EARTH OBSERVATION SYMPOSIUM (B1)
Future Earth Observation Systems (2)

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POTENTIAL OF THE GEOSTATIONARY GEOCARB MISSION TO ESTIMATE SURFACE EMISSIONS OF CO2, CH4 AND CO IN A POLLUTED URBAN ENVIRONMENT

Abstract

In December 2016 NASA competitively selected GeoCarb as an Earth Venture mission. GeoCarb will measure plant health and stress, and will probe, in unprecedented detail, sources, sinks and exchange processes that control CO_2, CH_4 and CO in the atmosphere.

GeoCarb will be placed in geostationary orbit over the Americas to measure spectra of reflected sunlight in absorption bands of CO_2, CH_4, CO and O_2. Plant stress will be inferred from solar-induced fluorescence, using observation in Fraunhofer lines within the O_2 band. Column-averaged concentrations of CO_2, CH_4 and CO will be derived from all bands simultaneously.

GeoCarb will scan the hemisphere in its field of view at least twice per day with spatial resolution of approximately 5 km. Thus, GeoCarb will provide concentration maps at unprecedented spatial and temporal resolution. In addition, GeoCarb can be commanded in flight to scan selected targets multiple times per day in order to capture diurnal cycles. Such detailed observations will allow the emissions of large cities to be estimated directly, thereby providing a new and important source of data for monitoring compliance with emission treaties.

To demonstrate the latter capability, detailed numerical models were used to simulate the polluted atmosphere over selected large, industrial cities. Next spectra of radiation reflected to space in the bands of GeoCarb were computed, and then deliberately corrupted with noise at the level predicted for GeoCarb. Finally, the pseudo-observations were inverted to recover (1) the time-varying fields of CO_2, CH_4 and CO and (2) the time-varying sources of these gases within the city. This paper presents a selection of results from these simulations, highlighting the accuracy with which gas concentrations and source strengths can be recovered.