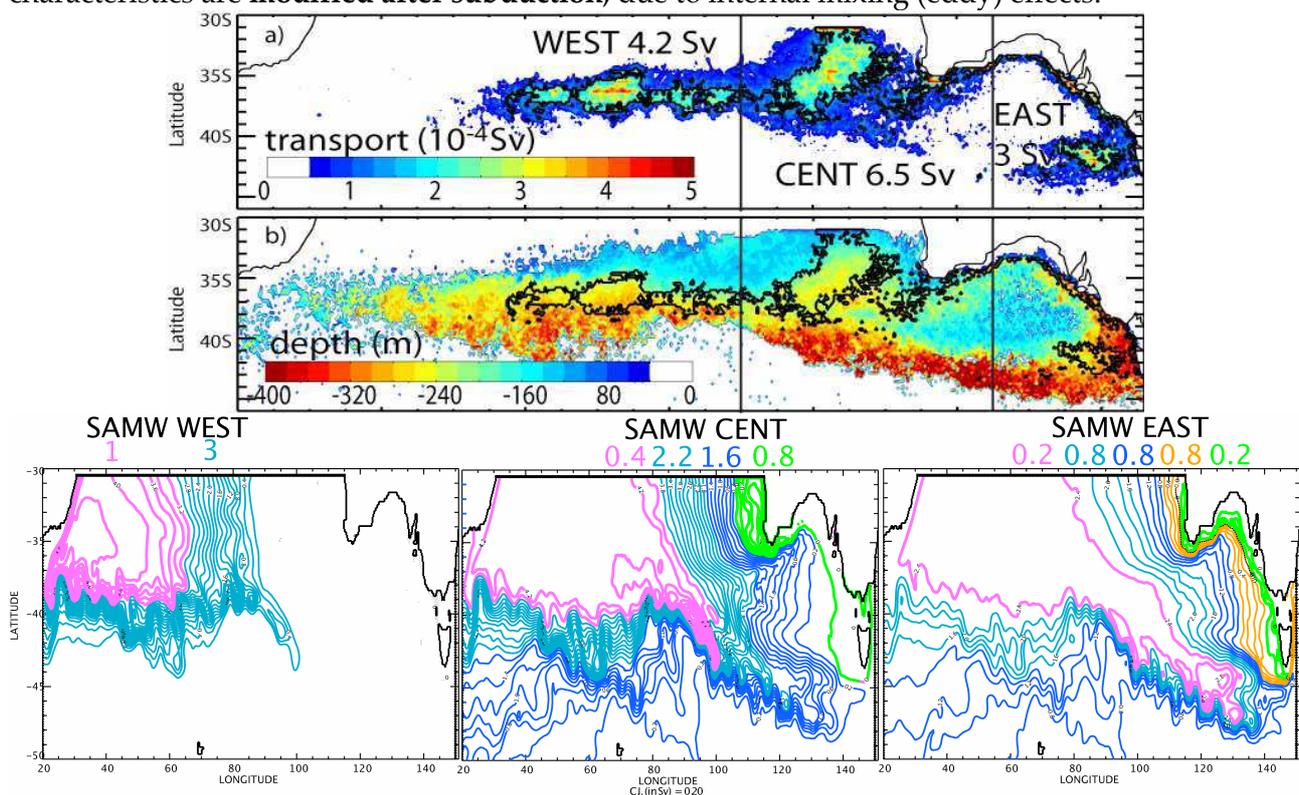


# ORIGIN AND MECHANISM OF MODE WATER FORMATION AND TRANSFORMATION IN THE SOUTHERN INDIAN OCEAN

A. Koch-Larrouy and R. Morrow<sup>1</sup>

The sources and pathways of mode waters entering the subtropical gyre of the Indian Ocean are examined using a lagrangian analysis of an eddy resolving model of the Southern Ocean. **We trace the subducted mode water's pathways, identify their formation regions, and trace whether their source waters** come from the Atlantic, Pacific or Indian sectors of the Southern Ocean. **Three main sites for SAMW ventilation in the Indian sector are identified:** a) just north of Kerguelen, where 4.2 Sv of lighter SAMW ( $\sigma_0 \sim 26.5$ ) are exported – originating in the Atlantic and Agulhas Retroflexion regions; b) SW of Australia, where 6.5 Sv of medium SAMW ( $\sigma_0 \sim 26.6$ ) are ventilated – originating in the southern and denser Agulhas Retroflexion region; c) SW of Tasmania and along the South Australian Coast, where 3 Sv of denser SAMW ( $\sigma_0 \sim 26.75$ ) are ventilated – originating from three sources : Leeuwin Current waters, Tasman Sea (Pacific) waters, and Antarctic Surface Waters. In all cases, modelled waters are **subducted into the Indian Ocean just north of the deepest winter mixed layers** (see Figure). However, **these waters are then re-ventilated**, e.g. SW of Australia, mode waters are re-ventilated 5 years after their subduction from the deepest winter mixed layers north of the ACC. The model shows for the first time a significant contribution of waters subducted along the south Australian coast, and the recirculation of salty Leeuwin Current and Tasman Leakage waters. Finally, our analysis shows how mode water characteristics are **modified after subduction**, due to internal mixing (eddy) effects.



**Fig.** Map of the last ventilation site for mode waters exiting at 30°S in the Indian Ocean, in terms of **a) their volume transport, and b) their depth**. Black contours represent the region where the transport is statistically significant and delimit the key regions of the last ventilation. **c) Depth integrated streamfunction [CI 0.5 Sv] for mode waters ventilated in the west [left panel], centre [central panel] and east [right panel]. The origin of the different waters and the volume transport for each branch are colour coded: northern ACC branch (light blue); southern ACC branch (dark blue); Agulhas Retroflexion (pink); Leeuwin current (green); Tasman leakage orange).**

<sup>1</sup> Koch-Larrouy, A. and R. Morrow, 2009. Origin and Mechanisms of mode water formation in the Southern Indian Ocean (*J. Phys. Oceanogr.* submitted).