

# THE INTERNATIONAL PRECIPITATION WORKING GROUP

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## Abstract

The International Precipitation Working Group (IPWG) is a permanent Working Group of the Coordination Group for Meteorological Satellites (CGMS), co-sponsored by CGMS and the World Meteorological Organization (WMO). The group focuses the international scientific community on operational and research satellite based quantitative precipitation measurement issues and challenges, providing a forum for operational and research users of satellite precipitation measurements. It provides a mechanism for the exchange of information on methods for measuring precipitation and the impact of space borne precipitation measurements in numerical weather and hydrometeorological prediction and climate studies. Through its work it aims to development better measurements of precipitation, improve their utilization and scientific understanding and to development international partnerships.

## Introduction

The International Precipitation Working Group (IPWG) was endorsed during the 52nd session of the WMO Executive Council in 2000. The WMO encouraged the Coordination Group for Meteorological Satellites (CGMS) to participate in the formation of the IPWG with active participation by WMO and the Global Precipitation Climatology Program (GPCP). The foundation meeting of the IPWG was held at Colorado State University in June 2001, and the group was subsequently endorsed by the CGMS in July 2001.

Main function of the IPWG is to provide a focus for the international scientific community for operational and research satellite-based quantitative precipitation measurement, with an emphasis on the derivation of improved precipitation products through greater scientific understanding.

The objectives of the IPWG are:

1. to promote standard operational procedures and common software for deriving precipitation measurements from satellites;
2. to establish standards for validation and independent verification of precipitation measurements derived from satellite data; including:
  - o reference standards for the validation of precipitation for weather, hydrometeorological and climate applications;
  - o standard analysis techniques that quantify the uncertainty of ground-based measurements over relevant time and space scales needed by satellite products;
3. to devise and implement regular procedures for the exchange of data on inter-comparisons of operational precipitation measurements from satellites;

4. to stimulate increased international scientific research and development in this field and to establish routine means of exchanging scientific results and verification results;
5. to make recommendations to national and international agencies regarding the utilization of current and future satellite instruments on both polar and geostationary platforms; and
6. to encourage regular education and training activities with the goal of improving

The IPWG, the precipitation equivalent of the longstanding International TOVS Working Group (ITWG) and the International Winds Working Group (IWWG), therefore provides a focus for the international precipitation community to foster the exchange of ideas, promote their research and to represent their interests.

## **IPWG Meetings**

The exchange of scientific results is facilitated through the organisation of a number of international workshops at which issues relating to the observation, measurement and validation of precipitation have been discussed. The first workshop was held in Madrid, Spain, in September 2003 and focused upon operational rainfall estimates, missions and instruments, research activities and validation studies (Levizzani and Gruber, 2003). In October 2004 a second workshop was held in Monterey, California, building upon the initial workshop: data sets, error analysis, precipitation characterisation, retrievals and microphysics being the main themes (Turk and Bauer, 2005).

The most recent meeting was hosted by the Bureau of Meteorology in Melbourne, Australia, in October 2006. Topics ranged from data sets and applications through to the use of satellite retrievals with numerical models. This workshop also contributed to the Asia Pacific Satellite Applications Training Seminar (APSATS) held at the Bureau at the same time as the meeting. The next meeting of the IPWG will be held in Beijing in October 2008.

In addition to the IPWG workshop, the IPWG has participated in a number of key meetings including the International Geostationary Laboratory (IGeoLab) meetings, NASA Global Precipitation Measurement (GPM) mission meetings, Snow Hydrology workshop and the Joint Centre for Satellite Data Assimilation Workshop. It is currently organizing a workshop for the Program for the Evaluation of High Resolution Precipitation Products (PEHRPP) to be held in Geneva in December 2007, and for a follow-on Snow Hydrology workshop to be held at the end of March 2008 in Colorado.

## **IPWG Activities**

Three working groups have been established with the IPWG to concentrate upon key activities. These are:

**Operational activities:** it is recognised that many products generated by algorithms and techniques are not satisfactory for operational applications. With this in mind, the operational activities working group is charged with addressing this shortfall. The subgroup aims to collect information on the current availability of algorithms using both geostationary and polar-orbiting satellite data, both operational and research. In particular, the availability of either the algorithm/technique, to enable others to generate the product, or of the product itself are identified. In addition, a survey on the requirements for spatial/temporal accuracy, data latency and temporal coverage is being undertaken: many routine algorithms produce coarse-resolution precipitation products, but there is an increasing requirement for finer temporal and spatial resolution data sets to be prepared and available to the operational user. A final activity in this subgroup is the continued development of multi-sourced precipitation algorithms using both satellite and model information.

**Research Activities:** One of the goals of the IPWG is to enable the exchange of information between the algorithm developers and the data users as to how the precipitation products are performing: in this was it

is expected that shortcomings in algorithm performance can be addressed by the developers. To facilitate this, an inventory of field campaign data with colocated has been established to provide data sets for validation exercises. In addition, the further development of more complex methodologies is being encouraged, both in terms of physical models, but also the use of data from more sensors and observations: the usefulness of this being dependent upon the final application of the precipitation products being generated. The identification of key research questions is one output from this group, and has helped to formulate the recommended requirements for future satellite sensors.

**Validation activities:** A large part of the overall efforts in the IPWG are associated with the validation of precipitation products to assess the suitability of the products for operational use, and to inform the algorithm developers of their success, and failure. A number of baseline algorithms are included in the inter-comparisons, together with a range of NWP models, quasi-operational and ‘experimental’ satellite algorithms (both geostationary and polar-orbiting, infrared and/or passive microwave). These products are compared against surface data sets using gauge and/or radar. Product-validation data comparisons are generated in near real-time and the results made available on the internet. A number of regional sites have been established to provide inter-comparisons at daily, ~25km scales: Australia (co-ordinated by Beth Ebert); USA (John Janowiak); Europe (Chris Kidd) and; South America (Daniel Vila). Links to other validation regions are provided from these main sites. The web site addresses are shown in Table 1, while an example of an inter-comparison product is shown in Figure 1. A common template is used for the display of the comparison, comprising of images of the product and the validation source, scatterplot, descriptive statistics and quantitative statistics.

IPWG home page	<a href="http://www.isac.cnr.it/~ipwg/IPWG.html">http://www.isac.cnr.it/~ipwg/IPWG.html</a>
Australian validation	<a href="http://www.bom.gov.au/bmrc/SatRainVal/sat_val_au.html">http://www.bom.gov.au/bmrc/SatRainVal/sat_val_au.html</a>
European validation	<a href="http://kermit.bham.ac.uk/~ipwgeu/">http://kermit.bham.ac.uk/~ipwgeu/</a>
US validation	<a href="http://www.cpc.ncep.noaa.gov/products/janowiak/us_web.shtml">http://www.cpc.ncep.noaa.gov/products/janowiak/us_web.shtml</a>
S. America validation	<a href="http://cics.umd.edu/~dvila/web/SatRainVal/dailyval.html">http://cics.umd.edu/~dvila/web/SatRainVal/dailyval.html</a>

Table 1: List of IPWG home page and inter-comparison web site links

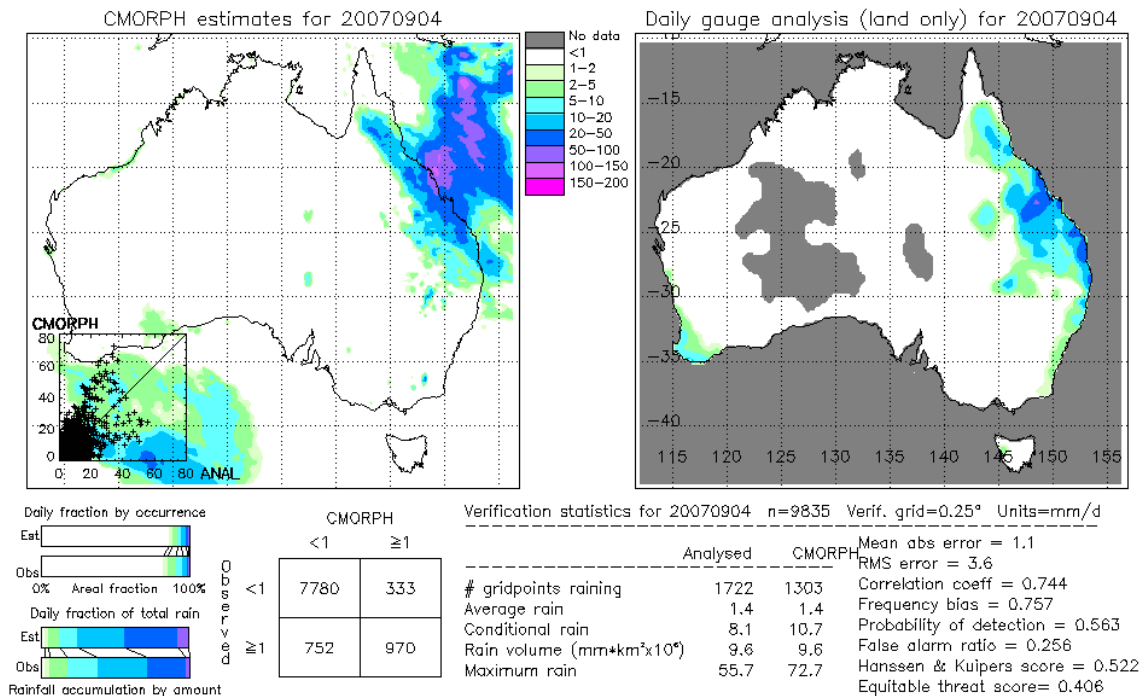


Figure 1: Example of the inter-comparison of the CMORPH precipitation product and surface gauge network over Australia for 4 September 2007

These main inter-comparison sites are starting to be complemented by a number of other emerging sites, such as South Africa, South Korea, Japan and China, to name a few. In addition, special attention is also being given to surface reference data, in particular, to encourage the use of dual gauges and optimal network design to improve the reliability and quality of gauge measurements; improving the validation of 'difficult' precipitation situations (orographic, light and solid precipitation) and; development of an assessment package for algorithm developers and users.

Additional comparisons being carried out as part of the Program for the Evaluation of High Resolution Precipitation Products (PEHRPP) with the main aim of evaluating the increasing number of high resolution satellite-derived precipitation products ( $\leq 0.25$  degree and  $\leq 3$  hours).

### **Accomplishments with IPWG Involvement**

An objective of the IPWG is to provide recommendations to national and international agencies regarding the utilization of current and future satellite instruments. The IPWG contributed to two major National Academy of Sciences (NAS) reports on the Tropical Rainfall Measurement Mission and Global Precipitation Measurement (GPM) mission. As a result of studies carried out by IPWG scientists additional high frequency channels (166 and 183 GHz) will be included on the GPM Microwave Imager (GMI). Following the third IPWG meeting, a number of recommendations were made, including:

- implementation of a second Megha-Tropiques ground station to facilitate better data collection;
- implementation of both conical imagers and cross-track sounders on operational platforms;
- that level-0 datasets are maintained and preserved and that procedures are established to properly blend and mix data from various sensors
- NOAA is encouraged to act on the recommendations of the National Academy of Sciences reports on TRMM and GPM
- the continued development geostationary microwave capabilities
- support efforts for preservation of passive microwave frequency allocations
- plans for a second "Snowfall" workshop and encourage second JCSDA workshop

### **Summary**

The IPWG therefore provides a focus and support for precipitation research through and number of activities, including workshops, meetings and education. Through these it encourages the development, exploitation and testing of new techniques, together with the inter-comparison of techniques for operational applications. It also provides a means to represent the precipitation scientific community, and to make recommendations to the national and international agencies responsible for overseeing precipitation-related programmes.

### **References**

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