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THE TANSAT MISSION: GLOBAL CO₂ OBSERVATION AND MONITORING

Abstract

The TanSat mission is a Chinese Earth Observation project managed in the national 863 program by the Ministry of Science and Technology. The main objective of the TanSat is to retrieve the atmosphere column-averaged CO₂ dry air mole fraction (XCO₂) with precisions of 1% (4ppm) on national and global scales. TanSat is a small-sized satellite(around 500kg), consisting of an agile platform and two scientific instruments. A high-resolution spectrometer (CO₂ Sounder) is designed to measure the near-infrared absorption by CO₂ at 1.61 and 2.06 microns and the molecular oxygen (O₂) A-band in reflected sunlight at 0.76 microns, with spatial resolution of 2*1km². A Cloud and Aerosol Polarimetry Imager (CAPI) is used to compensate CO₂ measurement errors which are caused by cloud and aerosol, based on the high-resolution measurement at 0.38, 0.67, 0.87, 1.38 and 1.64 microns. Moreover, CAPI is able to perform polarimetry measurement at 0.67 and 1.64 microns in multi angles to retrieve accurate cloud and aerosol data. These two instruments are integratedly designed and assembled on the platform as a whole. The platform is characterized by its agility, in order to perform principle-plane constrained nadir and sun-glint observation, target gazing observation, as well as sun and moon observation for instrument calibration. Flying in a 1:30 PM sun-synchronous orbit at 700km, TanSat will collect more than 800 cloud-free observations per orbit, which will be incorporated with other environmental measurements to retrieve columnar density distribution of CO₂. A network of ground CO₂ monitoring bases will also be established, to validate the space-based XCO₂ measurement by correlating retrieval models. With a designed lifetime of three years following the expected launch in 2015, TanSat will deliver valuable data of the atmospheric CO₂, provide first-hand information to understand the relation between the human activities and CO₂, and enable accurate predictions of future increases in atmospheric CO₂ and its impact on the climate. This paper will give an overview introduction of the TanSat mission, including its mission

objectives, observation scenario, the overall system architecture, and scientific instruments and platform design.