

INTERNATIONAL PRECIPITATION WORKING GROUP

(Submitted by WMO)

Summary and purpose of document

To inform CGMS Members on the status of activity related to International Precipitation Working Group (IPWG).

ACTION PROPOSED

- (1) CGMS Members to note the status of activity related to the International Precipitation Working Group (IPWG);
 - (2) CGMS Members to continue to provide and update the inventory of routinely produced precipitation estimates, either operational or experimental/research, to the IPWG co-chairs;
 - (3) CGMS Members to note and support the ongoing Satellite based Precipitation Estimation Validation activities;
 - (4) CGMS Members to provide information to the IPWG Rapporteur on areas for future consideration by the IPWG.
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DISCUSSION

1. Background

1. CGMS-XXVIII initiated the establishment of a Working Group on Precipitation, with co-sponsorship by WMO and CGMS.
2. CGMS-XXIX noted the successful organizational session of the International Precipitation Working Group (IPWG) and approved the terms of reference for the IPWG.
3. CGMS-XXX received with enthusiasm the report of the First International Precipitation Working Group (IPWG) Workshop and noted the establishment of three working groups: Operational Applications, Research Activities, and Validation Activities with their plans for future activities with short term, intermediate and long term goals.
4. CGMS-XXXI was updated on algorithm activities and developed Action item 31.29 requesting CGMS Members to provide and update the inventory of routinely produced precipitation estimates, either operational or experimental/research, along with training information for the IPWG web page.
5. CGMS-XXXII noted the imminent IPWG science meeting to be held in October 2004 in Monterey, California, and looked forward to its success.
6. CGMS-XXXIII noted the success of the "Second International Precipitation Working Group Workshop", Monterey, California, USA, in October 2004, and that over 50 participants from 19 countries took part in this 3½-day workshop. In addition, CGMS was pleased that the workshop addressed science issues that were posed by CGMS-32: (1) GPCP assessment; (2) solid precipitation; (3) precipitation over complex terrain; and, 4) ongoing validation studies.
7. CGMS-XXXIII noted that considerable activity is underway with respect to validation and intercomparison studies and recognized that CGMS Members should note and support these ongoing Validation activities.
8. EUMETSAT informed CGMS that implementation for Second Generation Meteosat of hourly rainfall rates, making use of the full multispectral image potential of SEVIRI, would be done during the next months, based on developments in the IPWG and previous studies at the Consiglio Nazionale delle Ricerche (CNR) and the University of Bologna (Italy).
9. Finally, CGMS reminded Members to note and support the third IPWG workshop scheduled to take place in Melbourne Australia in October 2006. A portion of the workshop will overlap with the Asian Pacific Satellite Training (APSATS-2006) event.

2. Activity of the IPWG since CGMS-XXXIII

Third IPWG Science Meeting

10. The "Third Workshop of the International Precipitation Working Group" (IPWG). The workshop took place during 23-27 October 2006, and was hosted by the Australian Bureau of Meteorology Research Centre (BMRC) in Melbourne, Australia.
11. The goals for the third IPWG meeting are: (a) To update the current *status of operational and quasi-operational satellite-based estimates* of precipitation for weather, hydrometeorological and climate applications, including the status of current and future satellite missions, both experimental and operational (TRMM, GPM, etc.); (b) Analysis of the open issues underlying precipitation retrievals, such as *retrievals over complex terrain, light precipitation, and snowfall*; (c)

Analysis of the *statistical performance* of current forecast models and satellite techniques over various seasons, rainfall regimes, and space-time scales, including initial results from the Pilot Evaluation of High Resolution Precipitation Products (PEHRPP); and, (d) To support algorithm developers in devising observational and modelling approaches for physical validation of advanced precipitation retrieval methods from passive and active sensors.

12. As with IPWG meetings, the format of the workshop begins with plenary sessions where participants will make brief presentations on topics of relevance. These are followed by individual working group sessions on Research Activities, Operational Applications, and Validation, where participants formulated recommendations and activities for the advancement of remote sensing of precipitation.

13. The 3rd IPWG workshop was held in parallel with the 2006 Asia Pacific Satellite Application Training Seminar (APSATS), hosted by the Bureau of Meteorology Training Centre, with one joint session to enable sharing of information among IPWG and APSATS participants.

14. Since this workshop occurs the week before CGMS-XXXIV, a more detailed report on the meeting and its actions will be reported to CGMS XXXIV following the IPWG Workshop.

GPCP Assessment

15. A brief look at future possibilities for improved global precipitation has been prepared by a group of esteemed authors. Entitled "Assessment of Global Precipitation" the draft is a Project of the Global Energy and Water Cycle Experiment (GEWEX) Radiation Panel GEWEX, World Climate Research Programme, WMO. It identifies the most likely areas where one can expect significant improvement to our understanding of the distribution and variability of global precipitation within the next several years. However, it is most likely not a complete identification of future possibilities of enhanced precipitation measurements. Whatever the future holds the GPCP data set has set the foundation for global precipitation measurements and one of the biggest challenges facing the scientific community is how to utilize new observations and science innovations to both improve and extend the existing global precipitation data. The authors recognize that retrieval algorithms are continuously evolving and that there is need to emphasize that the GPCP, which for the most part utilizes single sensor techniques that are decades old, will at some point have to consider the impact of new retrieval algorithms as well as sensors (e.g., TRMM). This is suggested in Chapter 4 which called for a re-analysis where new retrieval techniques and sensors would be evaluated for use in global precipitation estimates along with higher space and time resolution data.

The final draft is available at:

See <http://cics.umd.edu/~yin/GPCP//ASSESSMENT/assessment.html> for more information.

Solid Precipitation

16. From the 1st "IPWG/GPM/GRP Workshop on Modelling of Snowfall" that took place on 11-13 October 2005 in Madison, Wisconsin, a final workshop report has been published and can be obtained from the IPWG web site (<http://www.isac.cnr.it/~ipwg/IPWG.html>). Eight high priority recommendations from the focus areas include:

- (1) Encourage the generation of community Cloud Resolving Model (CRM)/Numerical Weather Prediction (NWP) model profile databases that represent natural variability. A parallel effort for databases generated from observations or combined model simulations and observations is also encouraged;
- (2) Intensify studies of data assimilation that include precipitation observations in NWP analysis systems;

- (3) Establish a modelling chain that links cloud models with improved models on cloud microphysical information (e.g., shapes, phase, etc.) that can be used for the development of parameterizations for general use in cost-driven applications;
- (4) Develop high-latitude surface emissivity products (10-200 GHz) including error estimates;
- (5) The development and further refinement of inexpensive ground-based remote sensing instruments for snowfall should be encouraged. In particular, vertically pointing micro radars and microwave transmission links that measure attenuation due to snowfall are of interest;
- (6) The use of combined active (with sensitivity of 5 dBZ or less) and passive (including high frequency measurements, and oxygen and water vapour absorption bands) satellite data for light rainfall and snowfall detection/retrieval should be further encouraged. Missions such as CloudSat, GPM and EarthCare will be extremely helpful;
- (7) High level coordination of international Ground Validation (GV) programmes for snowfall (e.g., through GPM, GEWEX, IPWG) is urgently needed to advance the current state of snowfall retrievals. Engagement with other disciplines (e.g., atmospheric chemistry, cryosphere, etc.) for mutually beneficial collaboration, including the free exchange of unique data sets (e.g., SNOTEL observations) is strongly encouraged;
- (8) Long-term surface-based measurements of snowfall and water equivalent must continue to insure continuity for climate assessment and monitoring.

17. The above-mentioned recommendations will be tracked by the IPWG and reported on at their next meeting (October 2006 in Melbourne, Australia). In addition, the GPM Project is utilizing these recommendations to make several planning decisions, including the addition of high frequency channels on the GPM Microwave Imager (GMI) and the selection of ground sites and required measurements within the GV programme.

Precipitation Over Complex Terrain

18. At IPWG2 was noted that since NWP models have terrain effects and orographics “built in”, that a combined satellite + model estimate would be appropriate. This was left as an action item for the technique developers and the NWP precipitation community to report on at the third IPWG workshop.

Interaction with ITWG

19. The IPWG has two members who act as liaisons with the ITWG and attend both workshops. Preliminary discussions are underway to decide if an upcoming meeting should be held jointly between the IPWG, ITWG, and IWWG. An IPWG poster was presented at the ITWG workshop in Beijing in May 2005.

Algorithm Inventory

20. The IPWG algorithm inventory is available from the IPWG web site and contains information to associated links for products, datasets, and relevant publications. The website contains all latest report and documents prepared with relevant IPWG participation.

Validation Studies

21. **IPWG Validation Website:** The main IPWG Validation website is at: <http://www.bom.gov.au/bmrc/SatRainVal/validation-intercomparison.html>. The project aims to validate and intercompare operational and semi-operational satellite rainfall estimates. The study

focuses on the large-scale validation of daily rainfall estimates, for two reasons. First, the large number of rainfall observations from rain gauges at the 24-hour time scale provides good quality verification data on a large scale. Second, daily rainfall estimates are required as input to a large number of climate and other applications. For comparison, 1-day forecasts from a limited number numerical weather prediction models, namely the ECMWF, the US (NCEP), and US Navy global models, and the Australian regional model, are also verified. Note that: (a) The IPWG validation results apply only to satellite precipitation estimates over land; (b) The project is only validating daily rainfall estimates, not those at shorter time scales; (c) The spatial scales of the estimates are typically ~25 km. Since validation results tend to improve with spatial averaging of the estimates, the *quantitative* results reported here would differ for finer or coarser scales; and, (d) The reported errors in the satellite precipitation estimates are larger than their true values because observation error in the reference data contributes to the total error.

22. **PEHRPP (Proposed Evaluation of High Resolution Precipitation Products).** This activity was proposed and initiated at the last IPWG workshop and is well underway. PEHRPP consists of four “suites” of validation studies. Suite 1 involves regional site validation of various High Resolution Precipitation Products (HRPP) using national gauge and radar networks. So far nine countries are participating by contributing their own set of validation data and statistical validation of all contributing HRPP datasets. Suites 2-4 involve detailed validation from high resolution, high quality field experiment data such as the NAME (North American Monsoon Experiment) and CEOP (Cooperative Enhanced Observing Period) datasets. The activities of PEHRPP are closely aligned with proposed validation requirements of the planned Global Precipitation Mission (GPM) and presentations have been made at GPM and related meetings. Up to date information on PEHRPP can be obtained from <http://essic.umd.edu/~msapiano/PEHRPP/>

Precipitation Assimilation in Numerical Weather Prediction Models

23. At IPWG2, the research group discussed the efforts that are underway in the assimilation of both passive microwave satellite-measured radiance and retrievals and related presentations were given by representatives from NASA, ECMWF and the UK Met Office.

24. Subsequently, the IPWG co-chairs (Drs Turk and Bauer) both represented the IPWG at the Joint Center for Satellite Data Assimilation (JCSDA) Workshop on the Assimilation of Clouds and Precipitation held during May 2005. The workshop was aimed at providing an up-to-date summary of satellite observations of clouds and precipitation, modelling in of these constituents in NWP, and data assimilation of satellite observations of clouds and precipitation, identification of the key impediments to progress in these areas, and the preparation of a list of recommendations to accelerate progress; (a special issue of *J. Atmos. Sci.* is planned and a workshop summary for *BAMS*).

25. It is also noted that the European Centre for Medium-Range Weather Forecasts (ECMWF) activated the assimilation of cloud and rain affected SSM/I radiances in their operational model on 28 June 2005. With the upcoming new model cycle, the forecasts will be performed at 25 km spatial resolution and 91 model levels for the medium range up to 10 days. The increase in spatial resolution and the assimilation of rain observations is expected to produce better forecasts of tropical cyclones.

New Sensor Technology

26. This will be updated after the third IPWG workshop.