• **Detecting Convective Class Precipitation with Satellite Microwave Sensors**

A manuscript by CISESS Scientist Veljko Petković and Ralph Ferraro was accepted for publication in the *Journal of Atmospheric and Oceanic Technology* and posted as an early online release on September 13. Passive Microwave (PMW) instruments on satellites have been useful for identifying precipitation but less successful in distinguishing stratiform vs. convection precipitation. In their paper, Petković and his coauthors discuss the use of a Deep-learning Neural Network (DNN) to identify convective precipitation, which was trained using data from the Microwave Imager (GMI) of the Global Precipitation Measurement mission. Their test show that the DNN can accurately categorize stratiform vs. nonconvective precipitation for 85% of the total precipitation volume.

The figure above shows an example of a squall line observed over the Wisconsin on 13 July 2015. Red indicates convective rain and blue indicates stratiform rain (gray is no rain). On the left is the validation dataset [GPM Ground Validation Multi-Radar/Multi-Sensor (MRMS) dataset]; in the middle, the current precipitation typing for GPM [GPM Goddard PROFiling (GPROF) algorithm]; and on the right, the DNN algorithm results. The researchers also found that the DNN significantly reduced precipitation rate bias and that its accuracy was not dependent on surface type. They conclude that a DNN approach has promise for deriving precipitation type from satellite observations. Petković, Veljko, Marko Orescanin, Pierre Kirstetter, Christian Kummerow, and Ralph Ferraro, 2019: Enhancing PMW satellite precipitation estimation: Detecting convective class. *J. Atmos. Oceanic Technol.*, accepted, [https://doi.org/10.1175/JTECH-D-19-0008.1](https://doi.org/10.1175/JTECH-D-19-0008.1)  

**Funding Source:** STAR, JSTAR, JSTAR GCOM. **POC:** V. Petković & R. Ferraro.
• **New ATMS Geometric Calibration based on Lunar Images**

CISESS Scientists Jun Zhou and Hu Yang published an article on 16 September 2019 in the journal *Atmospheric Measurement Techniques*. The article describes a new technique they developed to validate the Advanced Technology Microwave Sounder (ATMS) on NOAA-20 by using lunar scan images. This method improves ATMS on-orbit geometric calibration accuracy. The lunar scan dataset comes from when the satellite performed a “pitch-over maneuver” operation on 31 January 2018. The basic idea of using lunar scan data to identify the ATMS geometric calibration error is to correct the nominal antenna pattern frame until it is perfectly aligned with the actual one. The correction can be performed by correcting each axis of the antenna pattern frame, with the Euler angles counteracting the geometric calibration error. Because the observations are made at discrete points, the Moon may not pass the center of the antenna pattern during the pitch-over maneuver operation. To determine the position of the lunar vector in the antenna pattern frame where the Moon reaches the center of the antenna pattern, the observations are fitted by a Gaussian function. The fitting can also help to reduce the observation noise. The raw observations (left) and fitting function (right) for three channels are shown below.

NASA ACCP Community Forum

The 2017 NASA Decadal Survey (DS) identified Aerosol, Clouds, Convection and Precipitation (ACCP) as high priority designated observables. In response to the DS report, NASA is conducting a three-year study to produce science, technical, management, and cost details for three candidate Observing Systems (OS)/Architectures that can address the ACCP objectives. The new mission will be a follow-on to the Global Precipitation Measurement (GPM). The ACCP team held its first Quarterly Community Forum on September 20. The purpose of the forum was to continuously engage science communities, government agencies, industry and foreign partners and keep all interested parties informed of the development with regard to ACCP. In Year 1 of the study (concluding on September 30, 2019), NASA developed a Science and Applications Traceability Matrix (SATM), shown below.

They solicited and received over 50 Request for Information (RFI) about the SATM. A series of workshops were conducted and over 32 candidate OS/Architectures have been formulated. Some OS cases were shown at the forum. Every case included multiple satellites either in the same polar orbit or in both polar and mid latitude orbits. These OS/Architectures will be assessed for their science and applications benefits, programmatic factors, risk and cost. Six OS/Architectures will be selected for deeper designs in Year 2. The ACCP team has made tremendous progress in Year 1 and is on track to complete Architecture Definition, Refinement and Down-Selection in Year 2. The outcome of the 3-year study will be a final report to the NASA Headquarters with details on 3 OS/Architectures and recommendations of one for implementation. According to the current plan, the launch of the first ACCP satellite will be no earlier than 2028. Funding Source: JSTAR. POC: H. Meng & R. Ferraro