



Abstract Details

[AOGS 1st Annual Meeting](#) > [Biogeoscience](#) > **Characterization of Urban Landscapes as a Component of the Global Climate and Carbon System** >

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Title: Characterization of Urban Landscapes as a Component of the Global Climate and Carbon System

Abstract:

Urbanized areas are but at most a few percent of the global land surface. Their importance for climate depends on how they are weighted relative to other surfaces. Oceans are often given the most importance since they comprise about 70% of the earth's surface. However, from a human perspective the climates of urban areas may be the most significant since that is where approximately half of the world's population lives. Urban areas are also major human sources for global carbon. Of course, what happens elsewhere has a large influence on urban climates because of the global interconnectedness of the climate system. At the same time, local physical and micrometeorological processes also significantly modify the climate of urban areas. Such processes have been studied in a local context. This paper addresses the issue of how to include urban areas as components of the global climate system. Such inclusion may not appear to change climate much from the perspective of spatial average statistics but it provides a means of integrating local human influences with global influences to better assess their relative contribution. Urban influences include a large fraction of impervious surface, modifications of surface roughness, and concentrations of aerosol. These terms may in turn impact the local hydrological cycle in terms of clouds and precipitation. We discuss what data is becoming available and how the relevant processes can be described to provide a characterization of urban effects in a global climate model. Our own research has been dealing primarily with data from the MODIS instrument on the NASA terra satellite, and the CLM land model (Dai, et al, BAMS,2003). We look at effects in the context of MODIS surface layer linked to a convective and stable boundary layer. Sample data from MODIS is used to illustrate human impacts on the climate of Beijing. A better understanding of the human contributions to urban climate in a global context should help in the allocation of resources to changes in development practices and in the study of this issue versus that of mitigation and adaptation to the impacts of humans on their climates through their global modification of atmospheric composition. That is, it should provide a basis for better planning of urban construction and land-use in the context of optimizing climate for human requirements.

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