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TICFIRE – A FAR INFRARED PAYLOAD TO MONITOR THE EVOLUTION OF THIN ICE CLOUDS

Abstract

The TICFIRE mission concept developed with the support of the Canadian Space Agency aims: 1) to improve measurements of water-vapor concentration in the low limit, where cold regions are most sensitive and 2) to determine the contribution of Thin Ice Clouds (TIC) to the energy balance and the role of their microphysical properties on atmospheric cooling. TICFIRE is a process-oriented mission on a micro-satellite platform dedicated to observe key parameters of TIC forming in the cold regions of the Poles and globally, in the upper troposphere. It locates cloud top profiles at the limb and measures at nadir the corresponding upwelling radiance of the atmosphere directly in the thermal window and in the Far Infrared (FIR) spectrum over cold geographical regions, precisely where most of the atmospheric spectral cooling takes place. Due to technological limitations, the FIR spectrum (17 to 50 μm) is not regularly monitored by conventional sensors despite its major importance. This deficiency in key data also impacts operational weather forecasting and process treatment in atmospheric models. In recent years the development of FIR sensor technologies at INO has addressed specifically this deficiency. TICFIRE will provide on a global scale a needed contribution in calibrated radiance assimilation near the IR maximum emission to improve weather forecast in the Arctic and the mid latitudes, especially during the cold season. TICFIRE is therefore a science-driven mission with a strong operational component. The TICFIRE payload consists of two instruments; the main one being a Nadir-looking multiband radiometer based on uncooled microbolometer technology and covering a large spectral range from 7.9 μm to 50 μm . The secondary one is an imager that performs Limb measurements and provides cloud vertical structure information. This paper presents the key payload requirements, the conceptual design, and the estimated performance of the TICFIRE payload. Current technology developments in support to the mission are also presented.