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CLIMATE/ATMOSPHERIC SCIENCE & ENGINEERING COLLOQUIUM

Confronting spatial heterogeneity issues in passive satellite remote sensing of cloud properties

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- **Friday, June 4, 2021 | 2 p.m. | Via Zoom**
- **Free Registation:** https://uiowa.zoom.us/meeting/register/tJMkc-6orz0qG9VVanblFh83H3lDD4613C8r

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ABSTRACT: Cloud properties retrieved from passive satellite remote sensing have found widespread use in studying the energy and water cycles of our planet, despite the incomplete characterization of their uncertainties needed to draw scientific conclusions. While it is generally understood that cloud spatial heterogeneity and its treatment within cloud remote sensing algorithms can lead to large bias errors in retrieved cloud properties, quantifying and removing these biases in global datasets have remained elusive. Here, I will present ample evidence on the existence of large biases within our cloud climatologies, specifically those derived from MODIS and MISR instruments on the Terra platform. This evidence is drawn from (1) self-consistency tests derived from the cloud products, (2) the products inability to simulate independent measures of the radiation field when ingested into a forward model, (3) higher resolution satellite images, (4) opportunities of product coincident with the CATS lidar on the International Space Station, and (5) data collected during NASA's CAMP2Ex field campaign. I will also present recent progress towards characterizing and removing these biases from the MODIS and MISR cloud climatologies. These corrections have produced significant changes relative to their original cloud climatologies, which suggests a need to reevaluate past studies that have used the original product to study, for example, aerosol-cloud interactions and cloud microphysical parameterizations. Finally, I will discuss some remaining challenges in developing cloud climatologies and thoughts on future directions for improving the remote sensing of cloud properties from passive sensors.

BIO: Prof. Di Girolamo is a Blue Waters Professor of Atmospheric Sciences at the University of Illinois. His research aims at understanding cloud, aerosol, and radiation processes within the Earth system, with specializations in satellite remote sensing techniques and 3-D radiative transfer models. His current particular interests lie in characterizing the global nature of cloud, aerosol, and radiation properties, how they have changed over the satellite era, the drivers of these changes in the context of weather and climate research, and what impact these changes may have on human health. He works extensively with NASA and the Jet Propulsion Laboratory with a focus on developing and exploiting multi-angle technologies for studying Earth from space. He is a Co-Investigator for NASA's Multi-angle Imaging SpectroRadiometer (MISR) mission, which was launched in 1999 on the Terra satellite and remains in excellent health, and for NASA's Multi-Angle Imager for Aerosols (MAIA) that has been selected for launch in 2022. He is also a Science Team Member for the NASA's Moderate Resolution Imaging Spectroradiometer (MODIS) on the Terra and Aqua satellites. He has participated in numerous field campaigns across various agencies, most recently NASA's Cloud, Aerosol and Monsoon Processes – Philippines Experiment (CAMP2Ex). Since his work is computationally expensive and often involves processing petabytes of data, he maintains close collaboration with the National Center for Supercomputing Applications (NCSA), where they work together in solving some grand challenge problems faced by the Earth Science community in the era of Big Data."

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