

Workshop on Predictability, dynamics and applications research using the TIGGE and S2S ensembles - ECMWF 2-5 April 2019

Summary from Working group 3 on Processes and Forecasts

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1. Extension of TIGGE and S2S databases to facilitate process diagnostics

Stratospheric community needs more variables to make better use and evaluation of S2S database. Survey with wish list exists through SNAP (https://www.dropbox.com/s/cc07fdplb4xoizn/snap_request.docx?dl=0)

- EP Flux? – maybe too ambitious
- More vertical levels in the stratosphere
- WGNE GASS Orographic Drag inter-comparison project may help inform about model biases although at shorter forecast ranges

For specific studies we encourage direct collaborations with centres to derive additional variables from raw data rather than expanding S2S/TIGGE database.

PV more levels: TH@2PVU, and/or 310, 320, 330, 340, 350K PV, vertical average (500-150hPa)

10m wind 6-hourly

We noted that additional ocean variables will be added to S2S archive

2. Process studies/diagnostics: how to better coordinate these studies across the community (code sharing, post-processed data...)

Provision of pre-computed indices exists for RMM, TC tracks, Atlantic weather regimes. This could be expanded.

Stratospheric community already shares fields internally: heat fluxes, zonal means (SNAP group). Could this be communicated more formally via S2S website? Survey on existing pre-computed diagnostics?

Proposition for a Workshop to discuss which diagnostics to share and develop

Make better use of existing Wikis/Webpage about the S2S scientific projects to facilitate sharing data/tools

Connect better with other initiatives within WMO / WGNE focussing more on NWP or longer time scales, integrate more in S2S. What is going on there should penetrate better down into research community.

3. Process studies/diagnostics from TIGGE and S2S data: which areas need more attention?

We identified a range of processes that require better understanding on how they relate to forecast skill

Land-atmosphere interaction

air-sea interaction also in relation to MJO. Impact of resolution of ocean eddies?

How biases affect Rossby Wave propagation and therefore deteriorate teleconnections.

How well are planetary stationary waves are represented in S2S models? Note initiative in WGNE to compare resolved orography -> stationary planetary waves

Better understanding of tropical-extratropical interactions (both directions)

Better understanding of MJO-stratosphere-QBO link to establish teleconnections.

Better diagnostics to capture sources / and teleconnections? (e.g. MJO envelope rather than global index)

Large-scale patterns, how they relate to surface weather (multi-scale extremes, TCs) in different world regions? How do errors for these patterns grow?

4. Processes/forecasts: how can we bridge the gap between medium-range (TIGGE database with uncalibrated products) and extended-range (S2S database with calibrated products)?

Understanding the evolution of model bias in different variables and across time scales.

- Can we identify specific processes associated with error growth?
- More interaction with people working on error growth on shorter ranges (e.g. German Waves2Weather consortium)

Can we find a seamless calibration that is optimal from medium- to extended range?

- Process-oriented calibration needed?
- Multi-model calibration rather than single model calibration?

Research on the optimal filtering for assessing skill in a window moving from medium-range to extended range is encouraged (consider time and space filtering)

5. How can we harmonize more the TIGGE and S2S databases? (pre-calibrated variables?)

Need for having a reference climatology.

- Archiving a climatology, if this is not possible, at least provide documentation on methodologies to compute climatologies for specific applications and variables.
- Could the climatology computation be done directly online and / or tools provided?
- We realize that defining a consensus reference period might be difficult
- More information on how to best combine different ensemble data for research applications (problem of different init. times)

6. Re-forecasts: What is the impact of ignoring the bias at medium range? What would be the optimal design for medium-range and extended range?

Could reforecasts and other less time-critical tasks be computed externally on cheaper hardware/computers/cloud?

- Allocation of computer resources for reforecasts could be used for higher resolution / higher frequency / bigger ensemble for the operational forecast.
- Would encourage more centres to produce reforecasts.
- Move less time-critical tasks (reforecast, seasonal forecast) on cheaper hardware/cloud, to free resources to increase resolution / members.

Regularly updated reanalysis would improve consistency between reforecast and real-time forecast.

7. How important is it for research to have access to forecasts closer to real-time

It is important for demonstration of applications, during field campaigns, and for forecasters working in operational centres

8. How important is to diagnose processes associated with flow dependent predictability from medium to extended range?

More important the longer the lead time

Many examples for conditional skill associated with MJO / weather regimes / blocking / SSW / ENSO / land-surface shown here at workshop, but more processes need to be identified.

More research is needed to link errors in large-scale patterns to errors in specific processes

Better understanding of non-linear interactions between different processes

Ranking of importance for general skill emerging from the different processes (diabatic heating, vs. teleconnections from MJO, stratosphere).

For both conditional skill and non-linear interaction enhanced statistical tools are required to deal with small sample sizes

9. Ensemble generation: how optimal is it currently for seamless prediction? How useful are the TIGGE and S2S databases for intercomparing initialization strategies.

TIGGE and S2S databases are not ideal to address the question of initialisation strategy due to different configuration.

Better representation of land surface uncertainty both in IC and model needed.

Spread of analysis is informative for potential sources of uncertainty. Analysis are in TIGGE archive but not in S2S. Provision of initial condition (step 0h) for S2S would be helpful.

Better documentation on how ensembles are initialised is needed.

10. What is more important for ensemble prediction: forecast frequency/ensemble size/resolution/complexity?

Correct representation of processes is crucial. Only then larger ensemble might help.

Not possible to derive an answer from TIGGE/S2S database

Operational procedures constrain ensemble design and configuration

More research needed to define optimal configuration in terms of frequency /size/resolution /complexity

- The importance of vertical resolution at upper levels should be investigated specifically. Important to exploit potential predictability from stratosphere.

Systematic and harmonised investigation should be carried out within each operational centre

Harmonization of real-time forecast schedule is encouraged

Experimentation between lagged initialisation vs. burst initialisation or combination is on-going

In operational/research centres data sets exist testing aspects of frequency/size/resolution/complexity. Survey about available data and contact persons could help to communicate these datasets and make wider use of them.

11. TIGGE and S2S Forecast websites (e.g. “TIGGE museum”, “S2S museum”, “ECMWF S2S products”): how useful are these products. How could they be improved?

- Very useful for case studies.
- Will drive more interest if it was in real time.