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In-situ tracking of oil spectral fluorescence: field data, lab studies, and development of advanced sensors

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Spectral fluorescence provides 3D fingerprints of fluorescent behaviour and has been used to characterize colored dissolved organic matter (CDOM) extensively. Research has also shown that these Excitation Emission Matrix spectra (EEMs) can be used to distinguish between different types of crude oil, crude mixed with dispersant, breakdown products, biological metabolites, and more recently to distinguish oil from CDOM. Spectral fluorescence lends itself well to in-situ measurements and two families of WET Labs instruments, the SAFire and the XMF, have been mobilized with RAPID funds to help track oil near the Deepwater Horizon oil spill.
In addition to collecting EEMs in-situ, water samples have also been analyzed in the lab to validate in-situ results, and to allow for controlled studies (degradation, comparison to various crude EEMs) to complement our understanding of in-situ EEMs. Recent data illuminates the ability of EEMs to track Deepwater Horizon oil, distinguish oil from DOM, the utility of SAFire Ex/Em pairs, the effect of pH on EEM signatures, the characteristics of various crude oil EEMs, and EEM photodegradation dynamics of Deepwater Horizon oil samples.
Understanding the fluorescence characteristics of oil-in-seawater has led to the development of novel oil sensing technologies. By identifying key excitation and emission wavelengths, sensors simpler than spectral fluorometers are being developed to track oil in-situ and relative to CDOM. Development of sensors that are easy to use, less expensive, and which have simplified data output is critical for effective tracking of oil spills.