



**PDEF**

**Probability Dynamics Ensemble Forecasting**

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- Discussion of ways PDEF and WGNE might facilitate research progress in
  - Stochastic parameterization and observation error of representation estimation techniques.
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# Five Scientific Challenges

- PDEF is currently focussing on:
  1. Stochastic representation of the effect unresolved processes in numerical models (Judith Berner, Mark Rodwell)
  2. Construction of ensemble initial conditions (Craig Bishop)
  3. Interactions of diabatic processes with meso/synoptic scale dynamics (John Methven, Mark Rodwell)
  4. Assessment of multi-model ensembles and calibration techniques (Munehiko Yamaguchi )
  5. Coupled modelling & assimilation (Oscar Alves)
- The set of challenges will evolve as priorities change.



# Areas of PDEF-WGNE overlap

- Coupled DA and coupled model ensemble initialization (addressed in October 2016 Meteo-France coupled model workshop supported by WMO/DAOS/PDEF.)
- Stochastic parameterization
- Ensemble post-processing (including Multi-model).



# Model error and stochastic parameterization

- PDEF and WGNE have already helped organize two workshops on systematic and stochastic model error.
- For stochastic error, coarse graining experiments are fundamental for advancing understanding and testing techniques.
- Might NWP centers be persuaded to set-up coarse graining research test-beds for the general research community?
- Action: Advocate experimental design for coarse-graining studies that can be applied in a common framework across different models.



# Model error and stochastic parameterization

- Straw-man test-bed would contain something like
  1. A *coarse* non-convection resolving model.
  2. High spatio-temporal resolution output from a *fine* convection resolving model temporally and spatially averaged into the discrete  $\Delta T$ ,  $\Delta X$ ,  $\Delta Y$ ,  $\Delta Z$  space-time bins of the coarse resolution model.
  3. Researchers can initialize the coarse resolution model with data from step 2 to test how well their stochastic model accounts for deviations of the coarse resolution model from the coarse-grained fine resolution model.
  4. A web-site set up to describe such research and link published research papers associated with it.



# Climate model ensemble post-processing

- In March 2017 emails between Craig Bishop, Michel Rixen, Kumar Kolli and Paolo Ruti encouraged the idea of some sort of “multi-model climate ensemble post-processing” web-site be set-up with close links to the CMIP ensembles.
- This web site would list all known refereed research articles associated with CMIP5 post-processing.
- In addition it would suggest some “standard post-processing tests that could be performed; e.g. one randomly lets one of the CMIP5 members be a proxy for truth and then tests how well the post-processing technique allows pre-present observations to improve climate predictions for some future decade(s).
- How can we move forward with this?



# Other Relevant Actions

- PDEF to recommend to the leaders of the YTMIT initiative of S2S (Year of Tropics and Mid-Latitude Teleconnections) that they link their plans and experimental designs with the polar-low-latitude interactions activity of YOPP and share results.
- Encourage use of the NAWDEX campaign period for the investigation of the processes in NWP models and the origins of model error.
- TIGGE – a number of actions are required to ensure the successful continuation of the TIGGE data base and its utilisation in global research.
- There is very low usage of TIGGE-LAM and it is important to increase usage or discontinue. PDEF will promote its use ...
- Provide guidance on the S2S 5-year plan. Topics include:
  - Database link with TIGGE.
  - Project on analyzing ensemble characteristics of different forecast systems.
  - Role of systematic error and random error.
  - Rossby waves and teleconnections.
  - “Rossby wave triggers”: MJO, TCs, diabatic processes.





# Other Relevant Actions (2)

- Proposal to the S2S 5 –year plan. *Hypothetical users* as a way to evaluate benefit and improve S2S ensemble forecast systems. \$ Benefit of each system.
- **Coupled modelling/Coupled DA**
- Most centres tackling coupled DA – potential for some collaboration
- S2S should consider extending to maybe 4 months – allow inter-comparison of real-time seasonal forecasts (?) and case studies
- E.g Case study understand recent failures e.g. 2017, 2014 False El Nino's
- Already intercomparing ocean re-analyses in real-time (ORA-IP)