

The TROPICS smallsat tropical cyclone mission: High temporal resolution microwave imagery as part of NASA's third Earth Venture-Instrument (EVI-3) program

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ABSTRACT

The Time-Resolved Observations of Precipitation structure and storm Intensity with a Constellation of Smallsats (TROPICS) mission was recently selected by NASA as part of the Earth Venture-Instrument (EVI-3) program. The overarching goal for TROPICS is to provide nearly all-weather observations of 3-D temperature and humidity, as well as precipitation horizontal structure, at high temporal resolution to conduct high-value science investigations of tropical cyclones, including: (1) relationships of rapidly evolving precipitation and upper cloud structures to upper-level warm-core intensity and associated storm intensity changes; (2) the evolution of precipitation structure and storm intensification in relationship to environmental humidity fields; and (3) the impact of rapid-update observations on numerical and statistical intensity forecasts of tropical cyclones. TROPICS will provide rapid-refresh microwave measurements (median refresh rate of 21 minutes for the baseline mission) over the tropics that can be used to observe the thermodynamics of the troposphere and precipitation structure for storm systems at the mesoscale and synoptic scale over the entire storm lifecycle. TROPICS comprises 12 CubeSats in three low-Earth orbital planes. Each CubeSat will host a high performance radiometer to provide temperature profiles using seven channels near the 118.75 GHz oxygen absorption line, water vapor profiles using three channels near the 183 GHz water vapor absorption line, imagery in a single channel near 90 GHz for precipitation measurements (when combined with higher resolution water vapor channels), and a single channel at 206 GHz for cloud ice measurements. This observing system offers an unprecedented combination of horizontal (for a microwave sounder) and temporal resolution to measure environmental and inner-core conditions for tropical cyclones on a nearly global scale and is a major leap forward in the temporal resolution of several key parameters needed for detailed study of high-impact meteorological events.