# **OPERATIONAL APPLICATIONS WORKING GROUP**

Chair: Ralph Ferraro Rapporteur: Robert Joyce

**Participants:** Robert Joyce, Ralph Ferraro, Joe Turk, Jim Purdom, George Huffman, Tomoo Ushio, Authur Hou, Ian Bell, Bob Kuligowski, Thomas Heinemann, Tufa Dinku, Axel Andersson, John Janowiak, Peter Bauer, Wes Berg, Pieter Visser, Daniele Biron, Michel Desbois

### 1. EXPORT ALGORITHMS AND WEBSITE

<u>Algorithm Export:</u> Form a subgroup focusing on the development of instantaneous precipitation estimation export algorithms for users of geostationary and low Earth-orbiting satellite data. Organize and maintain an IPWG website for algorithm download and use by IPWG website-registered users. The website will contain an inventory and access to several existing products, as well as links to algorithm descriptions and a further link to online data, if available. The IPWG website should contain:

- Access to baseline export algorithms though registered user login.
- Information on existing online MW and geo-IR digital data sets (not all users will have satellite direct-capture capabilities)
- Access to existing / maintained precipitation products, with explanations.
- Comprehensive datasets of specific meteorological events for case studies.
- Training materials and information about training activities.
- Information on upcoming IPWG-related activities.

**Status:** Two algorithms now exist on web page: IR (Tapiador) and passive MW (Ferraro). Algorithm inventory continues to be enhanced and updated. Other significant updates have been made over the past two years (workshop reports/presentations, new items, etc.)

Action: Algorithm pages once again need to be updated and new ones added using an existing template which will be revised. (ST: Joyce)

Action: Algorithm limitations in the form of a guidance page should be developed (ST: Huffman)

Action: New actions assigned at this meeting to make changes/additions to the existing page will be coordinated by V. Levizzani. (ST: Levizzani)

<u>Case Study Links</u>: On the IPWG website, add in links to case studies (URL's, imagery, PPT, etc.) with a focus on user education. Template to be developed and distributed by Deborah Smith (ST, MT: *Deborah Smith*).

Status: Unknown (D. Smith not present)

Action: J. Turk to contact D. Smith (ST: Turk)

<u>Climatological algorithms and data:</u> Provide information on current and research-oriented climatological precipitation techniques accompanied by available climatological precipitation datasets and documentation. IPWG subgroup to survey the space/time needs, accuracies needed, data latency time, and temporal coverage. This material is also to be made available on the IPWG website.

Status: COMPLETED by Phil Arkin.

**Feedback to Developers:** Several users of the satellite rainfall products note deficiencies in their performance, many on regional scales. Providing such information to algorithm developers is essential for their improvement.

Action: A user feedback/anomaly form should be developed on the IPWG web site for the rainfall products. The associated algorithm developer for such products should be notified in an automated manner and be expected to respond to the user in a reasonable amount of time. This information should be organized and made highly visible on the IPWG web page. (ST – MT: R. Ferraro, V. Levizzani).

#### 2. TRAINING AND OUTREACH

**Algorithm Training Materials:** Training materials describing the basis of the algorithm, its applicability, and its capabilities and limitations must accompany any export algorithm. The training materials are to be patterned after the Virtual Laboratory (VL) for Satellite Data Utilization (<u>www.cira.colostate.edu/RAMM/WMOVL/main.html</u>). The training section in the IPWG web site should contain coming training activities (ST, LT: J. Purdom, D. Hinsman to coordinate). (UPDATED and CONTINUING: Most of this action has been completed).

Status: Much of this has been completed in an initial capacity.

**Action:** A new subgroup on training/outreach should be established within the next 6 months (ST: Ebert/V. Levizzani). This group should consider coordinating satellite training at future IPWG meetings.

Action: The material presented at the IPWG joint session with the APSATS should be posted on the IPWG web site (ST: Turk, Ebert, Heinemann, Huffman, Kuligowski, Levizzani). COMPLETED November 2006

#### **3. RESEARCH AND APPLICATIONS:**

<u>Critical research areas</u>: There are special problems faced by the algorithm developers and users such as orographic precipitation, frozen precipitation, and light precipitation (particularly outside of the tropical regime).

**Status:** Research appears to be moving towards making adjustments to current products for specialized climate regions. More work on regional algorithm approaches is needed.

**Status:** The Australia validation web page has already developed regional statistics; recommend other IPWG sites to also develop regional validations. The U.S. and European sites are good candidates because of their large domains.

**Action:** Develop region specific validation statistics that are stratified by climate regimes in order to better evaluate such differences (ST: Validation WG)

**IPWG-SAF Interaction:** It is recognized that the EUMETSAT Satellite Application Facilities (SAF's) have a vested interest in the activities of the IPWG. Several of the products that are reported on at the IPWG workshops will be applicable to several of the SAF's (e.g., Hydrology, Climate, NWP, etc.). It also should be noted that SAF products are of interest to IPWG.

Action: IPWG is encouraged to participate in activities centered on the SAF's. For example, the SAF-Hydrology will be hosting a workshop in Rome, Italy during October 2007 Also, it is suggested that the SAF web pages should be made accessible through the IPWG web page. (ST: Bizzarri, Heinemann).

**Expanded Development and Validation:** Encourage continued development, refinement, and validation of the various research-status satellite sensor precipitation estimation techniques.

**Status: Continuing.** Several new algorithms have been added to the IPWG validation effort since the last meeting.

**Action:** Continue to encourage algorithm developers to make their data available when they consider the algorithm to be mature enough. Candidate algorithms include the Staelin/Chen AMSU-B and the HOAPS-III (ST: Staelin/Chen and Klepp/Andersson).

## 4. CURRENT AND FUTURE SENSORS

<u>MAS Recommendations</u>: The National Academy of Sciences, recently completed a study on "NOAA's Role in Space-Based Global Precipitation Estimation and Application" in September 2006 (<u>http://fermat.nap.edu/books/0309102987/html/R1.html</u>). There are several specific recommendations that this report makes to NOAA regarding it's role in GPM and IPWG.

Action: IPWG endorses this excellent report and encourages NOAA to act on the recommendations provided. (ST: J. Purdom/CGMS; IPWG Co-Chairs R. Ferraro and C. Kidd)

<u>Megha-Tropiques Data:</u> The user community would like to acquire Megha-Tropiques data in near real-time to support tropical cyclone monitoring, QPE/QPF's, and NWP data assimilation. This data is also vital for the GPM mission. At present, this data will not be timely due to a single ground station.

Action: Recommend that CGMS and IPWG coordinate on developing a request for more timely data from M-T which can be accomplished through the addition of a second tropical ground station. (ST: J. Purdom, M. Desbois, D. Hinsman)

Action: Explore the potential candidate locations for the second ground station (ST: A. Hou)

**DMSP Data Distribution:** DMSP SSM/I data are vital for satellite rainfall estimation; IPWG is gratified that the DMSP is willing to share such data to the scientific community quickly after

launch. IPWG encourages that similar data distribution policies continue with the SSMIS sensor. Also, IPWG encourages the DMSP to communicate any satellite operational changes in a timely manner (e.g., the recent RADCAL beacon activation issue on F15) and coordinate with the IPWG in any matters related to precipitation retrieval.

Action: NOAA and/or the IPO should routinely report on the operational status and future launch schedule of DMSP and NPOESS to CGMS. WMO probably needs to take the lead on this. (ST: J. Purdom, D. Hinsman)

<u>Microwave Imaging and Sounding Capabilities:</u> IPWG is aware of the strict requirements for atmospheric sounding of NWP data assimilation systems. These may only be fulfilled by a combination of advanced infra-red and cross-track scanning microwave sounders as available from AIRS/IASI and AMSU-A/B/MHS-type instruments.

Cloud and precipitation remote sensing as well as the assimilation of cloud and precipitation affected microwave radiances requires accurate window channel observation as currently provided by TMI and AMSR-E. Recent studies suggest that in situations where these instruments lack sensitivity to clouds and precipitation (e.g., light rain over land, snowfall), additional sounding channels can provide substantial additional information as they can improve the retrieval of cloud vertical structures.

Due to budgetary constraints, ideas of combining both imaging and sounding capabilities from the same conically scanning instrument (SSMIS, CMIS) have been raised that satisfies the NWP calibration accuracy requirements only to a limited degree. However, imaging channels on a cross-track scanner would not provide sufficient accuracy for cloud and precipitation applications due to the loss of polarization information and the variable footprint size along the scan.

IPWG recommends maintaining the operation of both cross-track scanning sounders and conically scanning imagers—on the same platform if possible--to satisfy the high data quality required by both communities. Upgrading imagers with a limited number of sounding channels would provide substantial upgrades for the remote sensing of light precipitation and snowfall and can also support cross-platform algorithm calibration.

**Southern Hemisphere GOES Coverage:** At the 2<sup>nd</sup> IPWG, it was agreed to recommend better temporal coverage of GOES over the Southern Hemisphere (South America). Currently, the GOES-East half-hourly satellite coverage cuts off at 20 S latitude and in periods of rapid-scan operations the refresh rate for South America south of 20 S is reduced to three hours.

**Status:** Repositioning of GOES-10 to 60 W longitude is in progress.

<u>Geostationary Lightning and Microwave Capabilities:</u> As was the case at the second IPWG, the group discussed the possibility of recommending a geostationary-situated lightning sensor and passive microwave sounder to the CGMS. The IPWG was excited to learn that the GOES Lightning Mapper (GLM) will be available beginning with GOES-R (presently scheduled for December 2014 launch), and China seems to be furthest along with plans for a passive microwave sounder, with a possibility of deployment onboard the FY-4 satellite (approximately 2015).

Action: It should be reported to CGMS that all operational satellite agencies should be encouraged to include a lightning mapper in their future geostationary satellite missions. (ST: J. Purdom/D. Hinsman)

Action: Encourage research to accelerate the development of geostationary passive MW sounders by other satellite agencies. IPWG can help facilitate this by providing cost/benefits of such a sensor, possibly by determining the sensitivity of sensor dimensions relative to resulting accuracy/resolution. Anticipated benefits include improvements in tropical cyclone monitoring, QPE/QPF, and measurements in precipitating atmospheres for NWP model assimilation. (ST to MT: Kummerow/Research WG; Staelin)

**Documentation of Instrument Characteristics:** Characteristics of passive MW radiometers need to be properly documented in order to insure improved use for precipitation retrieval--in particular, for long term climate records. Information such as calibration changes, cross-scan biases, and inter-satellite calibration are vital. This needs to be addressed for both current and future sensors. It was noted that ITWG and GCIS were moving in this direction. (Cross referenced with Research WG).

Action: Data preservation of L0 data and the means by which it is generated are needed for both current and future sensors. These concerns should be conveyed to CGMS and coordinated with ITWG and GCIS. (ST – LT: W. Berg, others)

<u>Unified Geostationary IR Data Set:</u> A readily available, high quality single channel (IR) blended geostationary data set would benefit the algorithm development community. However, such data cannot be made available in near real time due to data agreements between data set developers and satellite operators. (It is noted that such data are not replacing the distribution of the original data since it is for only a single channel and it is enhanced by intersatellite calibration, parallax and limb correction, etc.).

Action: A request to CGMS satellite operators to waive data latency requirements related to this product. (ST: J. Janowiak, T. Heinemann, J. Purdom)

<u>Swath Rainfall Product Reprocessing</u>: Reprocessing of swath rainfall products (after algorithm upgrades are implemented) by operational agencies is critical for the continued use of such products in climate applications. Most satellite operators consider reprocessing a climate center function and not a satellite data center function.

Action: Satellite data centers should ensure that satellite rainfall products are reprocessed after major algorithm revisions are implemented. (ST - MT: IPWG co-chairs)

**Level-2 Precipitation File Content Standards:** At the 2<sup>nd</sup> IPWG, the group was presented with a proposal for Level-2 precipitation file content standards by Michael Goodman of NASA headquarters. The Operational Applications working group in general agreed there should be a Level 2 Precipitation File Content Standard and the Strawman approach by George Huffman was in the right direction (strawman agenda attached to the end of this working group report). However, partly because of both the numerous data specification details and numerous groups using the data products, the approach at this time was to form a separate group to determine protocols for these issues.

<u>Status:</u> Not much has transpired since the initial straw man. No further communication with M. Goodman.

**<u>Action</u>**: As an alternative, develop a matrix of parameters for each algorithm that allows users to identify contents (ST: G. Huffman).