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Project Abstract

A Comprehensive Statistical Analysis System to Associate Local Land- Cover/Land-Use Change and Regional Aerosol Composition and Concentration

Aerosols, particularly carbonaceous aerosols, will likely play an increasingly important role in the earth's energy balance and in global climate change. Much of these carbonaceous aerosols are generated by anthropogenic activities, including slash-and-burn agriculture, as well as fossil fuel combustion. The proposed research seeks to add to scientific understanding of the relationship between biomass burning and carbonaceous aerosols by estimating the spatial and temporal dependence structure of regional carbonaceous aerosol concentrations, given atmospheric circulation processes and observed fire occurrences. We examine these trends using a Bayesian hierarchical statistical framework coupled with a numerical weather simulator in a manner that explicitly accounts for the uncertainty associated with these processes. While it is difficult to separate the contribution of biomass burning to regional carbonaceous aerosols due to the chemical and physical processes occurring within the atmosphere, our analytical technique allows us to estimate the contribution of biomass burning to regional carbonaceous aerosols via the local fire/regional aerosol space-time associations. Finally, we embed the statistical model into an integrated system that will allow the user to forecast aerosol distributions under various environmental policy scenarios. This integrated system will seamlessly retrieve and examine data on aerosols and fires from MODIS and MISR, and visualize the results. In developing our system, we will focus on fire/aerosol relation in mainland Southeast Asia from the end of 2000 to the present. Mainland Southeast Asia is currently experiencing much varied land-use/cover change (including urbanization), though forest clearing for agricultural and forestry activities remains a dominant pattern; our tool is designed to deal with these complex processes and multiple sources of carbonaceous aerosols, yet emphasizes the estimation of the fire-aerosol relationship. We expect to add to the scientific understanding on the processes and changes at work in the study region, but our tool will ultimately have broad applicability to other regions and applications. Thus, the project contributes to NASA strategic objectives to understand and protect the earth, to study the earth from space, and to use NASA's space-based technology to study to the interactions between land and atmosphere.