



The Fall 2019 Physical Oceanography Seminar series presents:

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**Title: Sigma-Pi diagram and its application to water mass analysis and climate study**

**Abstract:**

The concept of spicity was first postulated by Stommel in 1962; searching for spicity went through more than half century. Recently, the potential spicity is redefined, which contours are orthogonal to potential density contours in the least square sense. Combining potential density ( $\sigma$ ) and potential spicity ( $\pi$ ) leads to a metric space, in which the distance between two water parcels can be rigorously defined. The concept of the distance in water mass analysis provides a new tool in the study of the oceanic circulation. Thus, water masses can be viewed in the sigma- $\pi$  diagram, instead of the traditional T-S diagram. In addition, density ratio and thermohaline intrusion can be easily identified from the sigma- $\pi$  diagram. Using the sigma- $\pi$  diagram, the huge amount of vertical profiles (more than 2 million) in the ARGO program provides an extremely useful dataset for un-revealing the vertical spectra of turbulence, internal waves and thermohaline intrusion.

For a collection of data points, the radius of signal can be defined by the root-mean square distance to the center of water masses. For the world oceans or a regional ocean, the state of oceanic circulation can be evaluated in terms of the radius of the state which is similarly defined. The radius of state proves a powerful index for evaluation of the oceanic state. Isopycnal analysis is the backbone of physical oceanography. On an isopycnal surface, temperature and salinity signals are density compensated; thus, the best variable to be used is spicity. It is postulated that the commonly used isopycnal analysis should be extended into the isopycnal layer analysis. Climate signals can be separated into three components: heaving, stretching, and spicing. For the general case, the first two terms are dominating, while the spicing term consists of a minor contributor.

Seminars are in Corless Auditorium (Watkins Building) at **10:30am**, followed by lunch in Nautilus Galley. Please contact Sarah & Luis if you would like to schedule an individual meeting with the presenter at [Sarah\\_nickford@uri.edu](mailto:Sarah_nickford@uri.edu) or [luispomales@my.uri.edu](mailto:luispomales@my.uri.edu).