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A comparison of remote sensing of active fires from MODIS and VIIRS

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The Moderate Resolution Imaging Spectroradiometer (MODIS) on board the NASA EOS Terra and Aqua satellites was the first sensor on medium-resolution polar orbiting missions with dedicated bands for the detection and characterization of high temperature objects, predominantly actively burning fires. The MODIS active fire data record now extends to over a decade and is a result of multiple re-processing of the data with improved algorithms resulting from extensive product validation. The active fire product from the Visible Infrared Imager Radiometer Suite (VIIRS) on the NPOESS Preparatory Project (NPP) satellite, launched on October 28, 2011, and on future JPSS (Joint Polar Satellite System) satellites, represents a continuation of the MODIS data record. VIIRS has capabilities for active fire detection and characterization for a broad range of fires, and observing and environmental conditions. While NPP and Aqua have similar orbital characteristics and compatible sampling of the diurnal cycle of fire activity, sensor differences result in inherent differences in the expected fire observations. The differences between the MODIS and VIIRS moderate resolution “M” band pixel sizes (nominally, 1km vs. 750m at nadir) lead to differences in the lower detection limits. The VIIRS along-scan aggregation scheme is aimed at reducing the increase of pixel size towards the edges of the swath and thus results in an overall improvement of performance for off-nadir conditions, but also in a more complex variation of detection limits with satellite view angle. In addition, spatial aggregation impacts within-pixel variation of contribution to the radiometric signal, which in turn impacts retrieval of the Fire Radiative Power. These issues can be analyzed by purely theoretical simulations and by a hybrid empirical-theoretical modeling framework that incorporates actual fire observations from higher spatial resolution sensors, such as the Advanced Spaceborne Thermal Emission and Reflection Radiometer (ASTER), Landsat-5 TM (Thematic Mapper) and Landsat-7 Enhanced Thematic Mapper (ETM+).