CGMS

CGMS-36, WMO-WP-04
v2, 24 October 2008
Prepared by WMO
Agenda Item: II/4
Discussed in WG II

REPORT ON THE INTERNATIONAL PRECIPITATION WORKING GROUP

The paper informs CGMS Members on the status of activities related to the International Precipitation Working Group (IPWG) since CGMS-35.

The Fourth IPWG Workshop (IPWG-4) met from 13-17 October 2008 in Beijing. The Workshop addressed topics that included current operational and research precipitation estimation techniques, applications to climate and weather, validation, sensor calibration, and future satellite missions. A new subgroup on new technology was formed within the IPWG, and new Co-chairs were nominated for confirmation by CGMS.

Other activities of note include:

Second International Workshop on Space-based Snowfall Measurement
First Programme for the Evaluation of High Resolution Precipitation Products (PEHRPP) Workshop
IPWG Validation Activities

Action items:

Continue to provide and update the inventory of routinely produced precipitation estimates, either operational or experimental/research, to the IPWG Co-chairs;
Provide information to the IPWG Rapporteur on areas for future consideration by the IPWG;
Appoint a new CGMS Rapporteur to the IPWG;
Confirm the new Co-chairs for the IPWG;
Continue to provide data necessary for global, 4-km IR data products in a timely manner to precipitation product producers;
Establish with the WMO Space Programme, the IPWG through its Co-chairs, and the WMO Hydrology Programme a small team to investigate the feasibility of “Mainstreaming the Operational use of Satellite Precipitation Data and Products” for Meteorological and Hydrological Services;
Consider ways to assure utility of datasets for use by IPWG Members, as discussed in connection with data issues at the IPWG-4 Workshop;
Consider ways to provide additional support for attendance at CGMS Science Working Group Meetings, particularly for those from developing and least developed countries;
Provide support as needed to help defray publication charges for the “special edition” of the AMS Journal of Applied Meteorology and Climatology.

REPORT ON THE INTERNATIONAL PRECIPITATION WORKING GROUP

1 BACKGROUND

CGMS-28 initiated the establishment of a Working Group on Precipitation, with co-sponsorship from WMO and CGMS.

CGMS-29 noted the successful organizational session of the International Precipitation Working Group (IPWG) and approved its Terms of Reference.

CGMS-30 received the report of the "First International Precipitation Working Group (IPWG) Workshop" with enthusiasm and noted the establishment of three working groups: Operational Applications, Research Activities and Validation Activities.

CGMS-31 was updated on algorithm activities and raised Action 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.

CGMS-33 noted the success of the "Second IPWG Workshop" which was held in Monterey, USA, in October 2004. CGMS was pleased that the Workshop addressed the following science issues that were posed by CGMS-32: 1) GPCP assessment; 2) solid precipitation; 3) precipitation over complex terrain; and, 4) ongoing validation studies.

CGMS-34 noted the success of the "Third IPWG Workshop" which was hosted by the Australian Bureau of Meteorology Research Centre (BMRC) in Melbourne, Australia and was held in conjunction with the Asian Pacific Satellite Training (APSATS-2006) event. It further noted that the goals for the third IPWG meeting were met.

CGMS-35 noted with appreciation the array of important activities being addressed by the International Precipitation Working Group (IPWG). CGMS-35 requested all Members to update as necessary the inventory of their routinely produced precipitation estimates to the IPWG Co-chairs and to report to CGMS-36 on their activities with respect to precipitation estimation and validation activity for time scales ranging from nowcasting and climate. CGMS WG-II recommended that the Chairpersons of the International Working Groups establish a list of topics of common interest to all three groups: it was seen as worthwhile to try at a future stage to hold the International Working Group meetings at the same place with a few common plenary meetings, but having most of the business done separately.

2 DISCUSSION

2.1 Fourth IPWG Workshop

The "Fourth IPWG Workshop" (IPWG-4) was hosted by the National Satellite Meteorological Center (NSMC) of the Chinese Meteorological Agency (CMA) in Beijing, China from 13-17 October 2008. The IPWG Co-chairs are grateful for the help and assistance from NSMC and CMA Members in organizing and hosting the IPWG-4 meeting. The IPWG-4 agenda is provided in the Annex. Papers and

extended abstracts should be posted to the IPWG web site by the end of the year. A special "collection" issue of the American Meteorological Society Journal of Applied Meteorology and Climatology will be produced as a result of IPWG-4.

At the beginning of the IPWG-4 Workshop the Co-chairs pointed out key contributions and accomplishments of the IPWG since its inception in 2002 which included:

Expansion of IPWG membership to over 20 nations;

Contribution to studies that lead to the addition of high frequency channels (166 and 183 GHz) on the Global Precipitation Mission (GPM) Microwave Imager;

Real-time validation of satellite and NWP precipitation datasets: expansion with new sites and participants;

Assessment of global precipitation for IPCC;

Several key publications including *BAMS* – Ebert et al., 2007, 88,1,47-64; *Measuring Precipitation from Space – EURAINSAT and the Future* (Levizzani, Bauer and Turk, Eds, 722p); *JAWRA* – Kidd et al., 2008 (in press);

Organization of specialist meetings on Microwave/Snowfall workshops (IWSSM) at University of Wisconsin (Octobert 2005) and Steamboat Springs (April 2008);

Development of the Programme of the Evaluation of High Resolution Precipitation Products (PEHRPP) (December 2007);

Contribution to two major National Academy of Sciences (NAS) reports on TRMM and GPM missions;

Representation at meetings and conferences:

- Joint Center for Satellite Data Assimilation Precipitation Workshop;
- IGeoLab FG-3,-4,-5;
- EUMETSAT Users Conferences since 2002;
- AMS conferences since 2002;
- Third GPM Ground Validation Workshop;
- Environment Canada's Snow Hydrology Workshop;
- CEOS Precipitation Constellation Workshop.

IPWG-4 was attended by about 75 scientists with approximately 20 countries represented. There was a mix of oral presentations (41), posters (29), a conversation session and working groups covering international projects and satellite programmes, IPWG programmatic activities, algorithms, applications, validation, modelling, new technology and data assimilation. The IGeoLab FG-5 meeting (See WMO-WP-15) was arranged to coincide with the IPWG Workshop.

The CGMS Rapporteur to IPWG welcomed the Workshop attendees on behalf of WMO (at the request of Dr Wenjian Zhang, WMO) and on behalf of CGMS. The Rapporteur noted the importance of activities being undertaken by IPWG and relayed comments from CGMS-35 to the IPWG. At the end of the IPWG meeting, the Rapporteur noted that the goals for the fourth IPWG meeting had been met.

The IPWG addressed a number of issues relating to current and future precipitation-related satellite missions. A number of common themes were discussed in both plenary and working group sessions. These included:

- Continuity of satellite missions with precipitation radar capabilities (e.g. TRMM and GPM);
- Development of new capabilities, such as Doppler radar in space;
- New sensors with high frequency observation capabilities, particularly in relationship to IGeoLab, to exploit frequencies around 54 and 118 GHz;
- Protection of existing 'no emission' frequencies was deemed vital (see action 34.10 CGMS-35), with the IPWG fully supporting the work of ITWG to protect these frequencies;
- Advantages and disadvantages of formation versus constellation orbital configurations. IPWG noted that when possible, operators should consider the advantages of formation flying, as proven through the A-Train, which could provide a valuable intersection between future research and operational missions, as well as a possible new paradigm for future operational missions;
- The operators should note and inform, in a timely manner, the IPWG of issues that relate to the quality of current data and to issues relating to the future flow of data from relevant satellite missions (such as the cessation of data flow beyond the mission lifetime).

Data issues were addressed by several IPWG working groups. In particular, the timeliness, access and delivery of datasets were noted, along with the provision of correct documentation and metadata dataset information. Operators should ensure that there is provision for the archiving and documentation of level 0 and 1 datasets, continuity of level 2 and 3 data and any necessary reprocessing (with associated documentation/metadata). Furthermore, the long-term cross-calibration of sensors was deemed vital to the long-term usability of satellite datasets, alongside individual sensor characteristics. Inter-calibration studies will be continued to permit data to be usefully employed for climatological studies. Satellite operators should provide assistance with the necessary information on sensor and dataset characteristics to facilitate this activity.

It was noted at IPWG-4 that completeness of global precipitation retrievals continues to be a high priority, with emphasis being placed on areas where information is lacking and difficult to obtain, such as orographic regions, cold season precipitation, and polar regions. Furthermore, comparisons of High Resolution Precipitation Products (HRPP) need to continue and expand, to include for example, NWP model precipitation products. Work will also proceed on the development of new statistical tools for inter-comparison of satellite-surface-model products, together with the development of quality indices and error models and advances in data assimilation

within precipitating regions. Relevant to these matters, IPWG urges CGMS Members:

To continue to provide data necessary for global, 4-km IR data products in a timely manner to precipitation product producers;
To transition satellite precipitation products into operations as quickly as possible from sensors such as FY-3A and DMPS/SSMIS;
To develop, maintain, and reprocess archives of level 2 and 3 precipitation products;
To distribute HRPP's through Geonetcast in consultation with IPWG.

IPWG will continue its activity of outreach and education, through a number of actions. A specific focus group will be established to oversee the management and content of the IPWG web page. Information on training and development modules will be added, covering satellite observations, precipitation algorithms, example data, precipitation products and validation datasets. Efforts will be made to broaden the awareness and access to the precipitation products generated by the IPWG membership. Links with other interested groups will be explored, along with synergistic activities with other CGMS working groups, to widen the use of precipitation products across the user community. Contact points for IPWG topics will be established; together with feedback forums for current and future users of IPWG maintained algorithms and products. With regard to this type activity, CGMS is invited to establish with the WMO Space Programme, the IPWG through its Co-chairs, and the WMO Hydrology Programme a small team to investigate the feasibility of "Mainstreaming the Operational use of Satellite Precipitation Data and Products" for Meteorological and Hydrological Services.

Over-arching matters

IPWG sees areas of mutual benefit between the three CGMS working groups on topics such as land surface emissivity, microwave frequency protection, SSMI and SSMIS sensor calibration and techniques for detecting motion vectors It is suggested that the IPWG, ITWG and IWWG Co-chairs meet in the near future to discuss ways for the groups to interact more closely and develop a plan for meetings to be held in common venue (perhaps in the next three to five years in Geneva).

IPWG invites CGMS Members to note that, at IPWG-4, an opportunity was missed to engage new interested nations (Indonesia, Nigeria, Turkey) and to sustain previously involved nations (South Africa) due to lack of travel budget; only funds from EUMETAST and NSMC were available to support three scientists to attend the Workshop. Sustained funding in the future for continued IPWG outreach and exploitation of CGMS member satellites is desired. Additionally, IPWG would greatly appreciate CGMS support to help needy IPWG Members publish in a "special edition" of the AMS Journal of Applied Meteorology and Climatology dedicated to IPWG; to be published in the 2009-10 timeframe.

2.2 First Programme for the Evaluation of High Resolution Precipitation Products (PEHRPP) Workshop

Over 40 participants from 12 countries gathered at the World Meteorological Organization (WMO) headquarters in Geneva, Switzerland from 3-4 December 2007 to discuss various aspects of high resolution precipitation product (HRPP) development, validation and applications. The Workshop, which was co-organized by Phil Arkin (University of Maryland) and Joe Turk (NRL/Monterey) was broken down into two days of formal presentations, with the third day dedicated to working groups separated into validation, error metrics, and applications.

The main recommendations of each working group are as follows:

> Validation: Establishment of a specific inter-comparison project aimed at global 3 hourly/0.25° resolution products, with validation performed over specific regions. In conjunction with this, the creation of an Evaluation Science Team (EST) was recommended that would be responsible for the organization and coordination of precipitation evaluation and validation efforts.
> Applications: HRPP developers are encouraged to formulate and produce error estimates for each product together with relevant meta-data, including the source of data and its latency relative to the nominal output product.
> Error Metrics: IPWG should develop a standing committee or team focused on the topic of error metrics.

2.3 Second International Workshop on Space-based Snowfall Measurement

The Second International Workshop on Space-based Snowfall Measurement (IWSSM) was held in Steamboat Springs, CO during 1-4 April 2008 and was co-organized by Greg Tripoli and Ralf Bennartz, both from the University of Wisconsin. The local host was the Desert Research Institute/Storm Peak Laboratory. This Workshop followed the previous one which was held in October 2005 in Madison, WI. Fifty scientists representing eight nations were represented at the Workshop. There were five primary topical areas: Applications, Global Estimation, Modelling, New Technologies and Validation. Also included as part of the Workshop was a tour of the Storm Peak Laboratory (at an elevation of 10,500 feet) where they are conducting an aerosol experiment to study the types of particles that are in the clouds in that region, which affect the formation of clouds and precipitation. Finally, several key recommendations were developed at the end of the Workshop, including the development of a “modelling chain” that closely connects atmospheric, surface, cloud and radiative transfer modelling, primarily at microwave wavelengths which have the best chance to retrieve snowfall from space. Additionally, the continued development of space borne radars sensitive to snowfall was encouraged. Lastly, improved datasets are needed for algorithm development, in particular, microphysical cloud information. A workshop report is being finalized and will be posted on the IPWG web site.

2.4 Representation at Other Meetings

The current and past Co-chairs gave presentations at the following meetings during the past year:

> EUMETSAT/AMS Satellite Conference, Amsterdam, The Netherlands, 24-28 September 2007;

2007 AGU Annual Meeting, San Francisco, CA, 10-14 December 2007;

Third International GPM Ground Validation Workshop, Buzios, Brazil, 4-6 March 2008;

2008 EGU Annual Congress, Vienna, Austria, 13-18 April 2008;

Precipitation Measurement Missions (PMM) Science Team Meeting, Ft. Collins, CO, 3-8 August 2008;

2008 EUMETSAT Satellite Meteorology Conference, Darmstadt, Germany, 8 - 12 September 2008.

2.5 IPWG Validation Activities

IPWG continues to provide the following precipitation inter-comparison regions:

Australia: http://www.bom.gov.au/bmrc/SatRainVal/sat_val_aus.html
Europe: http://kermit.bham.ac.uk/~ipwgeu/
Japan: http://www.radar.aero.osakafu-u.ac.jp/~gsmap/IPWG/sat_val_Japan.html
S.America: http://cics.umd.edu/~dvila/web/SatRainVal/dailyval.html
USA: http://www.cpc.ncep.noaa.gov/products/janowiak/us_web.shtml

Support for other validation sites continues to be pursued and include Argentina, India, Indonesia, Nepal and South America.

2.6 Changes in Co-chairs

CGMS-36 is invited to confirm George Huffman from SSAI/GSFC/NASA and Christian Klepp of the University of Hamburg (Germany) as the new IPWG Co-chairs and thanked the outgoing Co-chairs Ralph Ferrarofrom NOAA and Chris Kidd from the University of Birmingham (United Kingdom).

3 CONCLUSIONS

CGMS Members are requested to:

Continue to provide and update the inventory of routinely produced precipitation estimates, either operational or experimental/research, to the IPWG Co-chairs;
Provide information to the IPWG Rapporteur on areas for future consideration by the IPWG;
Appoint a new CGMS Rapporteur to the IPWG;
Confirm the new Co-chairs for the IPWG;
Continue to provide data necessary for global, 4-km IR data-products in a timely manner to precipitation product producers;
Establish with the WMO Space Programme, the IPWG through its Co-chairs, and the WMO Hydrology Programme a small team to investigate the feasibility of “Mainstreaming the Operational use of Satellite

Precipitation Data and Products" for Meteorological and Hydrological Services;

Consider ways to assure utility of datasets for use by IPWG Members, as discussed in connection with data issues at the IPWG-4 Workshop;

Consider ways to provide additional support for attendance at CGMS Science Working Group Meetings, particularly for those from developing and least developed countries;

Provide support as needed to help defray publication charges for the "special edition" of the AMS Journal of Applied Meteorology and Climatology.

Annex – Fourth Workshop of the IPWG Meeting Agenda.

Date	Time	Topic/Title	Speaker	Affiliation
Monday, October 13	**830-900**	**Registration**		
Session 1A - Welcomes and Overviews	900-910	Welcome from CMA	L. Recong	CMA/China
	910-920	Opening Remarks from WMO	J. Purdom	WMO/Switzerland
	920-930	IPWG Remarks	C. Kidd/R. Ferraro	Univ. Birminham/UK & NOAA/USA
	930-950	FY-3 Status	J. Yang	NSMC/China
	950-1010	CGMS	J. Purdom	WMO/Switzerland
	1010-1030	**COFFEE/TEA**		
Session 1B - International Projects and Satellite Programs	1030-1045	Mainstreaming the Operational use of Satellite Precipitation Data and Products - Challenges and Opportunities	W. Grabs	WMO/Switzerland
	1045-1100	GPM - Status and Plans	A. Hou	NASA/USA
	1100-1115	China's Microwave Sensor Developments	H. Yang	NSMC/China
	1115-1130	Hydrology SAF	B. Bizzari	CNR/Italy
	1130-1145	Hydrology Programme of Australia	L. Renzullo	CSIRO/Australia
	1145-1200	GSMaP Passive microwave precipitation retrieval algorithm: description and validation	K. Aonashi	JMA/Japan
	1200-1330	**LUNCH**		
Session 1C - Programmatic Activites of IPWG	1330-1345	IPWG Validation Sites	C. Kidd	Univ. Birminham/UK
	1345-1400	PEHRPP	M. Sapiano	Univ. of Maryland/USA
	1400-1415	IWSMM	G. Tripoli	Univ. of Wisconsin/USA
	1415-1430	Charge to WG's, logistics, etc	Kidd/Ferraro	
Working Group Session	**1430-1500**	**COFFEE/TEA**		
	1500-1700	Working Group Session 1 - Old Business		
	1700	**Meeting Ends for the Day**		
		Reception		
Date	**Time**	**Topic/Title**	**Speaker**	**Affiliation**

Tuesday, October 14	830-845	Quality indicators in an operational precipitation product	T. Heinemann	EUMETSAT/Germany
Session 2A - Algorithms	845-900	Improvement of cold season land precipitation retrievals through the use of field campaign data and high frequency microwave radiative transfer model	N. Wang	Univ. of Maryland/USA
	900-915	An SSMI - SSMIS Application for Climate Research - The extension of Hydrological Products Climate Records	D. Vila	Univ. of Maryland/USA
	915-930	A Kalman filter approach to blend various satellite rainfall estimates in CMORPH	R. Joyce	NOAA/USA
	930-945	Evaluating the utility of multi-spectral information for delineating the areal extent and intensity of precipitation	A. Behrangi	Univ. of California-Irvine/USA
	945-1000	Observing precipitation with AMSU-B opaque channels: the 183-WSL algorithm	V. Levizzani	ISAC-CNR/Italy
	1000-1030	**COFFEE/TEA**		
Session 2B - Poster Session	**1030-1200**	**Poster and Conversation Session**		
	1200-1315	**LUNCH**		
Session 2C - Applications	1315-1330	Evaluating the impact of aerosols on the onset and microphysical properties of rainfall of the coast of China	W. Berg	Colorado State Univ./USA
	1330-1345	Characteristics of precipitating and non-precipitating clouds in typhoon Ranan as viewed by TRMM combined measurements	Y. Fu	NSMC/China
	1345-1400	Characteristic comparison of precipitation between TRMM PR measurements and rain gauge observation in mainland China	P. Liu	NSMC/China
	1400-1415	The role of remote sensing satellite data for rainfall forecasting in Indonesia	A. Sudradjat for K. Wikantika	Univ. of Maryland/USA; ITB/Indonesia
	1415-1430	Validation and analysis of precipitation extremes in TMPA	G. Huffman	NASA/USA
	1430-1445	Operational estimation of accumulated precipitation using satellite observation by EUMETSAT H-SAF	A. Di Diodato	IMAA-CNR/Italy
	1445-1515	**COFFEE/TEA**		

Session 2D - Poster Session	**1515-1700**	**Poster and Conversation Session**		
	1700	**Meeting Ends for the Day**		
Date	**Time**	**Topic/Title**	**Speaker**	**Affiliation**
Wednesday, October 15	830-845	First results of validation and hydrological impact studies for EUMETSAT H-SAF satellite precipitation products	B. Lapeta	IMWM/Poland
Session 3A - Validation	845-900	Use of Satellite Precipitation measurements in Nigeria	A. Adesi	NMA/Nigeria
	900-915	Inter-comparison of CMORPH rainfall estimation with rain gauges over South America	A. Pereira	Univ. San Paulo/Brazil
	915-930	Very high resolution precipitation frequency and rainfall estimates from TRMM: applications and uncertainties	S. Nesbitt	Univ. of Illinois/USA
	930-945	Validation of satellite rainfall estimation in the summer monsoon dominated area of the Hindu Kush Himalayan region	S. Bajracharya	INGO/Nepal
	945-1000	Validation of daily satellite rainfall estimates over South America	T. Dinku	IRI/USA
	1000-1030	**COFFEE/TEA**		
Session 3B - Poster Session	**1030-1200**	**Poster and Conversation Session**		
	1200-1315	**LUNCH**		
Session 3C - New Applications, Modeling and Topical Issues	1315-1330	Satellite data assimilation in cloudy and precipitation conditions	F. Weng	NOAA/USA
	1330-1345	Assimilation of rain and cloud affected microwave radiances at ECMWF	A. Geer	ECMWF/UK
	1345-1400	Testing of Cloud Microphysics Scheme with Snow Events	W. Tao	NASA/USA
	1400-1415	Global precipitation analyses and reanalyses	P. Arkin	Univ. of Maryland/USA
	1415-1430	Application of high-resolution multi-satellite precipitation real-time estimates for global hydrological disaster monitoring and prediction	Y. Hong	Univ. of Oklahoma/USA
Working Group Session	**1430 - 1450**	**COFFEE/TEA**		

	1450-1700	Working Group Session 2 - New Business		
	1700	**Meeting Ends for the Day**		
Date	**Time**	**Topic/Title**	**Speaker**	**Affiliation**
Thursday, October 16	830-1000	**"Grand" Poster and Conversation Session**		
Session 4A - Grand Poster Session	830-1030	**IGeoLab FG-5 Parallel Session**		
	1000-1030	**COFFEE/TEA**		
Session 4B - New Technology & Techniques and Topical Issues	1030-1045	Inter-comparison and selection of rainfall estimation and nowcasting algorithms by the GOES-R Algorithm Working Group	R. Kuligowski	NOAA/USA
	1045-1100	Applications of CloudSat light precipitation products	T. L'Ecuyer	Colorado State Univ./USA
	1100-1115	HAMP - the microwave package on the upcoming high altitude and Long range aircraft HALO	M. Mech	Germany
	1115-1130	Current scientific progress and future scientific prospects enabled by space borne precipitation measurements	E. Smith	NASA/USA
	1130-1145	Passive and active microwave remote sensing of cold-cloud precipitation	B.Johnson	NASA/USA
	1145-1200	SSM/I inter-sensor calibration and impact on precipitation trend	S. Yang	NOAA/USA
	1200-1315	**LUNCH**		
Working Group Session	1315-1415	Working Group Reports		
	1415-1430	Discussion		
	1430-1500	**COFFEE/TEA**		
	1500-1700	Final Plenary/Discuss/Wrap Up		