

ARTHUR H. WAYNICK

Memorial Lecture

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A New Paradigm in Earth Observations: Micro Satellite Constellations

Abstract:

Several recent technological revolutions have converged to make possible a new paradigm in spaceborne Earth observations. One is the miniaturization of low power, high-performance digital electronic systems, largely driven by commercial products like smart phones and laptops. Another is the rise of “CubeSats” and their transition from educational student projects to highly capable, high-reliability small satellites. The third revolution is one of perception. Until recently, major space organizations such as NASA, NOAA, DoD, ESA, and the private sector tended not to view SmallSats as a serious part of the toolkit of technologies available to meet their core objectives. But that perception has changed. Not only are SmallSats becoming a mainstream element of spaceborne technology, they are enabling new types of measurements and new science and applications that would not otherwise be possible. One example of this is the ability to resolve short time scale geophysical processes such as extreme weather events, made possible by placing large constellations of SmallSats in low Earth orbit. One such SmallSat constellation is the NASA Cyclone Global Navigation Satellite System. CYGNSS is a constellation of eight 25 kg satellites which together can measure near-surface wind speed over the ocean and flood inundation over land with sufficient frequency to capture events like the rapid intensification of hurricanes and the flooding that follows when they make landfall. The CYGNSS mission will be highlighted in this presentation, including descriptions of its

engineering design and mission architecture and examples of recent scientific results, including hurricane weather prediction, ocean microplastic dynamics, inland flooding, and the detection of precursors to locust outbreaks.

Biography:

Dr. Chris Ruf is the Fredrick Bartman Collegiate Professor of Climate and Space Science at the University of Michigan. He received a bachelor's degree in physics from Reed College and a doctorate in electrical and computer engineering from the University of Massachusetts. He then worked at the NASA Jet Propulsion Laboratory and on the faculty of the Communications and Space Sciences Laboratory at Penn State before moving to Michigan. Dr. Ruf's research interests involve microwave remote sensing of the Earth environment from space, with a focus on sensor technology development, geophysical inversion methods, and spaceborne mission execution. He is principal investigator of the NASA Cyclone Global Navigation Satellite System (CYGNSS) mission.

Dr. Ruf serves on the U.S. National Academies of Science Committee on Earth Science and Applications from Space and served on their 2006 and 2016 Earth Science Decadal Survey Panels. He is also a member of the United Nations UNESCO Task Force on the Remote Sensing of Marine Litter and Debris, is former editor-in-chief of the IEEE Transactions on Geoscience and Remote Sensing and is a fellow of the IEEE.

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