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Title: Detecting And Discriminating Petroleum And Petroleum Products From Water On Terrestrial Backgrounds With Hyperspectral Remote Sensing

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ABSTRACT

Oil and petroleum product spills are frequent and as both Hurricane *Katrina* and the *Deepwater Horizon* accident demonstrated, they can be catastrophic. A prominent portion of the response is mapping the extent to which oil has reached both shoreline and inland areas. Yet, petroleum and water—when present on common substrates such as sand, concrete, and vegetation—are often difficult to distinguish in panchromatic and multispectral imagery. This research demonstrates how hyperspectral remote sensing, also known as imaging spectroscopy, provides petroleum detection and discrimination from water on terrestrial backgrounds. Utilizing spectral libraries, it also performs material identification and successfully discriminates some petroleum products from one another as a means of further classification and mapping spill extent.

To achieve these goals, this effort collected spectral signatures of four crude oils and five refined petroleum products on ten common terrestrial substrates and compared them to water on the same backgrounds over a period of 1-90 days, depending on liquid volatility. The result is the first publicly available spectral library for petroleum and petroleum products on terrestrial substrates in the reflective portion of the electromagnetic spectrum (400-2500 nm) for use in petroleum spill detection and response. It also establishes a baseline for the use of imaging spectroscopy as a technique for confident, accurate petroleum detection in the terrestrial environment. Using common material identification algorithms, the spectra were successfully applied to airborne hyperspectral data from the Hurricane *Katrina* disaster in 2005 as a proof-of-concept for discriminating petroleum from water.