Title:

The summer heat balance of the Oregon inner shelf over two decades

Authors:

Emily Lemagie*, Anthony Kirincich, Steve Lentz

Affiliation:

Woods Hole Oceanographic Institution (all)

Abstract:

Summer temperature and velocity measurements from 14 years in 15 meters of water over the inner shelf off Oregon were used to investigate daily to inter-annual temperature variability and the capacity of the across-shelf heat flux to buffer net surface warming. There was no observable trend in summer mean temperatures, and the standard deviation of inter-annual variability (0.5^{o}C) was less than the standard deviation in daily temperatures each summer (1.6^{o}C, on average). The summer mean across-shelf upwelling circulation advected relatively warmer water offshore near the surface, cooling the inner shelf and buffering the surface warming. In most years (11 out of 14), this two-dimensional heat budget roughly closed with a residual less than 20% of the leading term. Synoptic temperature variability (on daily to weekly time scales) was predominantly due to the across-shelf heat flux, as there was little synoptic variability in the surface heating and no evidence that an along-shelf heat flux would close the two-dimensional heat budget when the residual was large. The analyses suggest the across-shelf heat flux was influenced by multiple mechanisms in addition to Ekman transport by along-shelf winds. For example, there was a three-layer vertical across-shelf velocity structure 40 +/- 10% of the time and during downwelling winds there was an upwelling circulation 80% of the time. The across-shelf heat flux was generally highest near the surface and bottom boundaries, where the velocity observations were most limited and this source of uncertainty potentially lead to a persistent positive bias in the heat budget residual.