YOPP archive: needs of the verification community

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Talk Outline:
P1 – model and observation data
P2 – observation uncertainty
P2 – matched model and observation: time series
P3,P4,P5 – verification software and products

... where P1 = Priority 1, P2 = Priority 2, ...

Model and Analyses (P1)

- List of model variables, origin / lead times.
- Grid meta-data (lat lon, topo, land-ocean mask ...).
- Model data in standard format (GRIB, netcdf). Native grid.

- Code to extract model gridded data (GRIB, netcdf).
- Code to extract data over a subdomain.
- Code to extract model time series at specific location.
  ➔ This was a shortcoming in TIGGE

- Code to download data includes a selection procedure and a prior estimation of size of data to be downloaded.

- Basic model data display (e.g. maps, Hovmoller diagrams)

Example: ECMWF S2S and TIGGE webAPI interface with Python scripts

ECMWF

Home | Chart dashboard | Contact | Search ECMWF | Log in

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S2S sets
- Real time
- Reforecasts

Statistical process
- Instantaneous and accumulated
- Daily averaged

Origins
- BoM
- CMA
- ECMWF
- HMCR
- ISAC-CNR
- JMA
- Météo France
- NCEP
- UKMO
- ECCC

Type
- ▸ Control forecast
- Perturbed forecast

About
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Navigation
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See also...
- Access Public Datasets
- General FAQ
- WebAPI FAQ
- Accessing forecasts
- GRIB decoder

S2S, ECMWF, Realtime, Daily averaged

Please login before retrieving data from this dataserver.

This dataset is available Mondays and Thursdays. read more

Select date

◉ **Select a date in the interval 2015-01-01 to 2016-10-17**

Start date: 2015-01-01 End date: 2016-10-17

○ **Select a list of months**

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2015	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	2016	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐		

Select All or Clear

Select step

☐ 168-192	☐ 192-216	☐ 216-240	☐ 240-264	☐ 264-288	☐ 288-312	☐ 312-336
☐ 336-360	☐ 360-384	☐ 384-408	☐ 408-432	☐ 432-456	☐ 456-480	☐ 480-504
☐ 504-528	☐ 528-552	☐ 552-576	☐ 576-600	☐ 600-624	☐ 624-648	☐ 648-672
☐ 672-696	☐ 696-720	☐ 720-744	☐ 744-768	☐ 768-792	☐ 792-816	☐ 816-840
☐ 840-864	☐ 864-888	☐ 888-912	☐ 912-936	☐ 936-960	☐ 960-984	☐ 984-1008
☐ 1008-1032	☐ 1032-1056	☐ 1056-1080	☐ 1080-1104			

Select All or Clear

Select parameter

☐ 2 metre dewpoint temperature	☐ 2 metre temperature	☐ Convective available potential energy
☐ Sea surface temperature	☐ Sea-ice cover	☐ Skin temperature
☐ Snow albedo	☐ Snow density	☐ Snow depth water equivalent
☐ Soil moisture top 20 cm	☐ Soil moisture top 100 cm	☐ Soil temperature top 20 cm
☐ Soil temperature top 100 cm	☐ Total Cloud Cover	☐ Total column water

Select All or Clear

Observations (P1)

- Table / landing web-page with obs variables, period coverage, frequency (to be prepared possibly prior obs campaign).
- Observation meta-data (lat-lon, altitude, ...)

- Gridded obs in standard format (GRIB, netcdf). Native grid.
- Observations at point location in standard format (BURF).

YOPP will encompass many different types of obs (gridded, stations, drifting buoys, aircraft measurements, ...): it will be challenging, but we should aim for as few different formats as possible.

- Code to extract obs time series at specific location.
- Code to extract gridded obs (GRIB, netcdf).
- Code to extract subdomain of data.
- Downloading selection procedure and a prior estimation of size.
- Each dataset basic product display (e.g. time series)

Observation Uncertainty (P2)

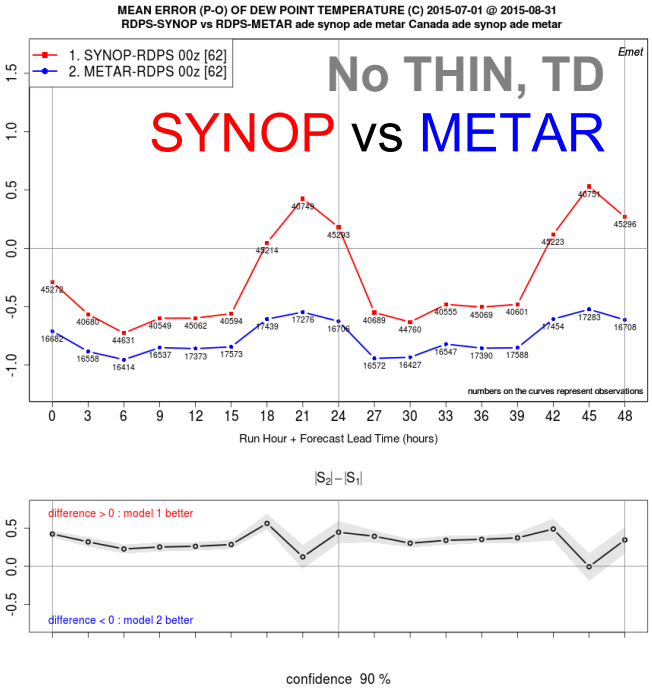
Observation

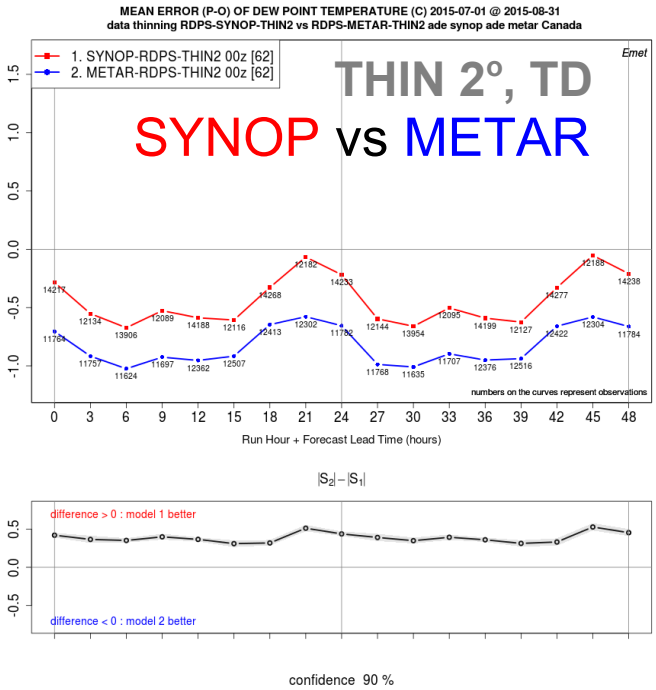
- Estimate of the obs uncertainty.
- Observation quality control:
  - transparent and reproducable procedure (flag);
  - model-independent;
  - based on: climatology, spatial coherence, temporal coherence, inter-variable coherence.
- Missing values (retain sample size).

Analyses

- Flag / mask to associate level of obs influence / level of background model dependence in analysis;
- Estimate of obs uncertainty from DA algorithms / error var-cov ... (need to outline this with DAOS).

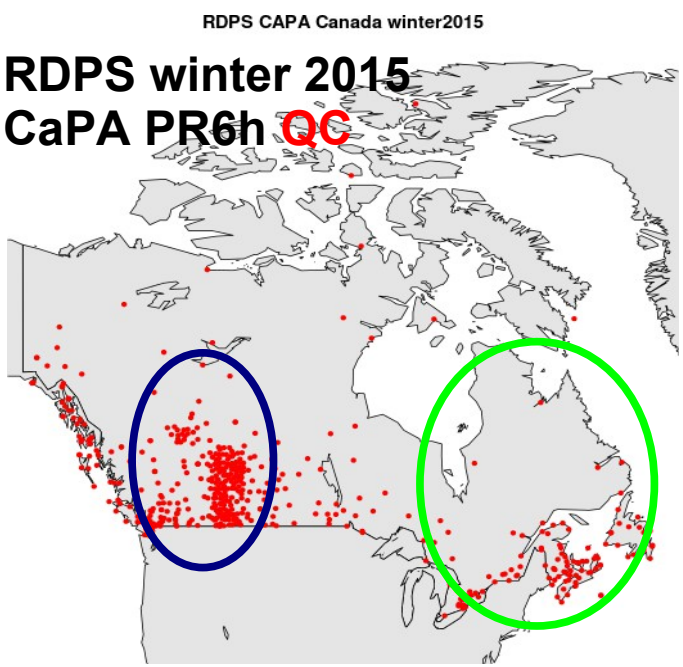
Uncertainty in obs is **not negligible**: there is a growing need to account for observation uncertainty in verification practices!

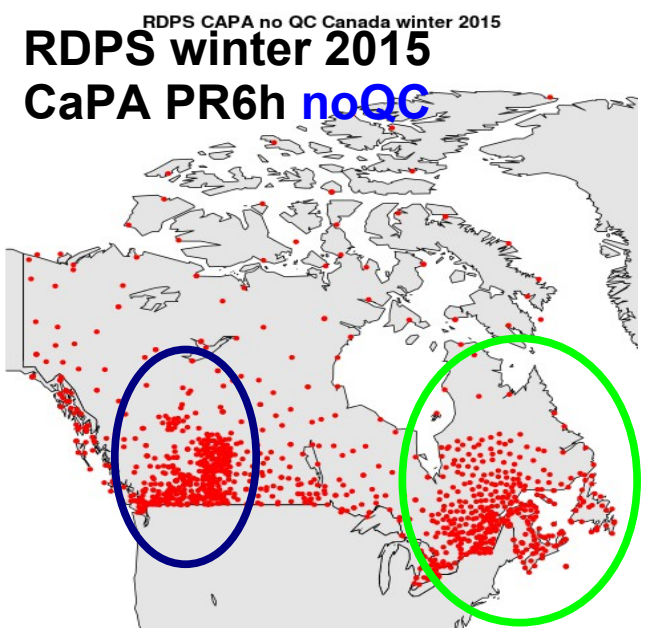


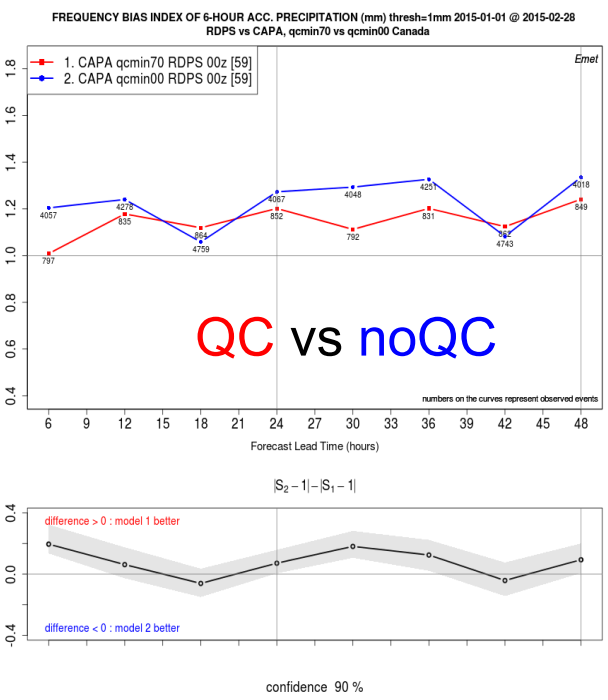


Example 1:
RDPS summer 2015, TD bias, SYNOP vs METAR without and with thinning (2º thinning leads to similar sample size and spatial sampling).

Example 2: effects of quality control (tipping bucket freeze), FBI.







Verif = Model + Observations (P2)

P2: Option to download already matched obs-forecasts (e.g. for time series at point locations):

- Option / code for different interpolations: linear, cubic, spline, Hermite, nearest point, conservative upscaling, ...
- Option / code for temporal matching and aggregation (e.g. 6h and 24h precipitation accumulation).
- Option / code to convert (model-based to observed) variables.

P2: Would be nice to archive the model output (at least) with the same frequency of the observations (e.g. for time series at point locations).

Note: Polar Regions are characterized by sparse observations. Weather moves: time series / the time dimension can partially compensate for the spatial sparseness.

General software and products (P3)

Desiderata (aka P3 and P4): provide script templates for linux/unix/shell environment and (some) codes in (some of) the most popular software (e.g. python, Matlab, R, F90, C++).

However we realize that the following list might be ambitious! Alternative: archive could provide links to sites providing software (e.g. NCAR Meteorological Evaluation Toolkit); create a YOPP verification software repository for exchange (outlined by YOPP verification task team).

P3 - Basic model and obs data display / manipulation:

- code to read and visualize model and observed gridded data;
- code to read and visualize time series at point locations;
- netcdf-GRIB convertor;
- interpolation and other codes used for obs-forecast matching.

Verification software and products (P4)

P3 - Basic verification plots

- P4 - Code to perform basic calculations / verification.
- P4 - Code to aggregate basic statistics (spatially, temporally)
- P4 - Code to perform inference (block bootstrapping)

P3 - Option to download basic verification statistics (to be stratified and aggregated by users)

P4 – Spatial verification tools.
P5 – Multi-variate conditional verification tools: code to extract subset of data based on dynamic condition (target physical process), and perform verification on this sub-sample.

Note: P4 codes are all already available in NCAR MET.

Ideally: independent YOPP verification web-site similar to TIGGE museum = P1 (but probably not within archive web page).

Conclusions

P1 – model, analyses and observation data

P2 – observation uncertainty: heavily affects verif results.

P2 – matched model and observation: time series

P3,P4,P5 – verification software and products

- Several software already exists (NCAR MET).
- Probably will be deferred to an independent YOPP verification webpage similar to the TIGGE museum.

THANK YOU!

(Some of the key) YOPP verification challenges

Demonstrate added value of:

1. Enhanced observations (in DA, predition, verification); verif in data-sparse regions + obs uncertainty
2. Coupled NWP: heat fluxes, radiation budget (ocean-land-atmosphere exchanges with/without sea-ice, snow).
3. Sea-ice models.

YOPP consolidation phase:

4. Pre- versus post-YOPP NWP systems
5. Linkages: improved predictability in Polar Regions leads to improved predictability in mid-latitudes.

Need to be further outlined by theYOPP verification task team:
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