

Time-Variable Gravity as a New Remote Sensing Tool and the Role of Taiwan's FormoSat-3/COSMIC Mission

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Abstract

Temporal variations of the Earth's gravity field (or “time-variable gravity” TVG) have been observed by studying the perturbations of orbiting satellites using Satellite Laser Ranging for over twenty years. Since 2002 the Gravity Recovery And Climate Experiment (GRACE) space mission, dual-satellites equipped with satellite-to-satellite tracking and on-board accelerometers, is opening a new window on global TVG with much improved resolutions and precision. TVG signals the temporal variations of distribution of mass on or in the Earth, representing a new type of remote sensing tool and new data source. The (potential) geophysical observables include mass transports in land hydrology, ocean circulation and dynamics, icesheet and glacial changes, post-glacial rebound, earthquake dislocation, core flows, and many more. The detectability threshold of GRACE is on the order of sub-cm level equivalent water thickness on spatial extent of ~1000 km at monthly sampling rate. More recently, the FormoSat-3/COSMIC (F-3/C) Mission, launched in April 2004, has the potential of yielding independent TVG measurements complementary to those of GRACE – at a much lower sensitivity and accuracy but (with 6 satellites) much larger amount of data and hence less aliasing problems.