Effects of hurricane Fiona on water biogeochemistry on the Scotian shelf and implications for CO_2 fluxes

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Extreme wind events such as hurricanes and tropical cyclones can have an outsized effect on ocean properties, especially on the continental shelves, by mixing the relatively shallow and stratified water column, bringing deep waters towards the surface and into contact with the atmosphere, and changing the air-sea interactions. Such events are also projected to become much more frequent, making it crucial to understand their impact on the ocean, including the socio-economic consequences of perturbed ecosystems (e.g. fisheries).

Shipboard observations in hurricanes are not typically carried out due to the danger posed by sailing in high wind conditions. Moreover, high-resolution measurements, unattainable with traditional ship-borne sampling, are necessary to link water column dynamics to the atmospheric forcing during hurricanes.

In this study, we analyze data from a Waveglider Uncrewed Surface Vehicle (USV) and Slocum glider that were deployed on the continental shelf south of Nova Scotia and sampled throughout hurricane Fiona, which passed over the region in mid-September 2022. The Waveglider carried a suite of sensors measuring temperature, salinity, pCO_2, pH, total dissolved gas pressure, wind speed, wave height, and atmospheric pressure, resulting in a unique data set to analyze hurricane-induced changes in ocean biogeochemistry, particularly the carbonate system of seawater. The waveglider measured a drop in sea surface temperature from 16°C to 8.7°C, and an increase in pCO_2 from 410 μatm to 460 μatm. The measurements from the autonomous glider and waveglider are put in the context of shipboard hydrography conducted after the hurricane to analyze the links between the water column and surface changes.