used for monitoring & verification
BUFR OBSOUL	LACE - ectrans		
BUFR	MetCoOp - ARCUS (AWS)		
BUFR	UWC-W - Local on ATOS:		
vobs	UWC-W, MetCoop & AEMET	Merged into OBSTABLES by vobs2sql_plugin (WP9.3) Runs daily	

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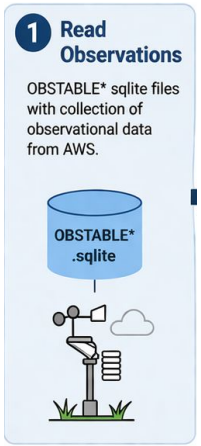
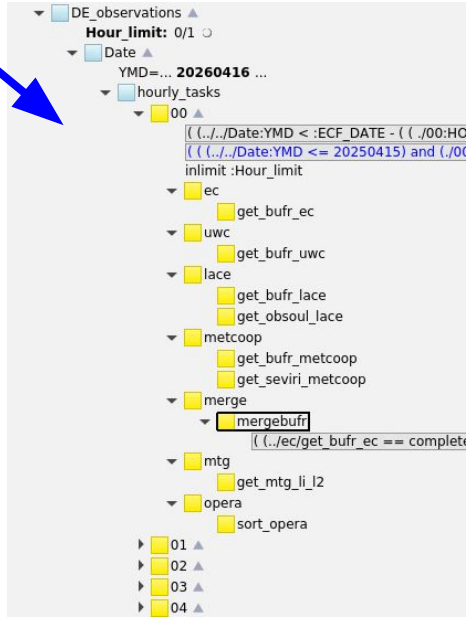
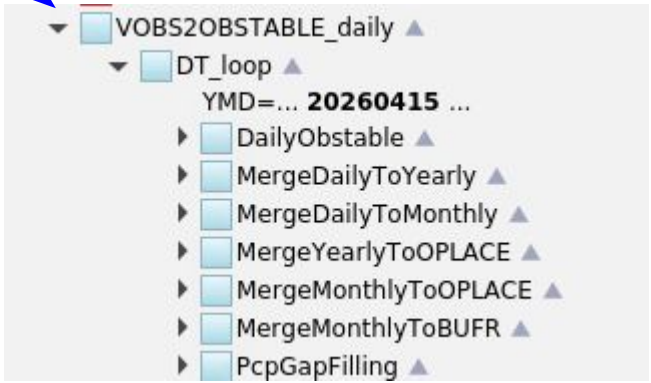
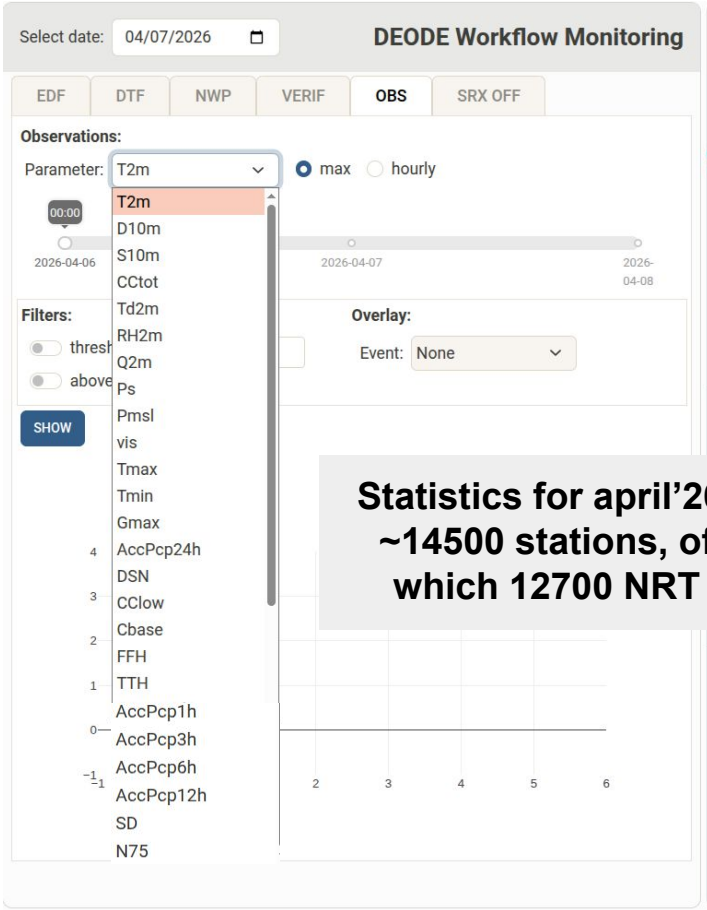


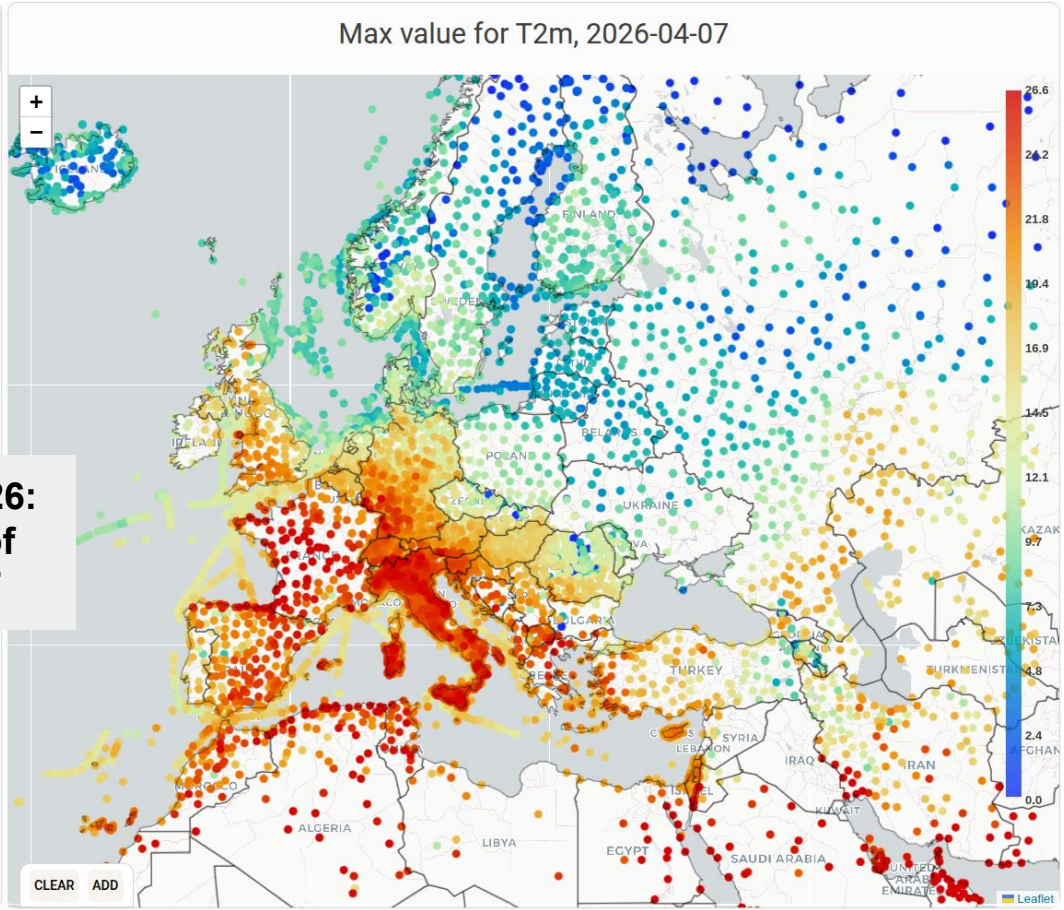




1. Observation collection & processing

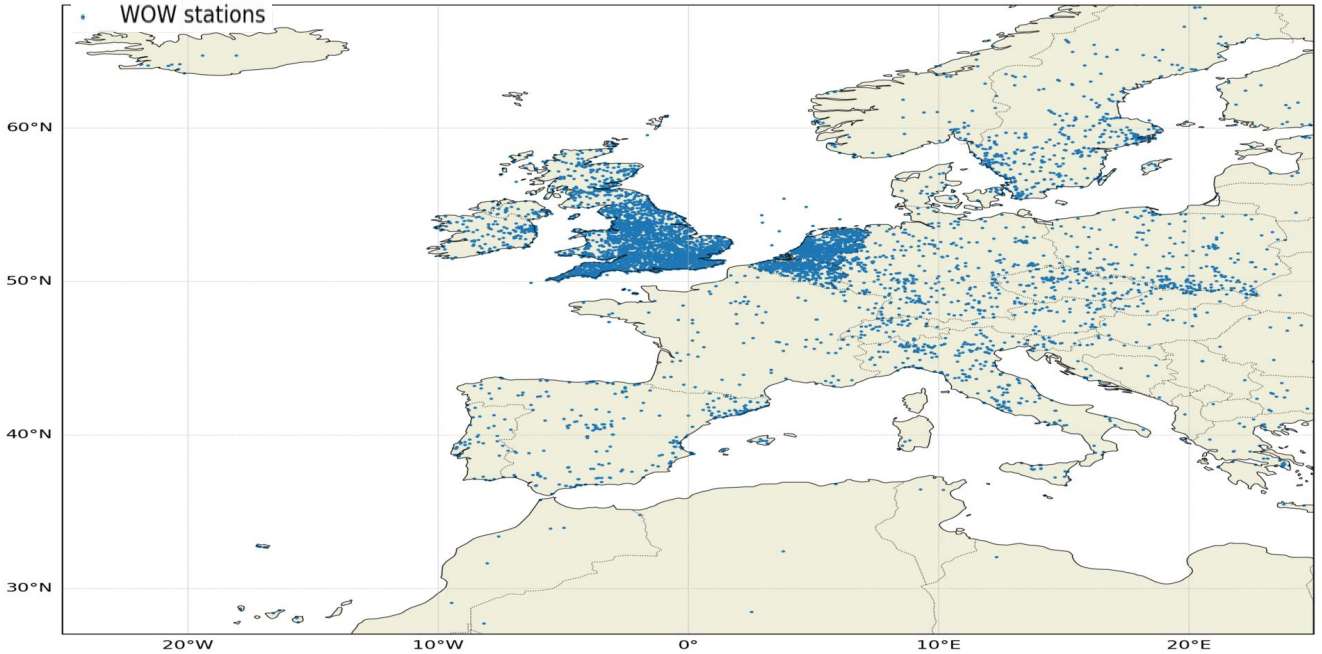


Statistics for april'26: ~14500 stations, of which 12700 NRT

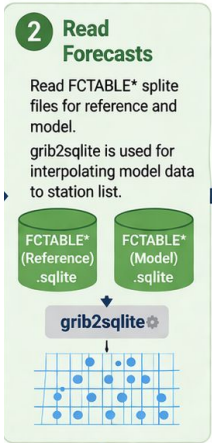


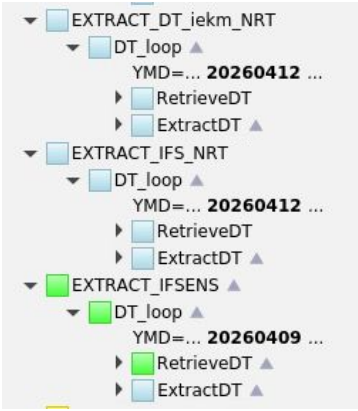
1. Observation collection & processing: WOW special dataset

- WOW: Crowdsourced observation platform by MetOffice & other partners
- Data from 2023 & 2024 made available for DEODE by Irene G. Marti (KNMI)
- Plans to have NRT WOW data in Phase 3, but WOW's future is uncertain



2. Extraction of interpolated data from the reference models

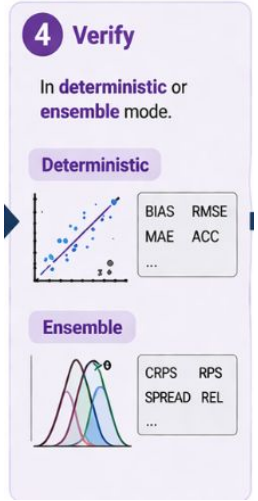




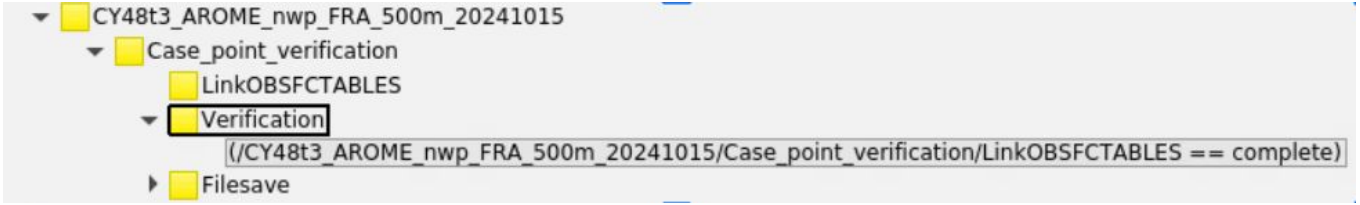
- Deode-Workflow writes FCTABLES*sqlite files for deterministic & ensemble On-Demand runs.
- For the reference deterministic models (Global_DT, IFS), extract_dt_plugin (Alex Deckmyn,RMI) is used to **retrieve** data from **MARS** or **polytope** and **extract** FCTABLES.
- Deode-Workflow and the plugin use **grib2sqlite** python library to interpolate grib files to sqlites.
- For the ensemble reference (IFSENS) we have been using data produced by UWCs (hlam) with a reduced station list.
- Recently, both the plugin and **grib2sqlite** have been extended to work for ensemble references (IFSENS)

3. Plugin for harp verification

- Used for run point verification of DEODE's operational simulations after the case is run and all the point observations have been collected
- Uses DEODE's plugin capabilities:
  - Start from the case's config file (config.toml)
  - Add HARP's configuration settings (harpverify_plugin.toml)



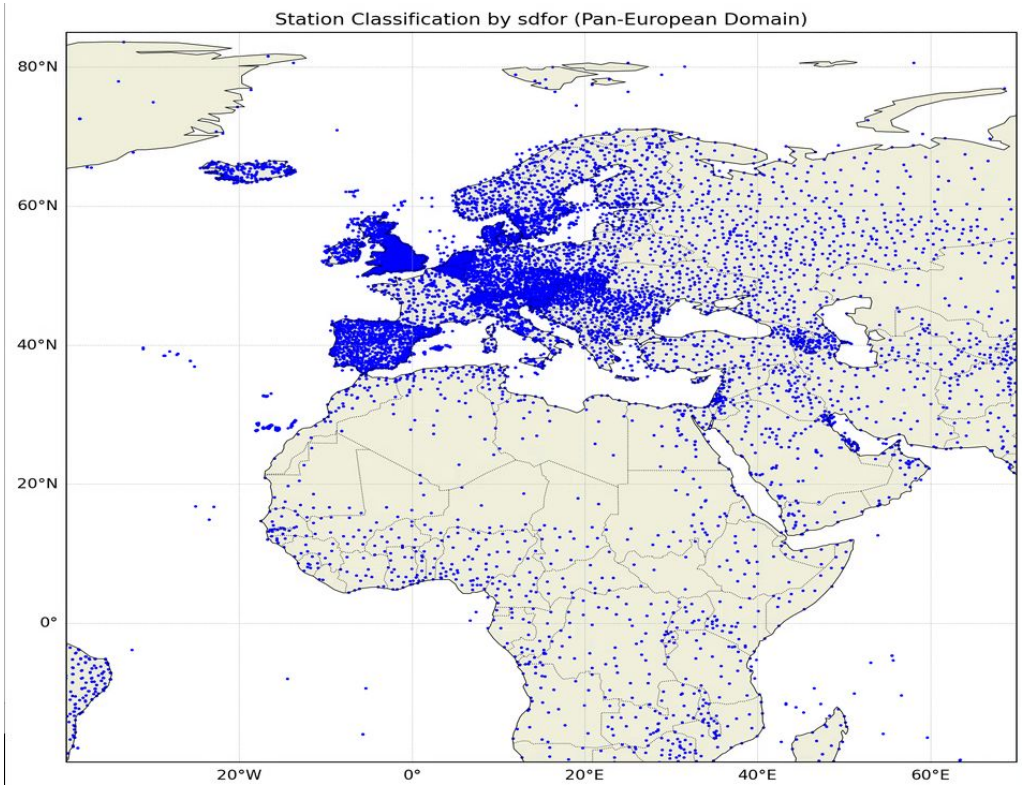
deode case config.toml harpverify_plugin.toml -o verification_suite.toml - - start-suite



The **Verification** task:

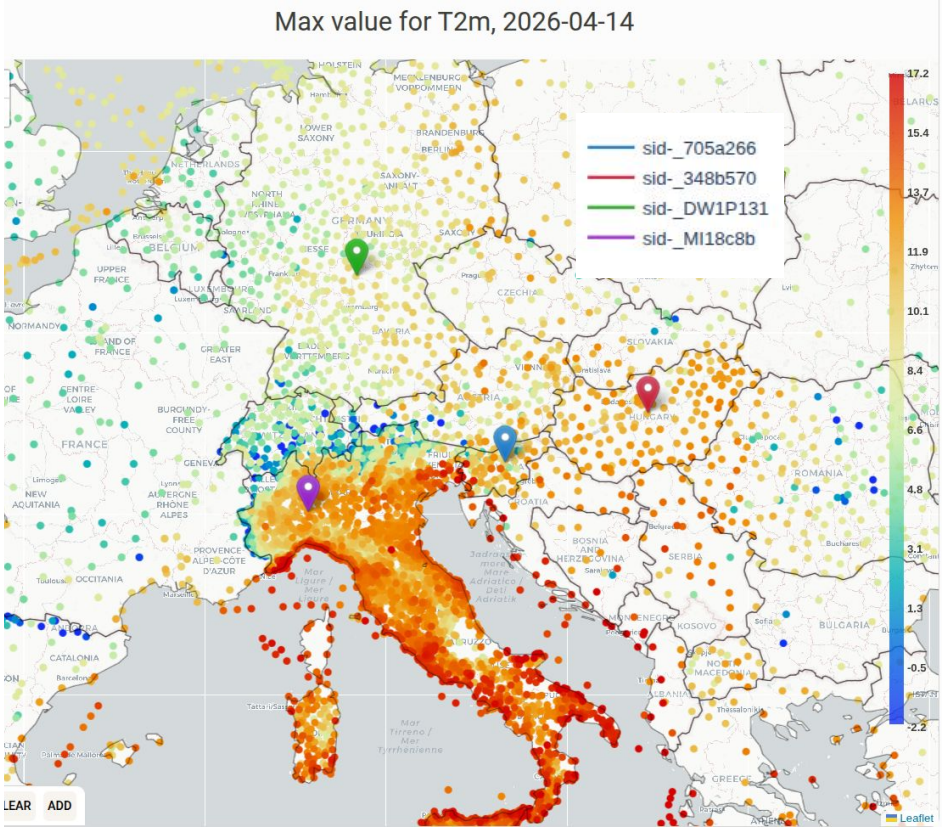
- Fills oper-harp-verif's .yml config file by parsing the general *toml file, selecting deterministic or ensemble references, etc
- Calls point_verif.R for T2m,{S,D}10m,Pmsl,Gmax,CCtot,S,D,RH,T,Q,Z and AccPcp{1,3,6,12,24}h

3a. Operational list of stations



- Merged from hirlam / UWC countries, LACE and WOW station lists
- ~23000 ground stations worldwide (including 8000 WOW) and ~600 temp stations.
- In practice, not so many in the obs collection (see slide 7)
- The list needs maintenance. Some issues discovered:
  - Duplicate coordinates
  - Obs collected for SIDs not in list

3a. Operational list of stations

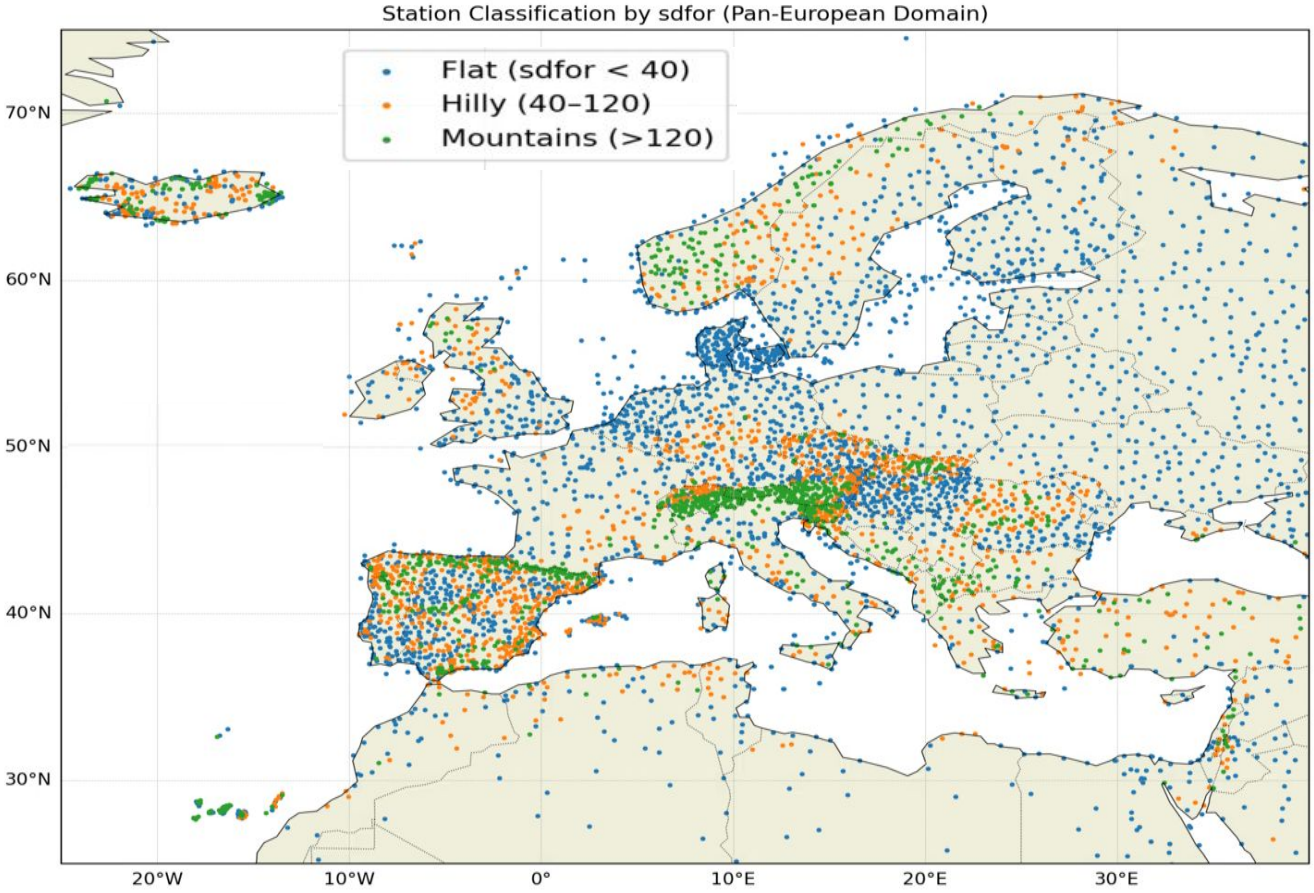


- Station IDs (SIDs) follow old WMO standards (purely numeric IDs)
- Data from some countries uses new WIGOS station ID's:

```
0  -  705  -  0  -  1948
|      |      |      |
|      |      |      └─ Local identifier (assigned by the NMS)
|      |      └──── Issue number (version, in case of reuse)
|      └─────── Issuer of identifier (ISO 3166-1 numeric country code)
└──────── WIGOS identifier series (always 0 for WMO members)
```

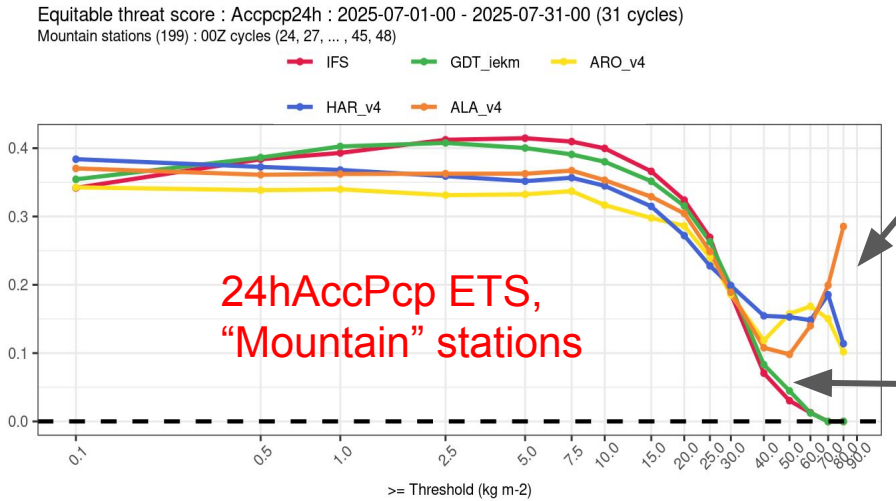
- Others have alphanumeric SIDs
- WIGOS / alphanumeric SIDs:
  - Not yet in the operational list of stations.
  - HARP can handle them correctly (tested by Polly Schmederer, GS)

3b: Operational selections of stations: Orography



- sdfor = standard deviation of filtered subgrid scale orography (SSO)
- Field retrieved from operational IFS
- Same clasification used by ECMWF to evaluate Global DT

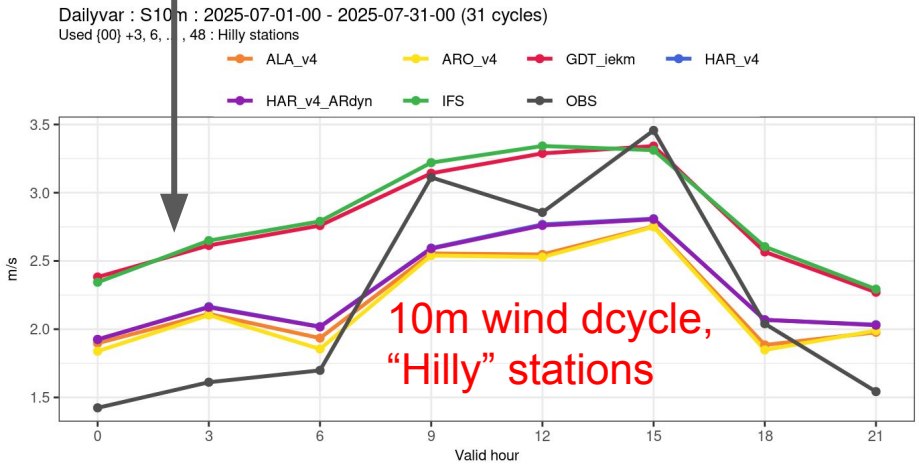
3b: Operational selections of stations: Orography



24hAccPcp ETS,
"Mountain" stations

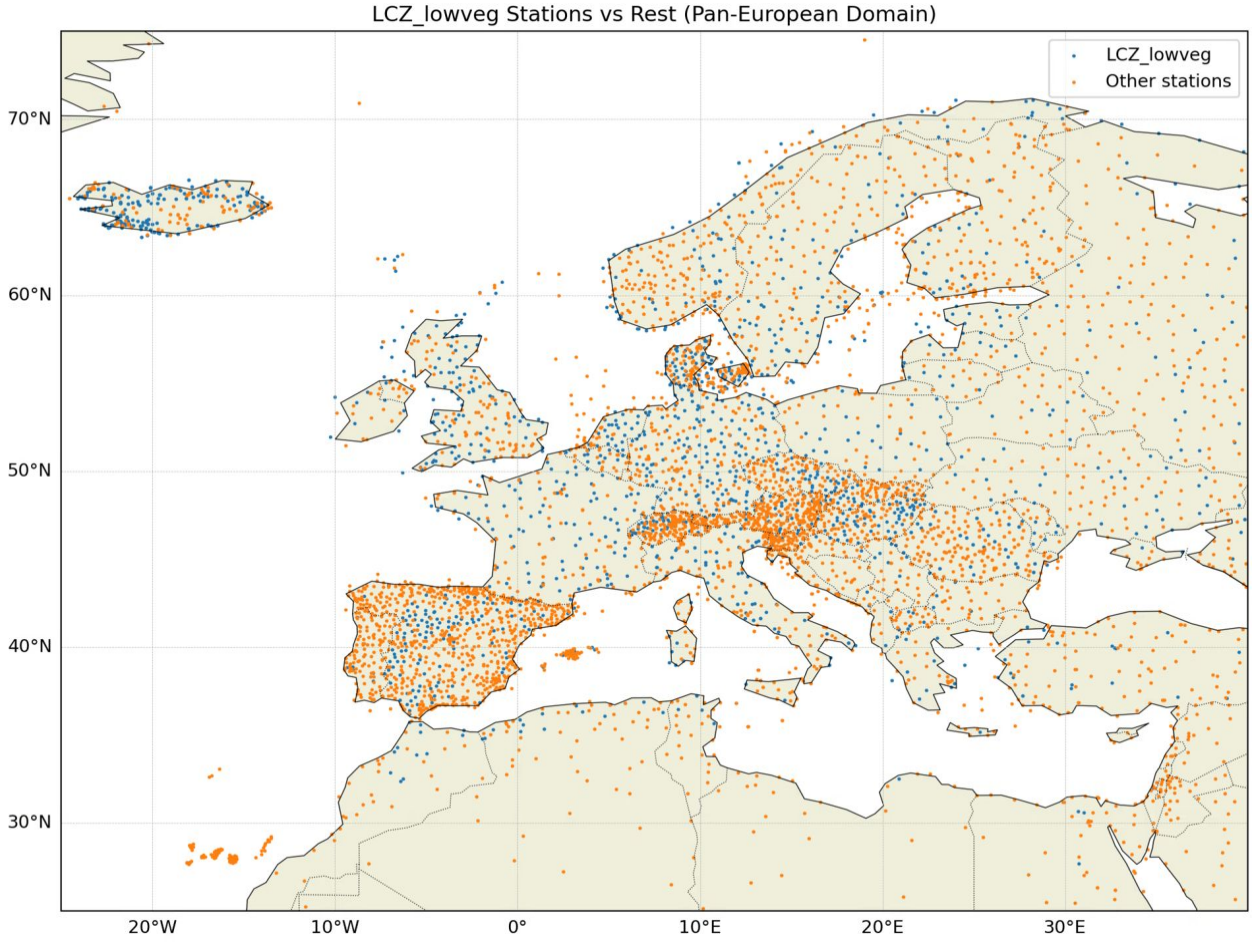
DEODE added value for extremes

IFS & Global_DT



10m wind dcycle,
"Hilly" stations

3b: Operational selections of stations: Low veg. LCZ(D)

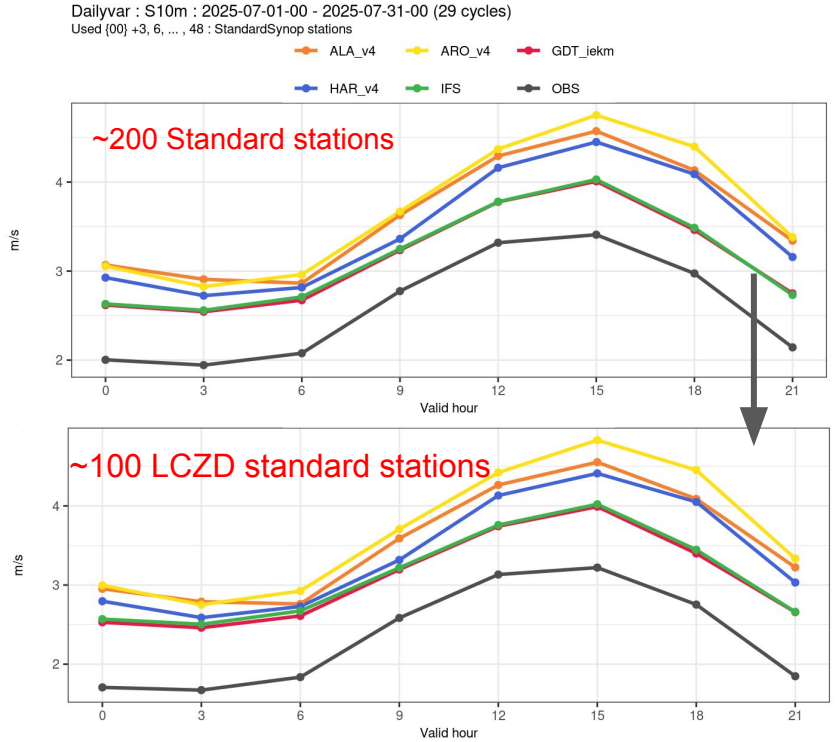


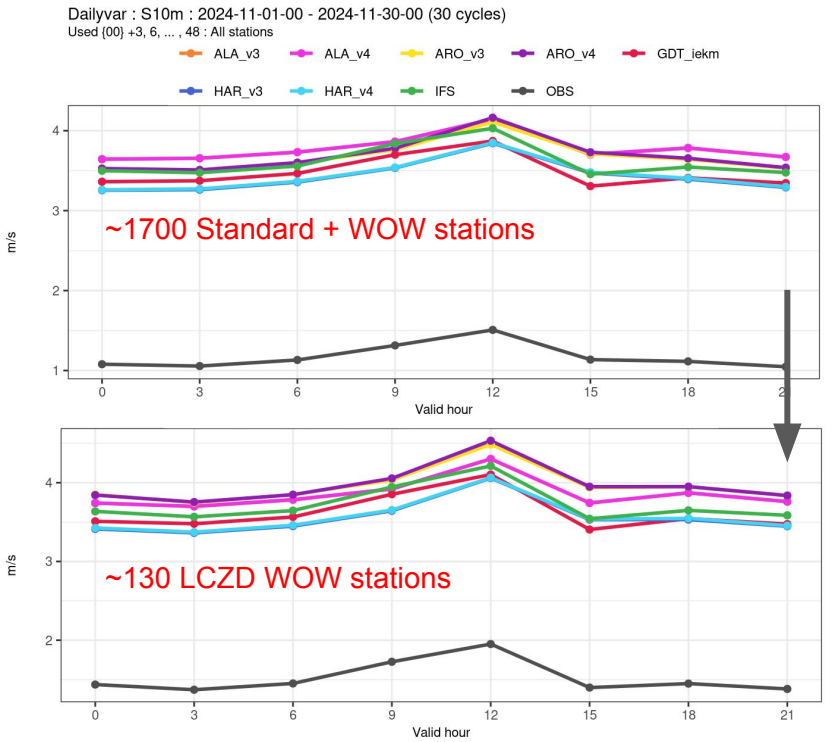
- Stations (specially WOW) may be poorly located→ obstacles distort wind measurements
- Use WUDAPT LCZ map to classify surroundings
- Check 100 m radius around each station
- Keep only stations fully inside uniform LCZ D (open low vegetation)

(*) In collaboration with Jeremy Bernard, Météo-France, CNRS

3b: Operational selections of stations: Low veg. LCZ(D)

Example: 1 month-long DEODE runs, 500m domain over North of France





For standard stations, results barely change with the LCZD filtering, i.e. they're not badly located after all…

…for WOW stations, a (large +) bias is even larger in LCZD areas ¡!

4. Plugin for score aggregation

- harpaggregate can be used to aggregate regular scores from different verifications
- It reads HARP results from *.rds files and weight-averages by lead times based on number of obs-fcst pairs (num_cases)

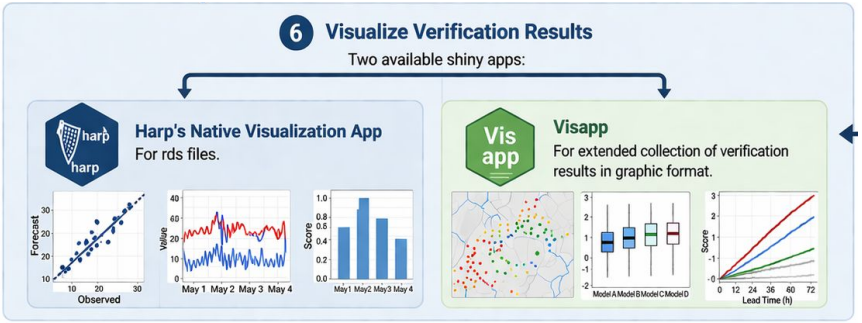
$$BIAS_{LT} = \frac{1}{\sum_{EXPS} cases_{LT}} \cdot \sum_{EXPS} BIAS_{LT} \cdot cases_{LT}$$

HARP's RDSs output files

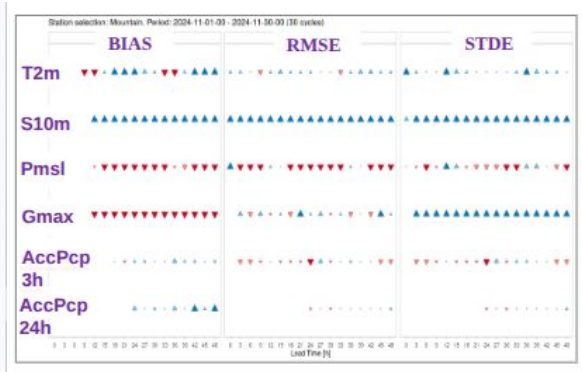
	fcst_model	lead_time	num_cases	num_stations	bias	rmse
1	harmonie_DK500m_DT	0	872	220	0.053966192	1.0544487
2	harmonie_DK500m_DT	1	868	218	-0.022097866	0.8696237
3	harmonie_DK500m_DT	2	868	218	-0.029283139	0.8915061
4	harmonie_DK500m_DT	3	870	219	-0.032408496	0.8616223
5	harmonie_DK500m_DT	4	867	218	-0.050958299	0.8474341
6	harmonie_DK500m_DT	5	869	218	-0.036151790	0.8960844
7	harmonie_DK500m_DT	6	885	222	-0.010667428	0.9453574

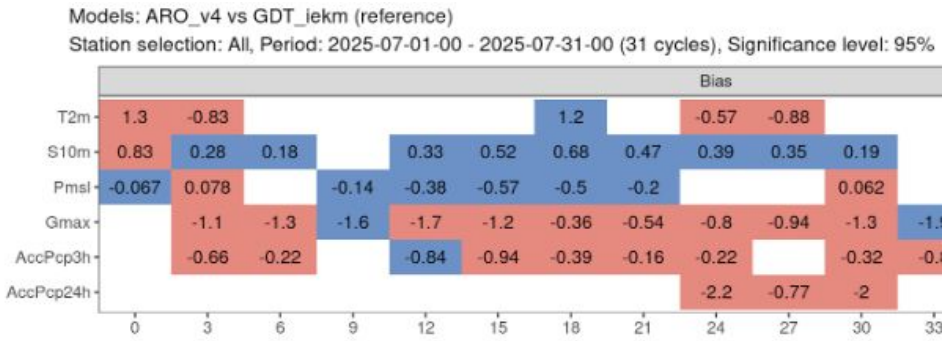
Aggregated BIAS,RMS,MAE, STDV of all OD runs over a period for each CSC

5. Visualization



- No adaptations needed, but a server to host these apps is necessary (currently an instance of the EWC)
- For validation rounds (long runs) we also produce scorecards with oper-harp-verif

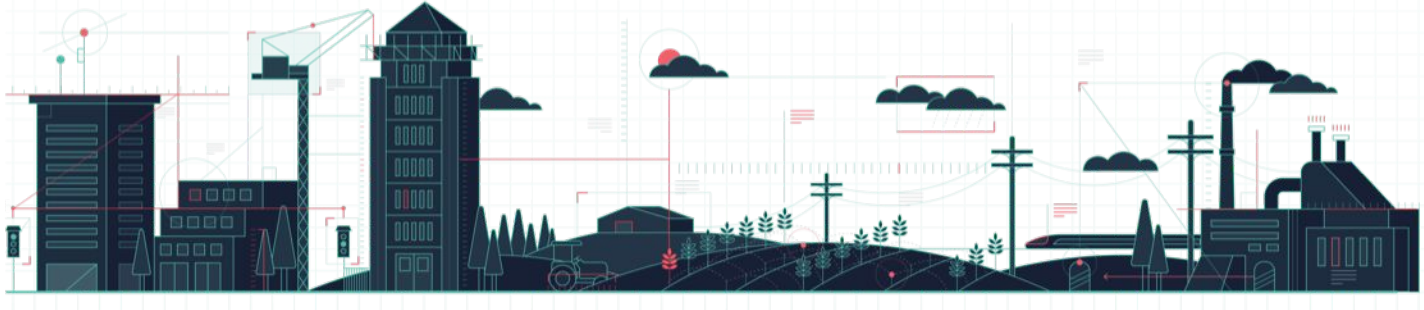




6. Summary and conclusions

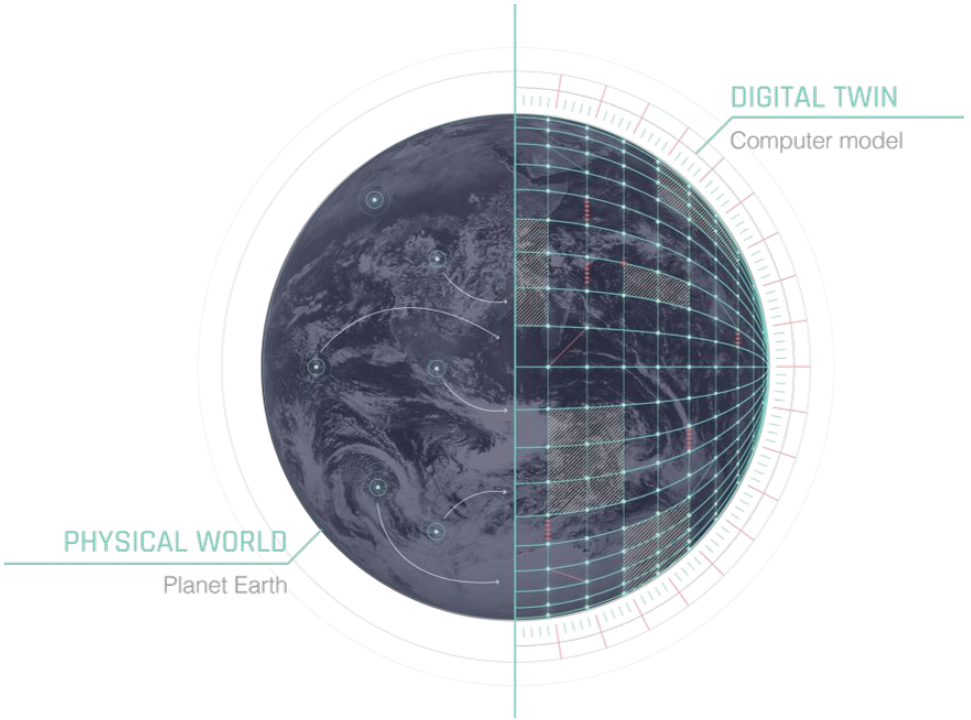
- Plenty of tools for obs collection & handling, model extraction & automatization of OD-DW verification
- Many of them developed as DW plugins, i.e. easily portable to use with Tactus
- Some basic infrastructure at ACCORD level for supporting MQA activities of the members can save resources by eliminating duplicities
  - Start with obs collection & extraction of reference model data?
  - Or DEODE data can be shared directly?
- More common practices, tools & data also mean results can be compared more easily + less question marks in conclusions

QUESTIONS?



CONTACT AND FURTHER INFORMATION

www.ecmwf.int/destine



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