



Fall Seminar Series

Thursday, October 30th @ 3 pm

Room 200, Oceanography & Physics Building

Or Via Zoom

Dr. Richard Feely

**NOAA Pacific Marine Environmental
Laboratory**

Title

**Have We Crossed Another Planetary Boundary with Respect
to Ocean Acidification?**

ABSTRACT

Ocean acidification has been identified as one of nine large scale Earth-system planetary boundaries that, if crossed, could cause significant environmental changes. Using revised estimates of pre-industrial conditions and state-of-the-art data-model synthesis products, we have utilized underway $f\text{CO}_2$ observations from the Surface Ocean Carbon Atlas (SOCAT) and the Global Ocean Data Analysis Project (GLODAP) databases for the global surface and subsurface waters collected over the past several decades, in comparison with model outputs, to provide decadal estimates of global rates of change in, total hydrogen ion content ($[\text{H}^+]_{\text{T}}$), pH on the total scale, and aragonite saturation state (Ω_{ar}) for selected time intervals from 1961 to 2020. Global area-averaged $[\text{H}^+]_{\text{T}}$ contents show an overall increase of approximately $0.3 \text{ nmol kg}^{-1} \text{ decade}^{-1}$ and Ω_{ar} values decrease by approximately $-0.08 \text{ decade}^{-1}$ in surface water. The results show very good agreement between the observations and model outputs and indicate more extensive increases in $[\text{H}^+]_{\text{T}}$ over the past 50 years than the previous 200 yr. Armed with these new results, we improve upon the ocean acidification planetary boundary assessment and demonstrate that by 2020, the average global ocean conditions in surface waters had already crossed into the uncertainty range of the ocean acidification boundary. This analysis was further extended to the subsurface ocean, revealing that up to 60% of the global subsurface ocean (down to 200 m) had crossed that same boundary. These changes result in significant declines in suitable habitats for important calcifying species, including 43% reduction in habitat for tropical and subtropical coral reefs, up to 61% for polar pteropods, and 13% for coastal bivalves. These changes are occurring rapidly in biologically sensitive regions that would usually be considered biological refugia, which is increasing the risk and limiting the sustainability of vulnerable species that are also facing multiple stressors.

Zoom: Contact OES Admin- OESadmin@odu.edu