# IPWG-7 Data Assimilation Working Group Report

With representatives from:

JMA, ECMWF, NOAA, UCLA, JPL, Meteo-France, CSU, RIKEN, NASA

IPWG-7, November 2014, Tsukuba, Japan

# What did the DA WG Discuss?

- First Day:
  - Set the agenda
  - We decided we will focus on the following:
    - Provide a context to DA importance to IPWG
    - What suggestions to IPWG?
    - What recommendations to make to CGMS/WMO/Space agencies (via IPWG)?
    - What concerns should we convey?
    - Convey trends and directions in DA that might impact IPWG community
  - From the discussion, 4 recommendations and 1 general comment were drafted
- Second Day:
  - Open discussion (about validation, climate, active data assimilation, coordination, requirements, etc)
  - Discuss additional points
  - From discussion, draft additional recommendations (4), comments (8)
  - Review all recommendations, prioritize them and prepare draft summary to be approved by all group

# General Discussion Points

- General Discussion items:
  - All other CGMS WGs have a robust DA component (TOVS WG, RO WG, Winds WG, ..)
  - We noted that major DA centers are focusing more and more on data impacted by cloud, rain and snow. This activity should be coordinated through IPWG
  - What about Cloud in IPWG? (scientifically intrinsically related to precip)
  - Economic and societal impact

- Scientific overall Discussion items:
  - Highlight that Cloudy/Precip Data Assimilation and Retrieval of Cloud and Precip use the same inputs. So techniques could be leveraged.
  - Cloudy and Rainy Data assimilation has a potential to improve both global and regional forecast systems (storm, hurricane, typhoons), at short/ medium-range, climate

# Trends Noted in DA

***(with potential impact on IPWG Activities)***

- Trends in DA impacting IPWG activities:
  - Trend to increased vertical, horizontal and temporal resolution of analyses
  - Trend in DA to do coupled assimilation (hydrometeors, sounding, surface)
  - Data Assimilation used more and more in rapid updates of analyses, as a way to fusion data from satellite, radar, ground based, etc (level-III or level IV)

# Comments (1/2)

- C#1 (To: CGMS, Timeframe: on-going): We take note of the mounting pressure to justify space missions acquisition by sponsoring programs and governments. We would like to provide our support, as a technical group, to the efforts to robustly and quantitatively assess the societal and economical impacts of satellite data on all applications. This is particularly important for cloudy and rainy data assimilation activities because of the potential severe impact of the extreme weather events.
- C2# (to IPWG community): Encourage research community to further develop/mature active (and passive) sensor data simulation capability in cloudy/rainy situations for effective use in operational DA
- C#3 (to:IPWG): Sounders should be better used in precip/cloudy inversion since most of the time, these also contain window channels with excellent sensitivity to rain, cloud and ice.
- C#4 (to IPWG scientists): Encourage use of alternative sensors from other missions: (such as FY3 sensors which has sounders and imagers)

# Comments (2/2)

- C#5 (To: IPWG co-chairs): Actively reach out to DA centers to encourage them to participate in future IPWG
- C#6 (IPWG validation group): From DA perspective, we know that rain does not always fall to the surface. Caution should be made when validating against gauges that might indicate no rain while space-based signal might rightfully detect rain.
- C#7 (CGMS. IPWG): OSSE is more and more used for assessing the impacts of future sensors, so we encourage the effort to be expanded to include the right metrics, models, etc that are relevant to precipitation and cloud sensing sensors
- C#8 (IPWG): We note that DA is less sensitive to errors in intercalibration between sensors because of the approach and the automatic bias correction imbedded in DA. It is important to note that DA is better served with uncorrected data (l1b instead of l1c). Output from DA has a large potential to be used for climate applications (less sensitivity to outliers), ie cross-calibration and outlier de-weighing is automatically done in DA.
- C#9 (IPWG): 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).

# Recommendations (1/3)

- R#1 (To: GPM mission, Timeframe: on-going): Collaboration between space programs and data assimilation centers should be encouraged and expanded to make DA an integral part of the satellite data utilization activities. Encouraging signs do exist already for other satellite missions: SNPP, SMAP, GOES-R, etc. We feel GPM mission should take a lead in involving DA more extensively in its mainstream activities especially given the current focus on the assimilation of cloudy and rainy data in the NWP centers. We believe this will lead to level-4 products that have many potential users.
- R#2 (To: IPWG, Timeframe: before next meeting): 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 organizing a scientific workshop 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.

# Recommendations (2/3)

- R#3 (To: CGMS, Space agencies, Timeframe: Long term planning): Major gap is identified in terms of information content in the current global observing system (GOS) for (1) solving for the microphysical properties impact on satellite measurements in the microwave and IR and (2) allow for hydrometeors profiling. Higher temporal (sub-hourly) resolution and higher spectral sampling in the microwave measurement should be considered in future GOS to address this gap.
- 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 new cloud ICWG and ITWG) which have (or should have) a cloudy data assimilation component

# Recommendations (3/3)

- R#5 (To: CGMS, Timeframe: Long term planning): *Temporal coverage* Space agencies should arrange for higher temporal resolution by better staging orbits (more than 3 and avoid current overlap: such as 3 similar satellites in same orbit). For Satellites carrying precip-sensitive channels
- R#6 (To: CGMS, Space agencies, Timeframe: Long term planning): Spatial resolution of sensors should keep up with foreseen improved DA systems resolutions (vertical, spatial and temporal)
- R#7 (To: CGMS, Timeframe:Long term planning): 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). At the same time, agencies should make available sensor characteristics before lunch (as well as sample data) to facilitate early readiness for these sensors.
- R#8 (To: IPWG , validation group): Make better use of (and make available) validation campaign data (performed for GPM), for both retrieval and DA scientists to reduce the dimensionality of the problem in cloudy/rainy DA. Both over land and ocean