"Fast Winds and Cold Water: California's Wind Driven Upwelling Hot Spots"

by

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Abstract:

California's summer atmospheric marine layer has the properties of an atmospheric lake. It is a cold, dense layer about 300 m deep, extending from Southern Oregon to past mid-Baja California. The semi-permanent atmospheric anticyclone sitting west of California keeps an air temperature inversion lid on the marine layer. The anticyclone also gangs up with the thermal low over the SW US to drive the coastal marine layer to the south. This marine layer responds as a hydraulic fluid, sharing properties of water flowing down a channel. The large scale bend in California forms a giant expansion fan, accelerating the marine layer to near supercritical or supercritical speeds. Each major cape causes smaller scale hydraulic features including slowing or compression bulges on the upwind side and yet greater acceleration to faster flow and thinner marine layer in a lee side expansion fan. Every major cape has an isolated patch in the immediate lee with the fastest winds, thinnest marine layer, strongest ocean upwelling and coldest water. Nasty complications arise when attempting numerical calculations of the coastal water movement due to the uncertainty in the drag coefficient that connects the wind to the water and the potentially significant role of the wind stress curl.

A dense cloud flow channel demonstrating supercritical hydraulic effects will be presented. Viewers will be invited to test the response of supercritical flow response to situations that they propose or to objects that they bring. A rolled-up thick wad of $ 100 bills held by a rubber band would be especially good to model marine layer flow around an island.