



# 2026-2027 EOAS Colloquium Series

## Coastal upwelling revisited: how do nutrients make their way to the surface?

Wind-driven upwelling of cold, nutrient-rich water is a key feature near the eastern boundaries of major ocean basins, with significant implications for the local physical environment and marine ecosystems. For a long time, wind-driven coastal upwelling has been examined within a simplified two-dimensional framework where the upwelling circulation is considered as a passive response to the surface offshore Ekman transport. As a result, a systematic understanding of the factors governing the spatial patterns of coastal upwelling and the pathways of nutrient transport remains elusive. Here, we delve into the physics of three-dimensional wind-driven coastal upwelling over the continental shelf and identify two leading-order pathways for nutrient upwelling: the residual circulation and eddy stirring associated with baroclinic instability. In particular, we demonstrate the factors that determine the spatial structures of the residual circulation and highlight the importance of eddy stirring, which works in synergy with the residual circulation in transporting nutrients in the coastal ocean. The results may help to improve our understanding of coastal upwelling systems and yield a more physical representation of coastal upwelling in coarse-resolution numerical models.



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**Time:** 3:00 PM, Friday, Oct. 9, 2026

**Location:** EOA 1044

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