New technology WG

20th Nov. 2014 Tristan L'Ecuyer, Vincenzo Levizzani, Mario Mech, Takuji Kubota, Gail Skofronick-Jackson, Joe Turk, Chris Kidd, Nicolas Viltard



High-frequency Passive Microwave

- EUMETSAT plans EPS-SG
 - Satellite A: MWS
 - Satellite B: MWS, ICI (183-664GHz), MWI (18.7-183GHz), SCA
- IPWG is excited about the launch of the MWI and ICI instruments on EPS-SG satellite B. The ICI is first and only planned space-based sub-millimeter instrument. The combination of low and high frequency MW channels has demonstrated value for understanding cloud and precipitation processes critical for improving forecasts and climate prediction.



Active Precipitation Sensors

- The IPWG is looking forward to the launch of EarthCARE since joint measurement dynamics and microphysics is the next step to improved understanding of precipitation processes. The IPWG encourages the further development of spaceborne multi-frequency Doppler radar technologies with improved precision, spatial resolution, and sampling (e.g. CaPPM).
 - Continuity of space-based precipitation radar for calibrating microwave imagers (TRMM à GPM à ?)
- IPWG encourages exploring the benefits of polarization diversity in addition to spaceborne Doppler radar (e.g. DYCECT)



Benefits of New Technologies

- IPWG endorses research directed toward optimally combining process missions and mapping constellations to improve high temporal resolution global precipitation datasets
 - e.g. use multi-frequency Doppler radar to improve databases used in PMW retrievals (GPM model)



Geostationary Precipitation Sensors

- IPWG recommends the development of active and passive Geostationary microwave concepts with sensitivity and resolution suitable for precipitation measurement in combination with planned GEO lightning mappers.
 - Target resolution of current LEO PMW sensors



Convoys and Constellations

- IPWG encourages cross-agency coordination of satellite assets into A-train-like convoys of instruments with sensitivities to distinct aspects of precipitation processes
- IPWG supports trade-space studies into the benefits of convoys of similar instruments (e.g. CubeSats or SmallSats with radar or radiometers) with revisit times suitable for sampling time-evolution of precipitating systems
- Constellations of precipitation sensors (e.g. MW radiometers) with optimized equatorial crossing times for precipitation mapping
 - Real-time data distribution of data from this constellation is encouraged



Sub-orbital Technologies

- Encourage development of sub-orbital and in situ instrumentation for demonstrating new precipitation measurement concepts
 - e.g. multi-frequency Doppler radar and submm radiometer
- Explore improved ground-based instrumentation to provide new measurement capabilities for improved validation of space-based precipitation datasets
 - e.g. rapid scanning phased-array radars; snowflake density measurements



High Latitude and Frozen Precipitation

- IPWG recognizes that polar precipitation is a significant gap in current satellite missions. IPWG recommends the development and launch of technologies with improved sensitivity to falling snow in high inclination orbits to improve sampling of polar regions.
- Given the contribution of snow to water resources at high latitudes and the importance of Arctic climate change, there is much to gained by investing in technologies that couple these measurements of frozen precipitation to snow on the ground to address climate and water cycle science/prediction priorities.

orkina Grout

Continuity of MW Constellation

Operational comment:

- Recognizing the increasing age of the existing microwave imager constellation, IPWG strongly recommends taking action to ensure the long-term continuity and optimization of equatorial crossing times of these observations.
 - MWI on EPS-SG
 - GCOM-W2
 - Windsat Follow-on
- Encourage simultaneous measurements of precipitation and surface winds e.g. MWI and scatterometer



Recommendations

- To shed new light on global cloud-precipitation processes, the IPWG recommends deployment of new space-based multi-frequency Doppler radar technologies with improved precision, spatial, spectral, and temporal sampling.
- IPWG recommends the development of active and passive geostationary microwave concepts with the sensitivity and resolution needed for precipitation measurement in combination with planned geo lightning mappers.

Norking Group