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Author: Prof. Daniel Rosenfeld
Hebrew University of Jerusalem, Israel

C3IEL SATELLITE MISSION: CLUSTER FOR CLOUD EVOLUTION, CLIMATE AND LIGHTNING

Abstract

Clouds play a major role in Earth's energy budget and hydrological cycle. Clouds dynamical structure and mixing with the ambient air have a large impact on their vertical mass and energy fluxes and on precipitation. Most of the clouds evolution and mixing occurs at scales smaller than presently observable from geostationary orbit, which is less than 1 km. A satellite mission is planned for bridging this gap, named "Cluster for Cloud evolution, Climate and Lightning" (C3IEL). The mission is a collaboration between the Israeli (ISA) and French (CNES) space agencies, which is presently at its Phase A. The planned mission will be constituted of a constellation of 3 nano-satellites in a sun synchronous early afternoon polar orbit, which will take multi-stereoscopic images of the field of view during an overpass. C3IEL will carry 3 instruments: (1) CLOUD visible imager at a spatial resolution of 20 m. The multi-stereoscopic reconstruction of the evolution of cloud surfaces at a resolution better than 100 m and velocity of few m/s will provide an unprecedented information on the clouds dynamics and evolution. (2) WATER VAPOR imagers at 3 wavebands with different vapor absorption will provide vertically integrated water vapor around the cloud and possibly a 3-dimensional structure of the vapor around the clouds due to their mixing and evaporation with the ambient air. (3) Lightning Optical Imagers and Photometers (LOIP). The lightning sensors will provide a link between cloud dynamics and electrification at higher resolution than previously available. C3IEL will provide presently missing observational evidence for the role of clouds at sub-km scale in redistributing the energy and water in the atmosphere, and of the relation between storm vigor and frequency of lightning activity.