Research Working Group Recommendations and Action Items

IPWG 2016, Bologna, Italy, Oct. 6th 2016.

Chairs: Ali Behrangi & Yeji Choi

Participants 2016:

R. Adler, M. Buiat., C. Funk, C. Guilloteau, K. Graw, G. Skofronick-Jackson, T. Kubota, R. Kuligowski, C. Kummerow, V. Levizzani, H. Meng, L. Milani, J. Mendrok, S. Shige, D-B. Shin, R. Sen Jaiswal., I. Stephanon, Wei-kuo Tao, J. Turk, S. Upadhyaya, Nai-Yu Wang

Action item # 1: High Latitude and cold region Precipitation

Summary: Cold season precipitation is an ongoing challenge

Lead: G. Jackson, C. Kummerow, A. Behrangi, T. Kubota, H. Meng

What to do?

Develop methods/strategy to improve cold region precipitation - phase, intensity.

(a) develop methods to improve quantification of precipitation in cold region,

(b) exploring decadal survey and explore what is needed in future (e.g., what combination of frequencies, what platform? CubeSat?),

(c) using alternative methods to estimate high latitude precipitation

Status:

(1)Recent GPROF has considerable improvement in high latitude precipitation (v5) (Kummerow),

(2) Kummerow: Data from Olympex Field Campaign is now available. It covers both high latitude as well as orographic precipitation. We note that GPROF retrieved precipitation is reasonably accurate but phase assignment is large incorrect because phase assignment uses temperature and dew point depression from the larger reanalysis box rather than the individual mountain tops in the area. Radar phase assignments suffer because the height assignment over the mountains is typically quite a bit than the actual surface. Both of these could be fixed with appropriate topographic information:

Some paper published along these lines :

- Behrangi, A., X. Yin, S. Rajagopal, D. Stampoulis, and H. Ye, 2018: On distinguishing snowfall from rainfall using near-surface atmospheric information: Comparative analysis, uncertainties and hydrologic importance. *Quarterly Journal of the Royal Meteorological Society*, doi:10.1002/qj.3240

(Large uncertainty can also be introduced due to poor spatiotemporal resolution of reanalysis used to determine precipitation. e.g., T errors > 4 degrees!)

- Tang, G., A. Behrangi, Z. Ma, D. Long, and Y. Hong, 2018: Downscaling of ERA-Interim Temperature in the Contiguous United States and Its Implications for Rain–Snow Partitioning. Journal of Hydrometeorology, 19, 1215-1233.

(compared 8 downscaling methods based on topography and air temperature lapse rate (TLR): Gruber TLR and PTLR worked the best)

- Tang, G., D. Long, A. Behrangi, C. Wang, and Y. Hong, 2018, Exploring Deep Neural Networks to Retrieve Rain and Snow in High Latitudes Using Multisensor and Reanalysis g: Data. Water Resources Res. 10.1029/2018WR023830
- Huan Meng paper in EOS: https://eos.org/project-updates/snowfall-rates-from-satellite-data-help-weather forecasters?utm_source=eos&utm_medium=email&utm_campaign=EosBuzz042718

(3) Progress in quantification of snowfall in high altitude and cold regions using alternative methods has been made

Great insights can be obtained by using water balance approach using diverse observations data sets to determine expected range of precipitation accumulation over high latitudes and cold regions:

- Behrangi, A., K. J. Bormann, and T. H. Painter, 2018: Using the Airborne Snow Observatory to Assess Remotely Sensed Snowfall Products in the California Sierra Nevada. *Water Resources Research*, https://doi.org/10.1029/2018WR023108.
- Behrangi, A., A. Gardner, J. T. Reager, J. B. Fisher, D. Yang, G. J. Huffman, and R. F. Adler, 2018: Using GRACE to Estimate Snowfall Accumulation and Assess Gauge Undercatch Corrections in High Latitudes. *J. of Climate*, 31, 8689-8704.
- Behrangi, A., A. S. Gardner, J. T. Reager, and J. B. Fisher, 2017: Using GRACE to constrain precipitation amount over cold mountainous basins. *GRL*, 44, 219-227.

Action item # 2: Oceanic precipitation observations

Summary: Many existing data sets, but are not publicly known or available

Lead: C. Klepp, B. Kuligowski, Y. Serra

What to do?

Develop common data observation table and add to IPWG web page; Improved QC procedures is a research endeavor.
(a) Develop common observation data table (under IPWG webpage) for over
ocean precipitation retrieval and validation,
(b) Quality control method and implementation

Status :

C. Klepp:
(status Feb. 2018): OceanRAIN-1.0 database publicly available in three subsets:
OceanRAIN-W: Water Cycle Components: https://doi.org/10.1594/WDCC/OceanRAIN-W
OceanRAIN-M: Microphysics for Precipitation: https://doi.org/10.1594/WDCC/OceanRAIN-M
OceanRAIN-R: Raw Precipitation PSD Data: https://doi.org/10.1594/WDCC/OceanRAIN-R
OceanRAIN 1.0 comes in both netCDF and ascii file formats.
More information can be found via the projects webpage: www.oceanrain.org

The data set feeds into A.RWG.2016.1 Feb18: Vincenzo posted the links to OceanRAIN on the IPWG page http://ipwg.isac.cnr.it/calval-links.html under “Gauge Data (Ocean)”. --> Disdrometer Data (Ocean)

- Christian Klepp (Aug 2018): the OceanRAIN data descriptor paper is now published in Nature's Scientific Data: https://www.nature.com/articles/sdata2018122

So OceanRAIN Release 1.0 is finalized, covers June 2010 to April 2017 for 8 ships, all ocean basins, latitudes and seasons.

Bob Kuligowski : I think he had some updates

Action item # 3: Shallow/Orographic Precipitation

Summary: Both active and passive sensors continue to have problems in capturing shallow and orographic precipitation

Lead: S. Shige, C. Kummerow, H. Meng, A. Behrangi, M. Kulie

(1) understanding physical mechanisms, improve retrieval methods, exploit field campaign data.
(2) Continue exploring physical mechanism for understanding orographic/shallow precipitation,
(2) Improve retrieval methods,
(3) Collect observation data sets in support of this research. (e.g., collecting data from field campaigns such as NAME, etc.). Potentially IPWG web can offer links to the data sets.

Status :

Huan Meng:

NOAA/NESDIS and the Cooperative Institute for Climate and Satellites (CICS) at the University of Maryland have made some progress in the detection of shallow snowfall recently. The improvement was made through
(1) targeted training of a PMW snowfall detection (SD) module using shallow snowfall data;
(2) developing a NWP model-based SD module;
(3) deriving a SD model through optimal combination of the two modules.
While the SD model improves the probability of detection (POD) of shallow snowfall, it also increases false alarm rate (FAR).

S. Shige:

We have improved the conceptual model of shallow orographic precipitation process for *considering strength of upstream flow of the low-level troposphere to resolve problems of overestimations and false alarms of heavy orographic rainfall.*

Kenichi Ueno (Tsukuba University, Japan) is collecting rain and snow data over the mountainous region for validation of GPM products. under the support of JAXA PMM .

Action item # 4: Enhancing spatial & temporal obs to improve microphysical parameterization

Summary: Much information is available to improve our understanding of particle size distribution and habitat.

Lead: C. Kummerow, D-B. Shin, Y. Choi, G. Jackson

What to do?

Exploit three frequency radar observations and also work with NWP assimilation community

Status :

Chris Kummerow :

The literature continues to be dominated by multi-frequency radar retrievals of DSD properties. Connecting retrievals with microphysical parameterizations is not occurring with any regularity from radar or radiometers on air- or spacecraft.

- The OceanRAIN data set.

Ground radar is using DSD regularly but more work needs in the satellite side

Action item # 5: Land surface emissivity and backscatter

Summary: Uncertainty remains over emissivity and surface backscatter over heterogeneous surfaces

Lead: J. Turk, N-Y. Wang

What to do?

Foster new techniques to incorporate land surface properties in precipitation retrievals and data assimilation observation operators

Status :

Joe Turk:

1) the data assimilation aspects are being advanced more for non-oceanic surfaces by most operational centers, via recent emphasis via the land surface meetings that are part of the ISWG (which is largely operationally focused). The first meeting of the International Surface Working Group was recently held, which is an ITWG sub-group but being proposed as the first ISWG:http://cimss.ssec.wisc.edu/iswg/meetings/2017/

2) For precip retrievals, after 3+ yrs now of GPM with abundant observations up to 65-deg lat there is a substantial collection of emissivity and radar properties of the various surface conditions encountered up to these latitudes. Several recent studies and publications on improvements to estimates over land, snow cover and coast. These and other findings from the land surface models are important, to begin moving away from fixed emissivity climatologies in passive and active MW retrieval algorithms.

Action item # 6: High spatiotemporal sampling of multispectral VIS/IR from new generation GEO satellites

Summary: This combination has been underutilized

Lead: C. Kummerow, A. Behrangi, J. Turk, C. Funk, N-Y. Wang

What to do?

Foster integration efforts between MW and IR communities

Status :

Chris Kummerow :

GOES 16 is in orbit and data is freely accessible. CIRA will store case studies of GOES16 imagery, ground based radar (MRMS) and model (HRRR) output for selected cases. The community will have access to these case studies within 6 months.

- GOES 17?

- Tang, G., D. Long, A. Behrangi, C. Wang, and Y. Hong, 2018, Exploring Deep Neural Networks to Retrieve Rain and Snow in High Latitudes Using Multisensor and Reanalysis g: Data. Water Resources Res. 10.1029/2018WR023830