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Looking under the hood of Physical Oceanography: Curiosities and Surprises

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The ocean interacts with the atmosphere, ice, and the solid earth, and the properties transferred across these boundaries are moved and mixed in the ocean interior by a variety of processes. Some of these processes have been known for just a few decades and act in curious and surprising ways which are difficult to understand.

The lecture will outline the thermodynamic theory and the mixing processes which underpin our oceanographic practices, concentrating on some counter-intuitive examples. For example, thermodynamic reasoning has recently led to clear but initially surprising interpretations of the temperature and salinity variables that are carried by our ocean and climate models.

The observed bottom intensification of diapycnal mixing in the abyssal ocean implies that the diapycnal velocity in the ocean interior is downwards towards denser water, and it follows that the upwelling occurs in thin bottom boundary layers. The use of simple buoyancy budgets shows that the upwards diapycnal transport in these thin boundary layers is twice or even three times the formation rate of Antarctic Bottom Water.