WORLD METEOROLOGICAL ORGANIZATION

COMMISSION FOR ATMOSPHERIC SCIENCES

CAS/THORPEX ICSC/WWRP SSG
DAOS/MWFR WGs

Joint meeting of the DAOS and MWFR WGs

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16th August (PM), 2014

DRAFT MEETING REPORT

1. Organisation of the meeting

1.1 Aims of the meeting

The meeting was intended as an opportunity for the two working groups to get to know each other and their respective programmes of work. Now that both groups will exist under the WWRP, it is important that there are clear definitions of the areas of responsibility of both groups as well as to ensure that there are no gaps, i.e. all important research areas are covered.

It was agreed that some areas of overlap in data assimilation will be acceptable presuming there is regular communication between both groups. It would also be very useful to identify those topics on which they might collaborate and others that would be better handled separately.

1.2 Adoption of the agenda

The agenda was agreed without amendment.

2 Reports

2.1 DAOS (Data Assimilation and Observing Systems) WG activities

The list of current members was reviewed by Roger Saunders, and an overview of the current DAOS-WG TORs and topics provided by Tom Hamill. The recent topics the WG has considered were outlined including the comprehensive review paper on targeting, DA advances, impact of observations in NWP, the current status of the satellite system and the in-situ networks. Future anticipated activities were outlined included the planned symposium on coupled DA (joint with ECMWF), a *BAMS* review article on targeting, and initial planning for the 7th WMO DA Symposium. The WG is also considering whether mesoscale targeting is a potential area for future collaboration between the two WGs.

2.2 MWFR (Mesoscale Weather Forecast Research) WG activities

Jeanette Onvlee noted that this WG has been active since 2007. The present membership was reviewed. MWFR tackles areas such as mesoscale analysis, modelling, RDPs/FDPs. Topics of interest shared with other working groups in the past have included forecast verification, data assimilation techniques, mesoscale modeling, and nowcasting. Past initiatives to which the WG has contributed include COPS, the MAP D-Phase, Beijing 2008, FROST-14, TOMACS, the Grey Zone, TIGGE-LAM aspects of GEOWOW, etc.. The WG maintains strong links with SRNWP, HyMEX, INCA-C, etc.. Planned work includes HR prediction of typhoon landfall, the Lake Victoria project, mesoscale verification in complex terrain, La Plata Basin (prediction of S. American mesoscale convective systems), the HIWeather and PPP projects, the 2018 Korean Winter Olympics, aviation RDPs and FDPs, and a data assimilation test environment.

The challenges of DA at the mesoscale were outlined:

- Defining what observations convey information at small spatial and temporal scales.
- The need to assess new types of observations (aircraft, lidars, etc.).
- Identifying which flow-dependent assimilation methods should be used to extract maximal information on small-scale features.

- Defining an optimal setup to permit rapid cycling of data assimilation.
- How to combine with large-scale information, including proper numerical techniques for nested data assimilation.
- How to assess impact of various types of assimilated observations.

3. New Observations

3.1 New observations for assimilation in convective scale models

Roger Saunders described the WMO OSCAR database of observational requirements for various application areas. New observations are available e.g. radar reflectivities, line of sight winds, rapid-scan AMVs, GNSS total precipitable water, etc.. The current UK local high-resolution modeling system assimilates radar wind data, AMVs, surface data, aircraft data, satellite cloud data, GPS ZTDs, satellite cloud-top height, etc.. The amount of data assimilated varies strongly with the time of day, e.g., fewer aircraft data are available at night. Novel observations are also available, such as water-vapour lidar (much better for temporal evolution of low cloud and fog; however the platform is currently too expensive to be deployed widely), cloud optical depth from solar cells, roadside sensor networks, crowd sourcing of data from smart phones, car satellite navigation, laptops, smart vehicles, and street lights, etc.. Many of these are very low cost, low power, robust, and already the subject of citizen projects. Convective scale DA, whilst in its infancy, would certainly benefit from mesonets.

3.2 Emerging meso-scale networks

Volker Wulfmeyer reviewed some of the observing systems available for convective scale data assimilation. It is necessary to have detailed, accurate and reliable information across the soil-vegetation-atmosphere system. Providing measurements in clear-air conditions and measurements of microphysical properties are both needed and have proven difficult to obtain with past observing systems. For mesoscale forecasting, we seek a precise definition of the vertical structure of the atmosphere, particularly in the boundary layer. Ideally, observations would have high spatial and temporal resolution and high accuracy.

Some early mesoscale studies of the impact of data were then outlined, including assimilation of lidar water-vapour measurements that improved forecasts of severe weather in the Texas panhandle of the US. This improved the position and intensity of rainfall predictions. The impacts of additional upper air data, GPS ZTD measurements and temperature data in mesoscale predictions were also described; GPS ZTD data was shown to be useful, though it does not provide vertical structure information, only an integral quantity. Doppler wind lidar is desired, but there is no network yet. Surface-based microwave radiometers may be low-enough cost to consider.

A summary table of the data requirements for monitoring, verification, data assimilation and process studies was considered. There are large gaps in data coverage that cannot be filled by space-based systems. New methods of remote and in-situ measurement will be required to meet these requirements.

4. Developments in data assimilation

4.1 Issues in global data assimilation for mesoscale models

Mark Buehner reviewed the topics discussed at the DAOS-7 meeting and outlined the talks given at the recent Munich Symposium meeting (see the record of the DAOS 7 WG meeting and presentations from the meeting, available on the WMO website).

4.2 Challenges in fine-scale data assimilation

Dale Barker discussed the challenges associated with fine scale DA. These included the need for frequent updates to define fast processes; the limited time scales of predictability for mesoscale features; the challenge of simultaneously providing mesoscale detail while maintaining a high-quality analysis at the synoptic and planetary scales; the difficulty in providing value added with respect to ever-improving global prediction systems; the relative immaturity of coupling of weather data into hydrologic prediction systems, and the treatment of model error in mesoscale ensemble prediction

systems and assimilation systems. Additionally, much reduced observations are available at night, and because of the limited time scale of predictability, mesoscale prediction necessitates the use of probabilistic techniques such as ensembles and statistical-dynamical methods. There are very complicated inter-variable covariances, and covariance models are needed that are appropriate for tropical as well as mid-latitude systems. He noted that the Met Office was planning to move to convective scale 4DVAR[TH1].

5. Interactions with projects and field campaigns

5.1 HIWeather

Sharan Majumdar and Peter Steinle outlined the HIWeather project. The main objective is to increase resilience to high-impact weather worldwide. The key challenges of the project were outlined. Possible joint activities with MWFR and DAOS include evaluation of new observation techniques, the improved use of observations, new observations strategies, etc.. Other challenges include coupling, convective initiation, physics parameterisations, error growth and the communication and distribution of information.
The two WGs could possibly collaborate on activities such as an inter-comparison of convective scale models, the validity of HR model parameterizations, uncertainty, selected process and field studies, multi-scale perturbations and inter-comparisons of EPS during RDPs/FDPs. Other topics might include EPS verification and diagnostic evaluation, reviews of stochastic physics and model error etc.

6. Topics and mechanism for collaboration

There followed a discussion on some possible joint activities that the two groups might consider going forward. The main areas identified were:

(i) The Winter Olympics in S. Korea at Pyeong-Chang in 2018 may provide a good opportunity for a mesoscale FDP. Several Met Services are likely to be involved in this and both DAOS and MWFR members could engage with it.

(ii) Sharing experiences on new observations for global and mesoscale data assimilation through reports from members of both groups.

(iii) The concept of OSSEs for the mesoscale is a new one and could be explored further in both groups to evaluate the impact of new observations such as MTG-IRS, Lidars, etc. Regional nature runs nested in global nature runs could be one option.

(iv) The provision of optimal LBCs for MWFR RDP/FDPs.

(v) Developments in ensemble-based observation sensitivity tools for the mesoscale.

(vi) Forecast verification metrics for mesoscale models and the development of comparisons of global vs mesoscale model performance over specific regions (as shown for UK Met Office models).

In addition it was noted that the MWFR could help with understanding model error and perhaps focus more on surface issues where the problems become even more difficult.
There are potential gaps around coupled DA and the DA of other parameters. It was noted that DAOS is now covering carbon fluxes.

In order to remain co-ordinated there should ideally be a member who attends both meetings and can report on the work of the other group. Efforts will be made to ensure this happens once the future of the MWFR WG is clear and the DAOS membership has been agreed at the ICSC and SSC meetings in Nov 2014.

7. Any other business

None

8. Meeting close