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BURN AREA DELINEATION VIA SINGLE IMAGE POLARIMETRIC SYNTHETIC APERTURE RADAR BACKSCATTER CLASSIFICATION

Abstract

Accurate discrimination of a fire's burned area is important for fire management operations and estimates of emissions from wildland fires. Polarimetric synthetic aperture radar (SAR) backscatter is sensitive to vegetative structural changes, such as the consumption of leaves and small branches, and moisture level changes through the dielectric constant, and therefore should be very useful for delineation of wildland fires. However, SAR backscatter is subject to speckle and topographical effects, which can lead to inaccurate classification and subsequent misinterpretation. Multi-temporal analysis can to some degree obviate topographical effects and assist in mapping burn areas by detecting changes in the level of backscatter from a pre-burn image to a post-burn image. This requires that the landscape experience minimal change apart from the fire, as well as strong co-registration of the prior and post images. It is therefore desirable that classification occur from a single post-fire image, based upon knowledge of polarimetric backscatter properties. The NASA UAVSAR airborne sensor serves as a proving platform for future spaceborne sensors and technologies, and provides all data for free to researchers. To demonstrate the potential a high resolution fully-polarimetric SAR satellite sensor has for wildland fire research, this study uses a single UAVSAR image to estimate the true burn area of the 2012 Ponderosa Fire in the Sierra Nevada Mountains of California. The data is first pre-processed to remove topographical and speckle confounds, and subsequently processed to highlight relevant backscatter responses. The image is classified to delineate the burn, and the result is compared with the official burn area extent to assess the

accuracy of the product. This study highlights the utility of polarimetric SAR sensors for fire management purposes, and demonstrates the need for easily accessible polarimetric SAR satellite data.