Intermittent frontogenesis in the Alboran Sea

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We present a phenomenological description and dynamical analysis of the Alboran fronts using a realistic simulation at submesoscale resolution. The study is focused on east Alboran fronts emerging within relatively strong flows that separate from the Spanish coast into the basin interior. The statistical analysis of our solution shows that strained-induced frontogenesis is a recurrent submesoscale mechanism associated with these fronts, and the process is assessed in terms of the advective Lagrangian frontogenetic tendencies associated with buoyancy and velocity horizontal gradients. Intermittency in their strength and patterns is indicative of high variability in the occurrence of active frontogenesis in association with the secondary circulation across the frontal gradient. As a result, we find many episodes with strong surface fronts that do not have much associated downwelling. Frontogenesis and the associated secondary circulation are further explored during two particular frontal events, both showing strong downwelling of O(1) cm s⁻¹ extending down into the pycnocline. A frontogenetic contribution of turbulent vertical momentum mixing to the secondary circulation is identified in the easternmost region during the cold season, when the dynamics are strongly influenced by the intrusion of the salty Northern Current. The background vertical velocity fields observed during the analyzed events indicate other currents in the submesoscale range, including tidal and topographic Internal waves.