IPWG-8 Data Assimilation Working Group Report

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Action Items

- **A#1** (B. Johnson; w/ T. Auligne, S. English): Collect breakout group reports and draft final recommendations from The 3rd Joint JCSDA-ECMWF Workshop on Assimilating Satellite Observations of Clouds and Precipitation into NWP Models, December 2015; share with IPWG,
- **A#2** (B. Johnson): Encourage interaction with IPWG within the DA community and at community meetings.

Comments (1/2)

- **C#1** (To IPWG): The DA WG feels that DA inclusion at IPWG is extremely beneficial and timely given the ongoing efforts to assimilate all-sky radiances. We encourage the continued growth of the DA-relevant interactions with IPWG, and look forward to collaboration with retrieval and system experts. IPWG should actively reach out to DA centers to encourage them to participate in future IPWG meetings (and IWCG/ITWG too)
- **C#2** (To Algorithm Developers): We note that DA is becoming coupled including surface, atmosphere and hydrometeors. We would encourage that retrieval algorithms adopt the dynamic coupling approach as well (simultaneous sensitivity of signal to both rain and surface). To a certain extent this is done already, but awareness of DA needs could help foster synergy.

Comments (2/2)

- **C#3** (To DA & Research Community): We note that validation of DA components are extremely challenging due to temporal and spatial variability, for example when comparing forecast models to instantaneous precipitation retrievals. We seek feedback on methodologies for making accurate comparisons (this is also a recommendation).
- **C#4** (To: research communities): We are now reaching a point where the full chain of physical models can be tested against observations. Data assimilation provides a framework to do combined validation of forecast models, microphysics schemes and radiative transfer operators against observations. This can be done both inside the operational NWP context, but now also outside, and in the framework of field campaigns via the assimilation of campaign data.

Recommendations (1/4)

- R#1 (To: Space Agencies, Cloud and Precipitation Retrieval Communities, Timeframe: on-going): Collaboration between space programs and data assimilation centers should be specifically encouraged to incorporate DA requirements as part of scientific requirements when developing new satellite / observing systems. This would reduce barriers for operational assimilation of observations, and potentially provide a greater range of utility for various sensors.
- R#2 (To: IPWG, Timeframe: regular intervals): We note the strong scientific link between retrieving cloud, rain, ice, snow and the cloudy/rainy data assimilation activities. These activities would benefit from closer interaction. We recommend a regular series of scientific workshops specifically to gather scientists in cloudy/rainy DA and scientists involved in algorithm development of rain, snow as well as modeling experts and microphysical campaign field measurements experts. Subjects of interest could include: techniques and methodology, RT accuracy and error characterization, microphysical properties and their inter-correlations, etc. This would be similar to the joint ECMWF-JCSDA workshop that occurred in December 2015, and would also include algorithm developers from specific missions that have the largest impact. (At the joint meeting it was recommended that once every 5 years might be a reasonable time frame)

Recommendations (2/4)

- R#3a (To: CGMS, Space agencies, Timeframe: Long term planning): Higher temporal (sub-hourly) resolution and higher spectral sampling in the microwave measurement of clouds and precipitation should be considered in future Global observing systems to address the temporal sampling issue.
- R#3b Latency for satellite data availability should be improved (from both operational and research missions) to fit in the DA high temporal resolution cycle. (sub-hour especially for regional NWP systems). Also encourage the continued development satellite programs with high temporal resolution (TROPICS, TEMPEST, geo-MW of China).

Recommendations (3/4)

- R#4 (To: IPWG co-chairs, Timeframe: before next meeting): We encourage the IPWG co-chairs to find a proper mechanism to coordinate with other CGMS WGs (especially the cloud ICWG and ITWG) which have (or should have) a cloudy data assimilation component. We encourage these groups to form a DA WG within each group, and enable communication between the DA WGs. Representatives should be identified to cross-pollinate between groups.
- R#5a (To: Validation Groups (IPWG, ICWG, ITWG, missions), Timeframe: ongoing): Coordinate with DA experts to develop validation strategies that are consistent with the operational / research analysis and forecast systems. Specifically the high temporal sampling in GV / Aircraft campaigns is ideal for assimilation validation.

Recommendations (4/4)

- R#5b (To: validation and research communities, Timeframe: ongoing?): We recommend that all groups characterize errors and uncertainties in their products to aid in the development of error covariance matrices used in DA systems, and to help validate the statistical performance of NWP/DA properties at various components of the system (analysis, forecast, forward operator, etc.). E.g., use climate community best practices for longer term validation activities. This will help motivate improvements in both systems, and provides additional incentive to produce error statistics.
- R#6 (To: DA Community, Microphysics Community, IPWG): Identify methods to improve microphysical consistency between models used in analysis and forecasts and the microphysical assumptions in forward models. Ideally this would be related to specific physical processes, with the goal of improving overall accuracy. Inviting precipitation microphysical experts to future IPWG/DA working groups to facilitate this connection would also benefit other research groups.