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Project Abstract

Development and Sensitivity Analysis of High Resolution Land Surface Parameters from Satellite Data and their Use in a Mesoscale Model – LDEO

Current Numerical Weather Prediction (NWP) and climate models generally use Land Surface Models (LSMs) that are based on low resolution thematic land cover classifications (e.g., USGS 1 km land cover). At global scales, these low resolution LSM inputs are adequate but at regional scales (100 to 1000 km) the limitations of the LSMs can have a significant impact on the accuracy of the model predictions. Specifically, current LSMs suffer from a) limited spatial and spectral resolution of the optical sensors used to generate the land cover classification, b) saturation of the Normalized Difference Vegetation Index (NDVI) at moderate levels of vegetation cover and c) inaccurate physical parameterization of some thematic land cover classes. This is particularly true in urban and suburban environments where land surface heterogeneity is not accurately represented in low resolution thematic classifications. In order to understand the effect of anthropogenic land cover modification on regional climate in urban and suburban areas, it is necessary to represent this land cover accurately in the LSMs that drive the climate models. We propose to use Spectral Mixture Analysis to estimate areal fractions of biophysical land surface types (e.g. vegetation, rock and soil substrate, water) from moderate resolution satellite imagery (e.g. Landsat) and derive land surface physical properties for input to the LSMs that drive mesoscale regional climate models. The procedure we propose to use has been shown to yield accurate fraction estimates in a variety of urban, suburban and rural environments worldwide. In order to determine the effect of these more detailed land cover inputs we will quantify the difference between traditional low resolution thematic land cover and aggregated moderate resolution land surface properties specifically vegetation fraction and albedo. We will test the sensitivity of the regional climate model to each input at different spatial scales in both temperate (New York) and arid (Phoenix) settings. We will also quantify the effect of fine scale (< 1 km) vegetation in each setting by comparing model runs with and without fine scale vegetation.