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Supplemental Material

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Observations of Submesoscale Variability and Frontal Subduction within the Mesoscale Eddy Field of the Tasman Sea

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Supplementary Materials

“Observations of submesoscale variability and frontal subduction within the mesoscale eddy field of the Tasman Sea”

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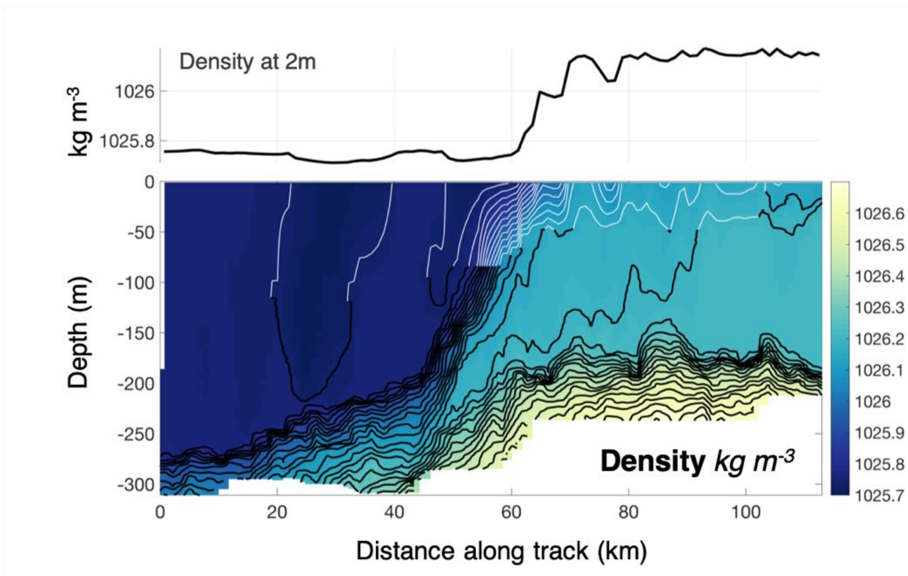

Figure S1: (bottom) Density field measured by Triaxus (colors), superimposed with density contours. White lines denote interpolated density contours, interpolated from depth to 2 m underway measurements. (top) Density along transect derived from temperature and salinity from an underway thermosalinograph.

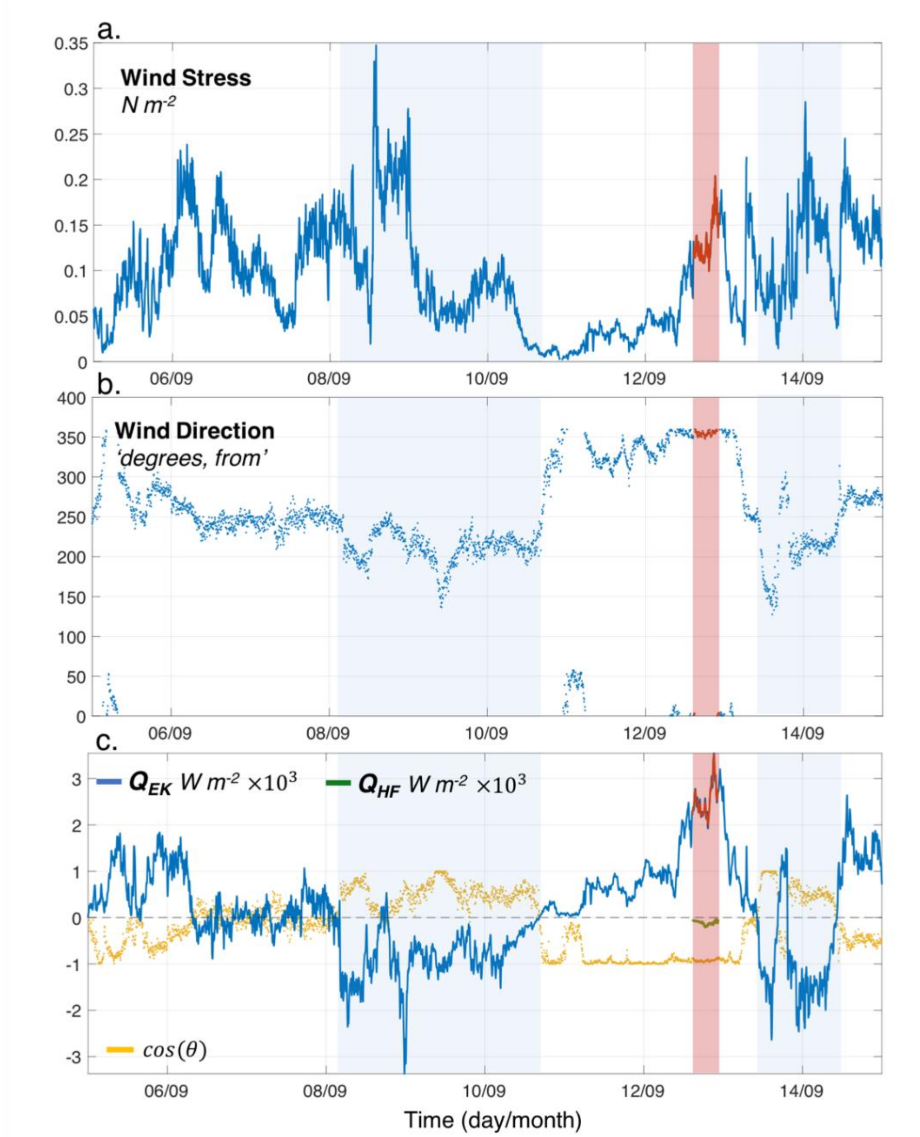

Figure S2: Meteorological measurements made aboard the R/V Investigator during 5 Sep to 15 Sep, 2017. The red band denotes the in-situ sampling period across the front. The blue bands denote periods when the wind is down-front leading to a destabilizing Q_{EK} value. (a) Wind stress; (b) wind direction; and (c) the total heat flux (Q_{HF}) during the in-situ sampling (red band), and Ekman equivalent heat flux (Q_{EK}) computed assuming a maximum density gradient of $M^2 = 1 \times 10^{-6}\ s^{-2}$ and a fixed orientation for the front (since we only sampled the front at one time, to quantify the effects of preceding and subsequent wind forcing, we take the maximum measured M^2 at the front for the calculation of Q_{EK} but use the longer wind timeseries measured by the ship; this provides us with a proxy Q_{EK} at the front over a period of days rather than hours. This metric assumes the front orientation and gradient remains stationary, so results are more qualitative than quantitative. However, this assumption is reasonable considering the front is a semi-persistent feature over a period of weeks, with similar cross-front temperature gradient, as shown by satellite imagery (Figure 9 of the paper). The resulting Q_{EK} timeseries reveals the wind was strongly destabilizing (reaching -3000 W m^{-2}) for several days up until 2 days before the observations). Yellow circles represent the value of cos(θ): 1 indicates the wind is blowing purely down-front, -1 is purely upfront, 0 is purely cross-front.

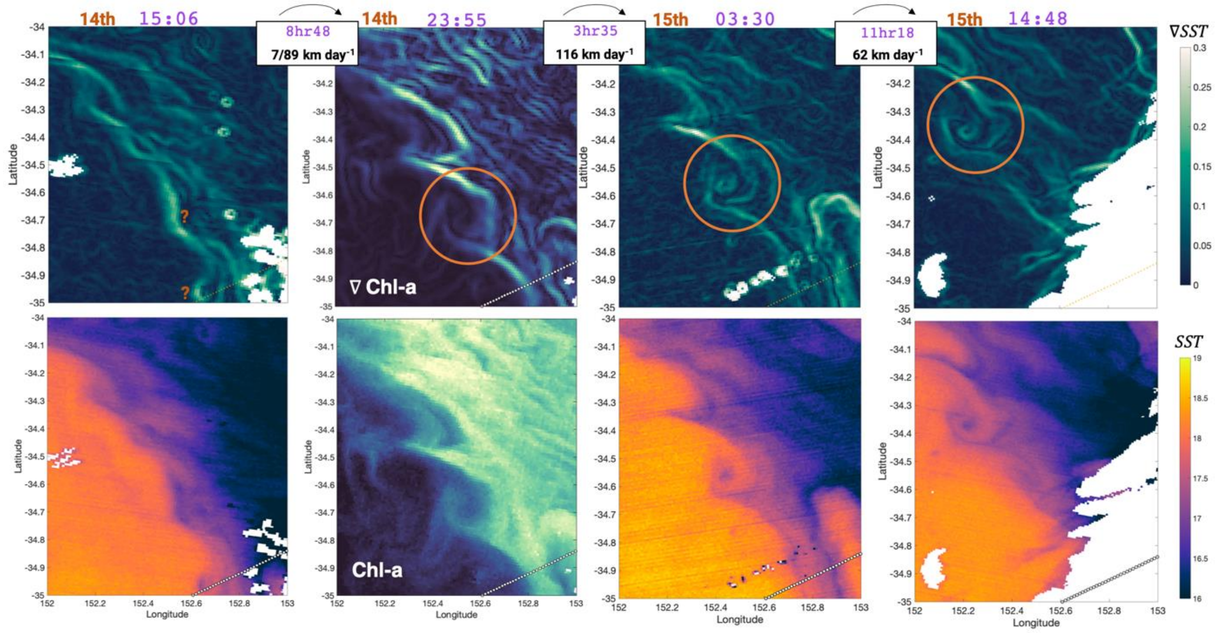

Figure S3: (top) SST gradient (ºC/km) and (bottom) SST (ºC) imagery taken by VIIRS on September 14-15th September shows the evolution of a frontal instability along the jet of the eddy dipole. Data/Time is given at the top, and phase speed estimated as c = *dx/dt* is shown in km day^{-1}.

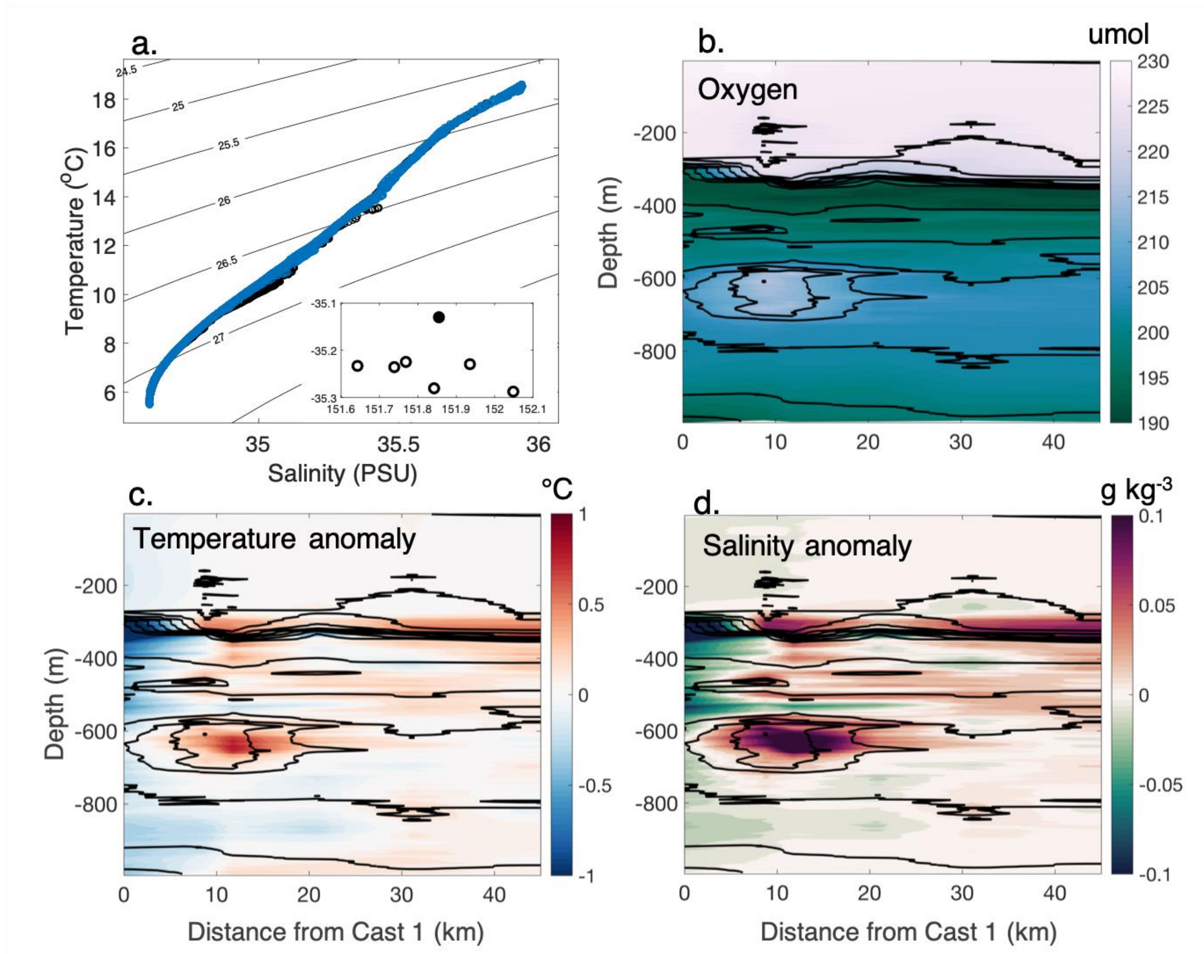

Figure S4: (a) Temperature-salinity diagram from all CTD casts (inset: all CTD cast locations), blue denotes CTD casts outside of the lens, black denotes CTD casts that sampled the lens. Casts used in the interpolation are denoted as a black ring (6 of 7 presented casts are used); (b) Oxygen as measured by the 6 CTD casts interpolated in space. (c) Temperature anomaly from the x-axis mean; (d) Salinity anomaly from the x-axis mean. Oxygen is plotted as black contours in (b)-(d). Large differences are evident at the base of the mixed layer, likely attributable to undulations by internal waves.