Recent activities of the International Precipitation Working Group (IPWG)

AOSUMC-12, 16 November 2022

Takuji Kubota* and Chris Kummerow, IPWG Co-Chairs
F. Joseph (Joe) Turk, CGMS rapporteur
*presenter

Coordination Group for
Meteorological Satellites

What's "IPWG"?

- The International Precipitation Working Group (IPWG) was established as a permanent Working Group of the Coordination Group for Meteorological Satellites (CGMS) in 2001.
  - ✓ The IPWG is co-sponsored by CGMS and the World Meteorological Organization (WMO)
  - ✓ focuses the scientific community on operational and research satellite based quantitative precipitation measurement issues and challenges.

- It provides a forum for operational and research users of satellite precipitation measurements to exchange information on methods for measuring precipitation and the impact of space borne precipitation measurements in numerical weather and hydrometeorological prediction and climate studies.

IPWG Membership April 2022
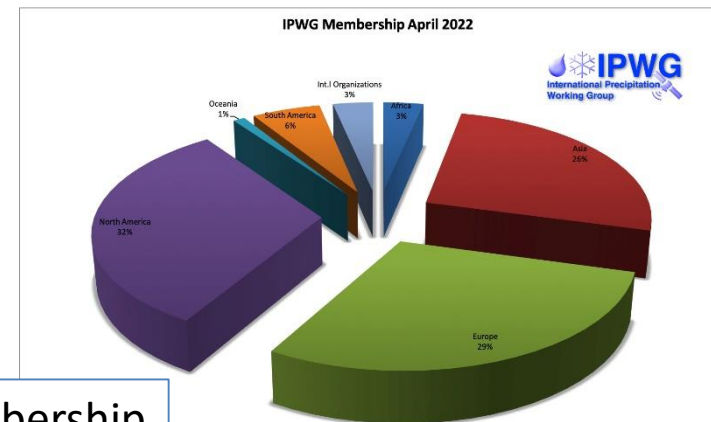
IPWG membership exceeds 500 members

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Reorganization of IPWG Working Groups

IPWG workshops have traditionally been broken into working group areas, which collectively contribute to the overall recommendations that are reported to CGMS, typically broad areas such as:

- Research
- Applications
- Data Assimilation
- Validation

In order to be more responsive to the discussions and sentiments expressed at IPWG-10, we have formed four new Working Groups that have deliverables in one-year increments. Additionally, there are now five Focus Groups, whose primary aim is to act as a forum for individual research questions that are meant to facilitate the transition from research to operations.

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IPWG Working Groups
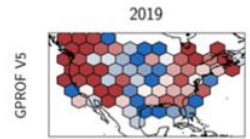
WG 1: Baseline Surface Precipitation Network

Goal: Produce a document that outlines the steps needed to produce a Quantitative Precipitation Estimation (QPE) product of uniform quality from radars/gauge networks for use in satellite data validation. Implement this by getting this uniform quality radar or radar network data from as many regimes as possible into a common database for use by satellite product and model developers. With Pekka Rossi and WMO Expert Team on Operational Radars

WG 2: Satellite Precipitation

Goal: Produce a document that outlines (a) User needs from global product producers (b) Needs from global product producers from research community.

WG 3: Machine Learning

Goal: Produce a standard training and independent test data set for individuals to test Machine Learning algorithm capabilities in a consistent fashion.

WG 4: CubeSat/SmallSat WG

Goal: Produce a document outlining relative capabilities of various channel combinations/spatial resolutions for helping constellation requirements. Likely will use geostationary IR as a baseline for comparison.

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IPWG
International Precipitation Working Group

CGMS

IPWG Focus Groups (FG)

FG 1: Orographic Precipitation
Longstanding issue, addressed in several algorithm products.

FG 2: Snowfall
Deficiencies in detecting and quantifying cold season precipitation.

FG 3: Particle Scattering
Needed for simulating passive/active MW sensors and use in DA forward operators

FG 4: Data Assimilation
Assimilation of rain-affected radiances, use of products for model validation. Latent Heating is being used in high resolution models

FG 5: Land Surface
Initially useful to properly simulate active/passive radiances but has clear feedback to cloud properties.

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Update on IPWG Reports

- **The Joint IPWG/GEWEX Precipitation Assessment**
  - ➢ Led by Rémy Roca (Chair of GEWEX/GDAP and former IPWG Co-chair) and Ziad Haddad (former IPWG Co-chair)
  - ➢ Published and available at the WCRP/GEWEX international project office

- **A review of the different operational applications of precipitation radars within the International Precipitation Working Group (IPWG) community** has been prepared:
  - ➢ Coordinated by the IPWG Co-Chairs; 20 contributors
  - ➢ Final copy approved during CGMS-49

"**The Joint IPWG/GEWEX Precipitation Assessment**"
https://doi.org/10.13021/gewex.precip
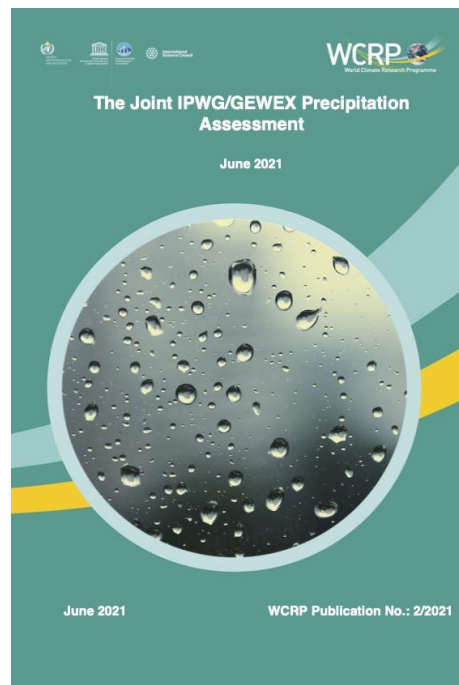
"**IPWG Report on Space Radar Applications**"
http://ipwg.isac.cnr.it/reports/IPWG_review_applications_space-borne_precipitation_radars.pdf

The Joint IPWG/GEWEX Precipitation Assessment

June 2021

WCRP Publication No.: 2/2021

A review of the different operational applications of spaceborne precipitation radars within the International Precipitation Working Group (IPWG) community

10 June 2021

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Report coordinated by IPWG co-Chairs:
Philippe Chambon[7] and Viviana Maggioni[17]

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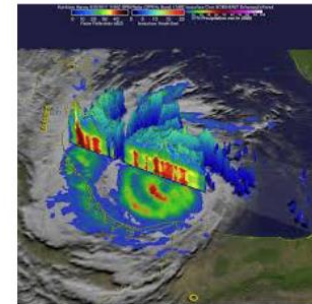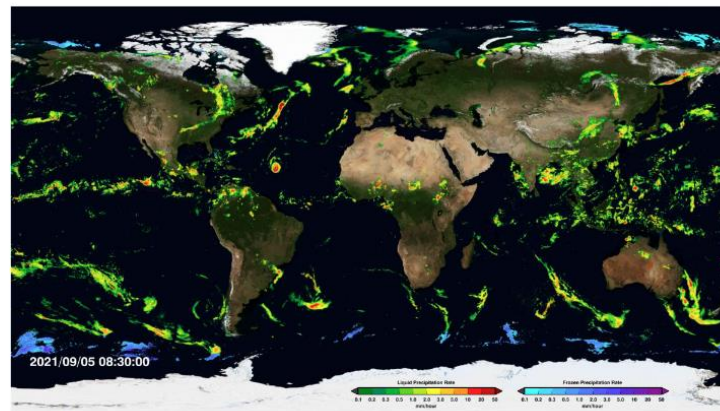18. Kyoto University, Kyoto, Japan

IPWG_Scientific Outreach and Training

Joint GPM-IPWG Applications Training

Part 2: GPM Precipitation Data Applications

- ➢ 15-16 September 2021
- ➢ Organized with the GPM applications team (Andrea Portier, Amita Mehta)
- ➢ Over 140 participants

IPWG-10 Workshop

10th Workshop of the International Precipitation Working Group (IPWG) and 6th International Workshop on Spaced-based Snowfall Measurement (IWSSM)

⇒ Joint meeting with the IWSSM community

- Took place during 13-17 June 2022 (same week as CGMS-50)
- Host: Cooperative Institute for Research in the Atmosphere, Colorado State University, Fort Collins, Colorado, US

⇒ Acknowledgement to CIRA and staff for hosting, after postponements in 2020 and 2021, and to Viviana Maggioni and Philippe Chambon for serving extra years as Co-Chairs

⇒ 173 attendees (in-person and online total), 94 presentations, 22 countries represented

⇒ Sessions dedicated to training, organized together with the Virtual Laboratory (plenary session, working group + dedicated interactive session of training)

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Yagmur Derin winning first prize for outstanding presentation/poster

Runners Up Fraser King and Linda Bogerd

IPWG-10
CSU/CIRA
Fort Collins, CO US

Recommendations from IPWG-10

Constellation

➢ Sustain continuity in missions that provide core, high-quality passive microwave (MW) observations across a wide range of frequencies (e.g. AMSR-2/3).

➢ Organization of these sensors into complementary syn-synchronous orbits across the diurnal period and mitigate observation-poor time periods.

➢ At least one space-based precipitation radar (e.g. GPM DPR) to provide a calibration source for the passive MW radiometers, and a climate data record for extreme events and precipitation types that are inherently difficult for passive MW sensors to detect.

➢ Maintain continuity of observations from deprecated, but still functioning sensors: The IPWG recognizes the value of these continued observations to augment the prime constellation at different times of day as their orbits drift.

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IPWG-10: Emerging Topics and Trends

➢ Growing usage of AI/ML techniques in algorithms

➢ Advancements to passive MW techniques specifically for estimating frozen (snow) precipitation from operational satellites, eg MetOp

➢ Continued effort to improve established global precipitation products, to address shortcomings inherent to high latitude/cold season and orographic precipitation

➢ Limited availability of science-quality ground radar network data, Needed to evaluate these same products in various regimes worldwide

➢ Growth in the number of limited lifetime, high quality small satellite observations with precipitation-sensing capabilities is expected to continue

➢ First participation of colleagues from the private sector (tomorrow.io)

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Science Highlight: Small Satellites for Precipitation

COWVR+TEMPEST (12/2021-)

- US Air Force sponsored mission on the ISS to demonstrate low-cost passive microwave sensor technologies for weather
- Support from NASA for data integration
- 18-183 GHz channels
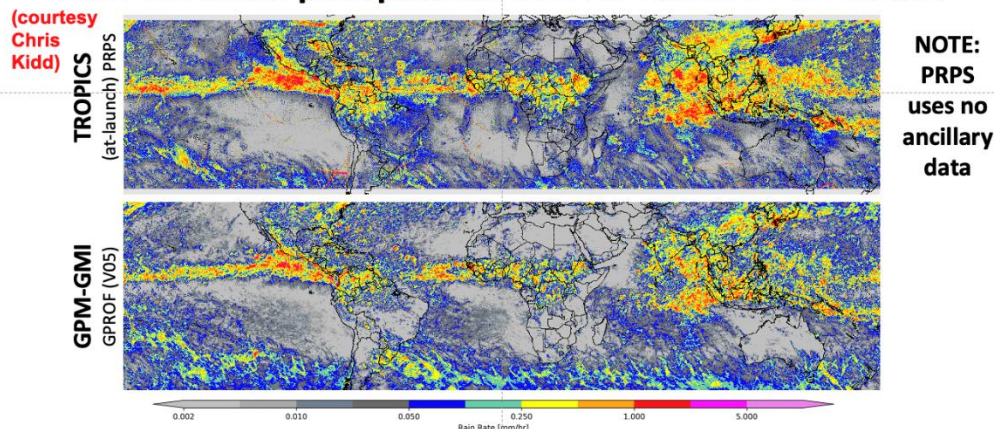- 3-year operations from the ISS
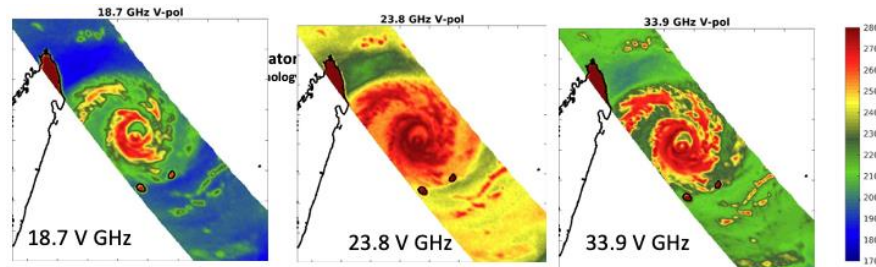
TROPICS-Pathfinder (6/2021-)

- 89-205 GHz channels

TROPICS (4 satellites, 2023)

- 89-205 GHz channels

TROPICS mean precipitation rate 2021.08.08-2021.09.05

NOTE: PRPS uses no ancillary data

Some L1B orbit/scanline issues, but the at-launch (4-channel) PRPS-TROPICS precipitation extent is similar to GPROF-GMI, but generally higher.

PMM workshop, 18-22 October 2021

Figures courtesy of Shannon Brown, JPL/Caltech

Summary

- The International Precipitation Working Group (IPWG) provides a forum for operational and research users of satellite precipitation measurements to exchange information.

- Recently, we have formed 4 Working Groups, and 5 Focus Groups.

- 10th Workshop of the IPWG (IPWG-10) was held with the IWSSM community, during 13-17 June 2022, in Colorado State University, Fort Collins, Colorado, US.

  ➢ Recommendations from IPWG-10, such as "Constellation"

  ➢ Emerging Topics and Trends

    ✓ Growing usage of AI/ML techniques in algorithms

    ✓ Growth in the number of limited lifetime, high quality small satellite observations

- 11th Workshop of the IPWG (IPWG-11) will be held at Tokyo, Japan, in 2024 (planned).

- When you are interested in the IPWG activity, please visit our homepage, and join to the IPWG!

  ➢ http://ipwg.isac.cnr.it/contacts.html

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