A System for Monitoring Fire Characteristics and Fire Danger Potential in the Eastern States Using Remote Sensing Techniques

John J. Qu, Xianjun Hao, Ruixin Yang, Swarvanu Dasgupta, Sanjeeb Bhoi, Wanting Wang, Yong Xie, Lingli Wang, Zuotao Li, Hank Wolf and Menas Kafatos

Abstract Wildland fire, a natural feature of ecosystems, causes extensive damage to forests, properties, and affects human lives. Since the last century, North American forest communities have been vitally concerned with wildland fires. In eastern United States (east of the Mississippi River), wildland fire is a very important issue because of frequent fire occurrences and their effects on the environment. The patterns of forest fires in eastern states are quite different from those in the western regions. Usually, eastern fires are small in size and many of them started as prescribed fires. However, many scientific questions remain, especially for wildland fire events at the urban-forest interface and different landscapes in eastern regions. Urban and suburban growth through the 20th Century has dramatically increased associations of housing and people with wildlands, increasing the complexity of fuel management and fire fighting activities. These features imply special requirements regarding forest fire remote sensing in eastern regions. Except for forest fire detection, burned area mapping, fire emissions, and fire danger rate estimation, fuel properties (including fuel type, fuel moisture, fuel temperature, fuel loading, etc.)which are all are especially important for decision making in management of prescribed burning and air quality related policies. Based on the analysis of current approaches for fuel property retrieval and fire characteristic estimation, and our analytical improvements, we developed an integrated system to monitor fire characteristics and fire danger potential with satellite remote sensing techniques. The critical components of our system include real-time data acquisition and a processing system, which collects real-time datasets from NASA. The MODIS Direct Broadcast system automatically provides real-time fuel property and fire characteristic products with which the generation system can retrieve real-time fuel properties and fire characteristics based on the enhancement of current algorithms, and a data distribution system which can provide our data products for various applications. In this paper, we present the general architecture and components of our system, and technical and scientific approaches for generating our value-added data products. The applications of this system are also discussed.