

Notes on process diagnostics session (IVMW-O 2020): 11 Nov 15UTC

Opening remarks by Barbara Casati:

Aim of process diagnostics: provide feedback on the physical nature of the forecast error (collaborative effort between modelers and verification scientists)

- [Haiden et al \(2019\)](#) outline some strategies for process diagnostics.
- Processes are interactions between physical variables. Two approaches for investigating processes are conditional verification and multivariate statistics
- Opportunities for advancing process diagnostics:
 - a) Testbed datasets (e.g. YOPPsiteMIP) containing paired obs-forecast multiple variables.
 - b) ESM increasing complexity: coordinated efforts such as CMIP, WGNE, GEWEX intercomparison projects stimulating collaborative research on process diagnostics

Talk 1: Representation of process based diagnostics in NCUM global and regional models (Mohana Thota)

Questions/discussions

Mark Rodwell: Commented on moisture budget analysis not closing on reanalysis and forecasts. Suggested to investigate other possible source of error.

Barbara Casati: Asked if other sources of observations other than reanalysis were used.

Response: Used only reanalysis.

Jess Baker: Asked how reliable are reanalyzes used in study area.

Response: Structure and evolution seems to be ok for the investigated rainfall break event.

Barbara Casati: Could you explain how the source of the rainfall break event was identified?

Response: Break event was identified based on the area averaged standardized rainfall anomalies exceed 1-sigma level and persists for more than 3 continuous days.

Jess Baker: Commented on challenges to use reanalysis. Differences between reanalysis and satellite data can be as large as difference between model simulations and reanalysis. Uncertainty in reanalysis is something to be considered. Models may not be so bad in some situation. Reanalysis may have errors in some situation.

Talk 2: Deep Learning for the Verification of Synoptic-scale Processes in NWP and Climate Models (Julian Quinting)

Questions/discussions

Mark Rodwell: Would the applied methodology work under global warming? Can you partition the analysis under a cold and warm period?

Response: The model was trained in a later (warmer) period and evaluated in an earlier (colder) period, and the methods seemed to work ok.

Mark Rodwell: Would it be possible to look at specific cases where high probabilities were identified and then start trajectories from the identified regions to see if these actually behave like WCBs?

Response: Yes, it would be possible. It has already been done for a logistic regression model). For the regression model, the trajectories which were started from the identified inflow regions ascended WCB-like.

Raghu Ashrit: Is there any post-processing before this is applied?

Response: No, this is not necessary.

Raghu Ashrit: Does it identify all possible structures?

Response: No it doesn't because it is not trained for that.

Talk 3: Diagnosing land-atmosphere moisture coupling over South America in simulations from the UK and Brazil climate models (Jessica Baker)

Questions/discussions

Jonathan Day: As for the identified damped seasonal cycle of soil moisture in reanalysis/satellite data, can you use in situ observations (station data) to validate this aspect?

Response: Not only satellite soil moisture but also satellite evapotranspiration can be challenging to validate over the Amazon. There

are a few (a hand full of sites with) data in the Amazon that can be used for this purpose. Have another submitted paper evaluating Amazon ET using such data.

Barbara Casati: Perhaps the slope of regression (that shows the relationship between two variables) can also be examined in addition to correlation value to gain addition information (slide 12).

Response: Agree. That is a good idea. It's also good to apply multiple evaluation metrics, not just a single one.

Marion Mittermaier: Great to see that these land-atmosphere moisture coupling diagnostics are already available at Github. It would be great if these diagnostics can also be added to the METPLUS verification software (next week there will be 2 session on IVMW-O on METPLUS).

Response: Jess would be interested in such a collaboration and would be happy to learn more about METPLUS to see how to make these land-atmosphere moisture coupling diagnostics available in METPLUS.

Raghu Ashrit: Still on slide 12, why did you look at the regression for the dry season?

Response: All seasons were examined, but the dry season showed the most remarkable features.

Talk 4: Evaluating the Impact of Planetary Boundary Layer, Land Surface Model, and Microphysics Parameterization Schemes on Cold Cloud Objects in Simulated GOES-16 Brightness Temperatures (Jason Otkin)

Questions/discussions

Jess Baker: Why is model performance different between warm and cold periods?

Response: Winter is better forecast because of the synoptic conditions prevailing during this time of the year. Summer is more convective, having more objects identified with more detailed structures.

Microphysics model developments are usually focused on improving precipitation forecasts. Upper level cloud features (such as cirrus clouds) are not well represented in models, leading to too many objects.

Improvements in representation of clouds for the shorter time scale (weather) can help improve the representation of clouds for longer time scales (climate).

Jonathan Day: Would it be possible to include additional cloud diagnostics to objects to have a better understand cloud representation?

Response: There are many attributes that can be looked at for this purpose, including for example complex scatter plots of objects with different sizes, which can provide important details for this purpose. Inaccuracy of small objects can be useful for identifying problems in the boundary layer scheme.

Raghu Ashrit: High resolution models produce noisy forecasts. Is there a need for post processing such noisy forecasts prior to verifying brightness temperatures?

Response: We try to account for that using object-based tools/features. Fields can be smoothed out before identifying objects.

Barbara Casati: Intersection area ratio. What is the intersection precisely?

Harvir Singh:???