RESEARCH WORKING GROUP

Chair: Peter Bauer
Rapporteur: Joerg Schulz

Participants: Geoff Pegram, Arthur Hou, Carlos Angelis, Cristian Mitrescu, Francisco J Tapiador, Steven Miller, Ben Jou, Chris Kummerow, Bizzarro Bizzarri, Michael Goodman, Kyle Hilburn, Eric Smith, Shannon Brown, Amy Doherty, Tristan L'Ecuyer, Una O'Keeffe

MAIN ISSUES

There is an ongoing uncertainty in *quantitative precipitation estimation*, *quantitative precipitation forecast* and the monitoring of *precipitation trends* on a climatological scale. Radars in space have provided the impetus for most recent advances in rainfall remote sensing. To that end this panel recommends the deployment of next generation space radar systems (e.g., dual frequency and increased sensitivity) such as those proposed for GPM and EGPM for improved understanding of precipitation physics and enhancement of existing radiometer measurements.

At mid to high latitudes *snowfall* constitutes an important part of the hydrological cycle. The currently available sensors are inadequate for snowfall detection and quantification over land surfaces. The new space-borne radars and radiometers (e.g. sounding frequencies on EGPM) are needed to continue improvement of the understanding of solid precipitation.

Based on this, the working group identified the following three topics as crucial for the adequate use of existing and future space-borne observations:

1. OPEN RAINFALL RETRIEVAL ALGORITHM ARCHITECTURE

See Research Working Group recommendations from IPWG-2002: Standard/Common procedures Recommendations 1 (except data issues), 2 and 3. Research recommendation 1 and 2.

From the requirement of across-sensor/satellite consistent estimates and internal physical consistency we recommend an open rainfall retrieval algorithm structure:

a) To combine the strengths of research groups in the international community.

b) We recommend that this structure be used for the monitoring of the rainfall environment and rainfall generation processes. Processes and environment are critical to further improve our knowledge of precipitation physics and to constrain precipitation retrieval algorithms (frozen precipitation, light rain, precipitation in complex terrain, warm rain etc.).

This has large implications on algorithm development and on validation (e.g., GPM supersites).

Action 1:
Establish international community working group for the development of an algorithm framework and validation requirements. (example GPM parametric algorithm development effort, link to IPWG). (ST-LT: C. Kummerow, P. Bauer).

Action 2:
We recommend the consideration of NWP-type analysis techniques (such as data assimilation) for the generation of rainfall products from rainfall and rainfall related observations as well as ancillary data with different error structures. These methods can also be used for retrieval error estimation and the optimization of future satellite sensor design (e.g., using observing system simulation studies).

2. COMBINING MW-IR-MODELS

See Research Working Group recommendations from IPWG-2002: Standard/Common procedures, recommendation 3.

We recommend combined approaches that embody the open and modular architecture philosophy (the open architecture referred to above). For example, techniques that combine the quantitative precipitation estimate from the microwave sensor and the temporal information on cloud development from the IR sensor embody the above principles. This will facilitate data reprocessing/reanalysis.

We recommend that merging of model data into retrieval algorithms should be considered for certain applications.

The impact of merging procedures on statistics of merged products (e.g., consistency of rain pdf´s, rain occurrence between product and ingredients, scale discrepancies) should be considered for all future algorithm developments.

3. TRANSPORTABLE RAINFALL ESTIMATION TECHNIQUES

There is an ongoing demand for high-frequency satellite rainfall retrievals (currently IR-based). These IR techniques should ultimately be replaced by microwave and sub-millimetre sounding from geostationary satellites to provide more direct information on precipitation physics. High frequency observations are mainly used for short-range meteorological and hydrological forecasting applications.

We recommend the development of a transportable technique that reflects the existing skill that is well documented, tutorial, and simple to implement.

Action:
As part of the algorithm development group, we will form a sub-group to implement such an algorithm for a test location (e.g., to be identified by D. Hinsman).

GENERAL RECOMMENDATIONS

In the short term, we recommend the planning of a workshop dedicated to frozen precipitation physics and observation (link to GPCP activities). (ST: Ralf Bennartz, Ralph Ferraro)

The initiation of a liaison with ITWG for the coordination of common projects. (Represent IPWG at the next ITSC in May 2005, links on ITWG website). (ST: Amy Doherty, Una O'Keeffe)

RESPONSES TO CGMS RECOMMENDATIONS:

GPCP assessment: The GPCP Assessment is currently under review and upcoming meetings will address its editing and completion (ST: V. Levizzani, A. Gruber).

Snowfall, frozen precip: A dedicated workshop on this topic is to be held in autumn 2005 under the sponsorship of IPWG, GPM, and the GEWEX Radiation Panel (GRP).

Orographic precip: Opertational applications working group to address.

Ongoing validation: Validation working group to address.

Formats, Level 2 Precipitation File Content Standard, precipitation standards: We support the introduction of standards for precipitation products, e.g., formats. We recommend the formation of a working group under the auspices of GPM to realize this.