Opportunity Title: Convective Precipitation Process Studies Using Data from Radio Occultation and Passive/Active Microwave Observations
Opportunity Reference Code: 0222-NPP-NOV23-JPL-EarthSci

Organization National Aeronautics and Space Administration (NASA)

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Application Deadline 11/1/2023 6:00:59 PM Eastern Time Zone

Description The study of tropical convection and the resulting precipitation is motivated by difficulties in their representation in global circulation models. The temperature and water vapor structure of the surrounding environment is the main control on the thermodynamic processes leading to the development of precipitation, acting as the broader sink and source for moisture exchange between clouds and their surroundings. A major source of uncertainty in understanding the relation between the water vapor structure and the associated precipitation remains the difficulty in obtaining a sufficient quantity of globally distributed, fine scale vertical profiles of temperature, pressure and moisture, through the boundary layer to the upper levels of the free troposphere, that probe internal to convective precipitating clouds. The GNSS radio occultation (RO) measurement has unique advantages for use with convective process studies. The attenuation by precipitation at GNSS frequencies is insignificant, making RO practical for probing through extreme precipitation weather systems with fine scale vertical resolution. JPL co-developed the polarimetric radio occultation (PRO) measurement principle currently being demonstrated with the Radio Occultations Through Heavy Precipitation (ROHP) instrument onboard the Spanish PAZ spacecraft. Analysis of ROHP data has shown that the polarimetric phase shift is sensitive to the path-integrated precipitation water content. Additionally, the 24-degree orbit inclination of the current COSMIC-2 six-satellite constellation is fortuitous for abundant sampling of this structure associated with heavy precipitation.

This opportunity involves analysis of ROHP and COSMIC-2 data, in conjunction with other space- based microwave-based observations, both passive (e.g., GPM-GMI, ATMS) and active (e.g., GPM-DPR, CloudSat), to further their joint usage in understanding the thermodynamics underlying heavy precipitation. Suggested topics include, but are not limited to, use of these data for (a) examination of the level of increased moistening that occurs within the boundary layer through the lower free troposphere within precipitation, and the vertical layers where the moisture is most sensitive to the precipitation structure, (b) assessment of the water vapor-precipitation convective transition process unique to each model in the suite of recent climate model intercomparison project such as CMIP6, and (c) numerical weather prediction (NWP) forecast model verification and assessment, RO data assimilation including PRO, and RO-related OSSE experiments.

Cardellach, E., Oliveras, S., Rius, A., Tomí¡s, S., Ao, C.O., Franklin, G.W., Iijima, B.A., Kuang, D., Meehan, T.K., Padullés, R., Juí¡rez, M. de la T., Turk, F.J., Hunt, D.C., Schreiner, W.S., Sokolovskiy, S.V., Hove, T.V., Weiss, J.P., Yoon, Y., Zeng, Z., Clapp, J., Xia“Serafino, W., Cerezo, F., 2019. Sensing Heavy Precipitation With GNSS Polarimetric Radio Occultations. *Geophysical Research Letters* **46**, 1024-1031. https://doi.org/10.1029/2018GL080412

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Juí¡rez, M. de la T., Padullés, R., Turk, F.J., Cardellach, E., 2018. Signatures of Heavy Precipitation on the Thermodynamics of Clouds Seen From Satellite: Changes Observed in Temperature Lapse Rates and Missed by Weather Analyses. *Journal of Geophysical Research: Atmospheres* **123**, 13,033-13,045. https://doi.org/10.1029/2017JD028170

Location:
Jet Propulsion Laboratory
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Field of Science: Earth Science

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Applications with citizens from Designated Countries will not be accepted at this time, unless they are Legal Permanent Residents of the United States. A complete list of Designated Countries can be found at: https://www.nasa.gov/oiir/export-control.

Eligibility is currently open to:

- U.S. Citizens;
- U.S. Lawful Permanent Residents (LPR);
- Foreign Nationals eligible for an Exchange Visitor J-1 visa status; and,
- Applicants for LPR, asylees, or refugees in the U.S. at the time of application with 1) a valid EAD card and 2) I-485 or I-589 forms in pending status

Eligibility Requirements

- **Degree:** Doctoral Degree.