

Columbia River and Adjacent Waters (CRAW**) Seminar

Impact of Density Gradients on Net Sediment Transport into the Wadden Sea

FRI 06 NOV 09 - 4:30p
Engineering Building, Room 103 (PSU)

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The Wadden Sea is a shallow tidal coastal area in the German Bight with extensive tidal flats and barrier islands. This study tests the hypothesis that horizontal density gradients have the potential to significantly contribute to the accumulation of suspended particulate matter (SPM) in the Wadden Sea. It is shown by means of long-term observations at various positions in the Wadden Sea of the German Bight that the water in the inner regions of the Wadden Sea is typically about 0.5–1.0 kg m⁻³ less dense than the North Sea water. During winter this occurs mostly because of freshwater run-off and net precipitation; during summer it occurs mostly because of differential heating. It is demonstrated with idealized one-dimensional water column model simulations that the interaction of such small horizontal density gradients with tidal currents generates net onshore SPM fluxes. Major mechanisms for this are tidal straining, estuarine circulation, and tidal mixing asymmetries. Three-dimensional model simulations in a semi-enclosed Wadden Sea embayment with periodic tidal forcing show that SPM with sufficiently high settling velocity ($w_s = 10^{-3}$ m s⁻¹) is accumulating in the Wadden Sea Bight because of density gradients. This is proven through a comparative model simulation in which the dynamic effects of the density gradients are switched off, with the consequence of no SPM accumulation. These numerical model results motivate future targeted field studies in different Wadden Sea regions with the aim to further support the hypothesis. Results of some recent field experiments in the Wadden Sea supporting the hypothesis will be presented.

** The Columbia River and Adjacent Waters (CRAW) Seminar Series is an occasional series of multidisciplinary seminars with a non-exclusive focus on the physical dynamics of the Columbia River, including its onshore drainage basin, lower-river estuary, and offshore plume, and the regional atmosphere above. Thus, the CRAW dominion is central to many sustainability issues in Oregon and Washington. And the CRAW Seminar Series provides a forum for fostering a multidisciplinary, system-wide approach. This approach will help the Portland Metropolitan Area's research community gain usefully accurate understandings of the CRAW physical dynamics, ecological and societal impacts, and responses to climate variability and global change as priority tasks for the foreseeable future.

Inquiries about the CRAW Seminar Series should be directed to:
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