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A single date SWIR-MIR index (SMI) for rapid fire severity assessments

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Rapid fire severity assessments are essential for timely post-fire rehabilitation responses. The Landsat differenced Normalized Burn Ratio (dNBR) has become the standard spectral index for assessing fire severity. The dNBR is generally calculated using the first available cloud-free post-fire image and a pre-fire image. This bi-temporal image differencing can be problematic due to image-to-image differences in illumination and phenology for example. We have developed an alternative index based on single date short-wave infrared (SWIR) and mid infrared (MIR) reflectance. In contrast with the (d)NBR, the SWIR-MIR index (SMI) is robust against scattering caused by smoke plumes over active fires allowing fire severity assessments to be generated when the area is still obscured by smoke. The SMI was generated using MODIS/ASTER (MASTER) airborne simulator data acquired over the recent 2011 Wallow fire in Arizona, USA. Simulation experiments showed that the SMI is more sensitive to char fractional cover than the NBR. In addition, the SMI had a stronger correlation with Geo Composite Burn Index (GeoCBI) field data of severity than the NBR (GeoCBI-SMI R2 = 0.67 and GeoCBI-NBR R2 = 0.61). The dNBR trended slightly better with the GeoCBI field data than the SMI (GeoCBI-dNBR R2 = 0.69). Although no spaceborne sensors with pixel sizes smaller than 100 m currently offer the possibility of a SWIR-MIR band combination, the airborne results illustrate the potential of this band combination for the remote sensing of post-fire effects. Such data will become available with the advent of the next generation satellite sensors, such as the planned spaceborne Hyperspectral Infrared Imager (HyspIRI).