UNIVERSITY OF LIVERPOOL

ALFRED-WEGENER-INSTITUT HELMHOLTZ-ZENTRUM FÜR POLAR- UND MEERESFORSCHUNG

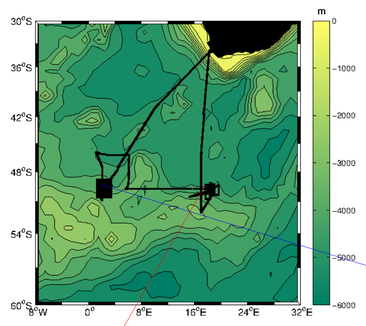
Ageing Cyclonic Eddies

Harry Leach (University of Liverpool), Volker Strass (Alfred Wegener Institute)

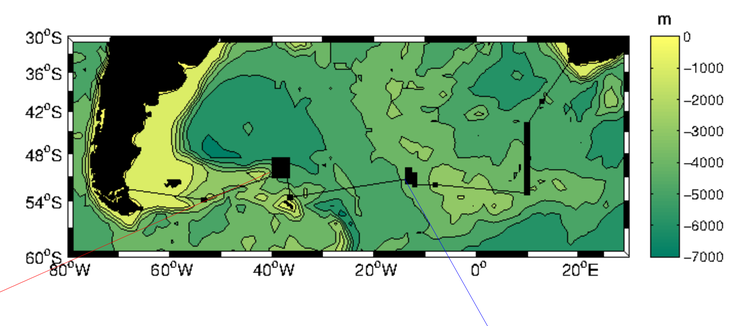
1.Ocean eddies are formed by baroclinic instability, in which the available potential energy from the large scale slope of the isopycnals is converted into the kinetic energy of the flow around the eddy.

We look at four eddies from two expeditions to the Southern Ocean and compare their characteristics:

ANTXXI/3 EIFEX 2004

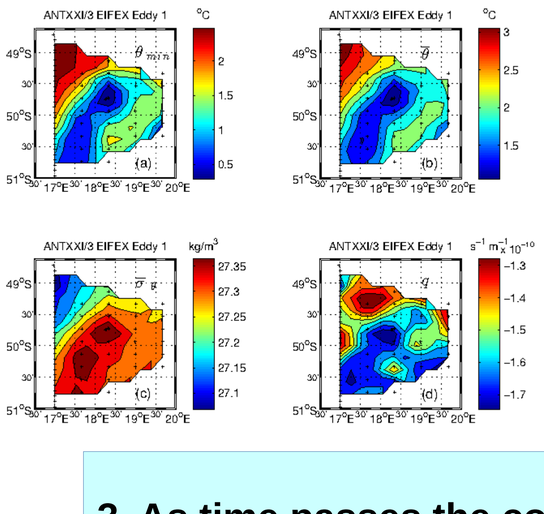


ANTXXVIII/3 Eddy Pump 2012

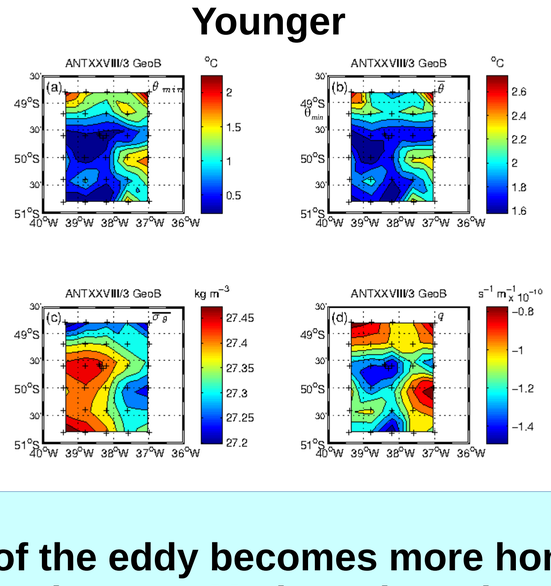


2. When a cyclonic eddy forms its isopycnals are domed upwards and it entrains a variety of waters with differing temperature-salinity characteristics. Maps of minimum and average potential temperature, density and potential vorticity:

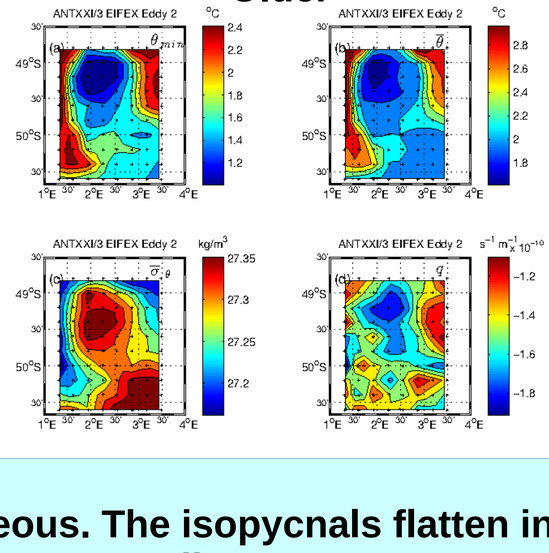
Youngest



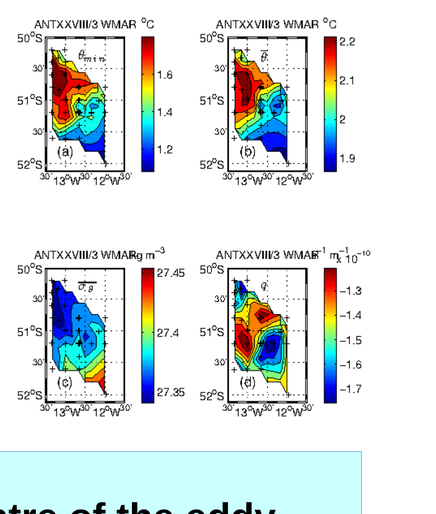
Younger



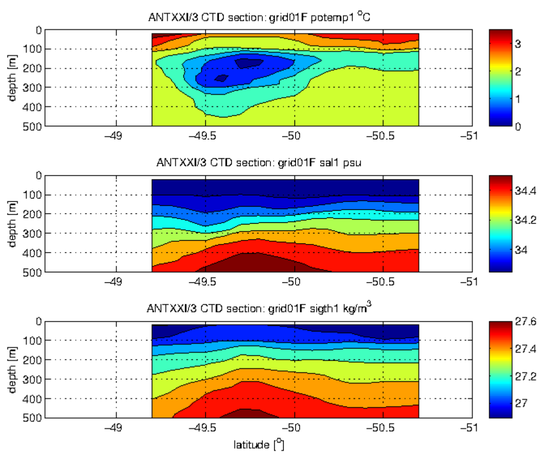
Older

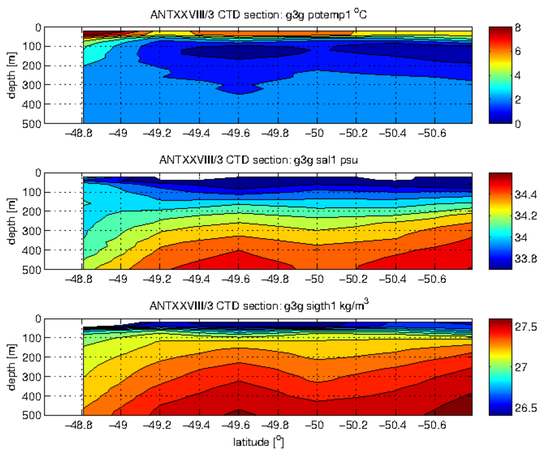


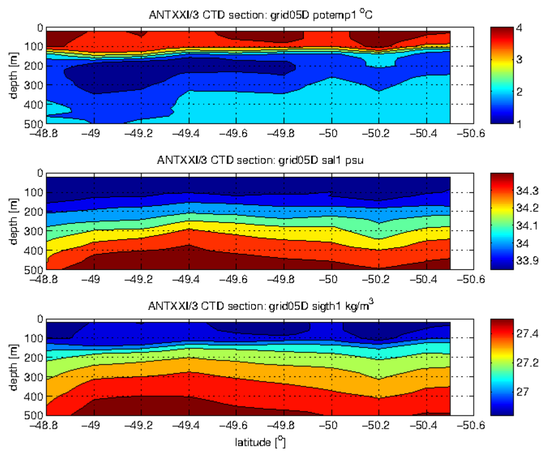
Oldest

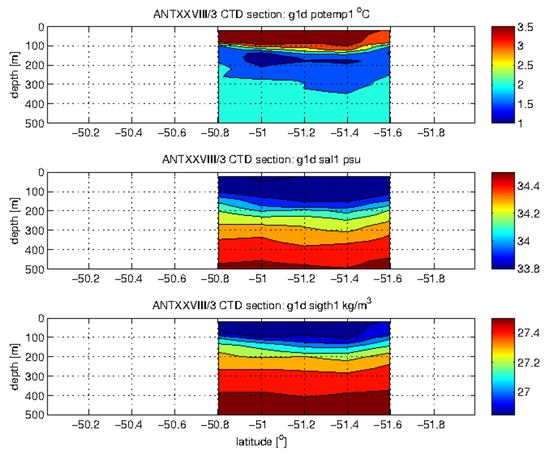


3. As time passes the core of the eddy becomes more homogeneous. The isopycnals flatten in the centre of the eddy and in cross-section they can become M-shaped, so that the steepest gradients are concentrated around the edge:

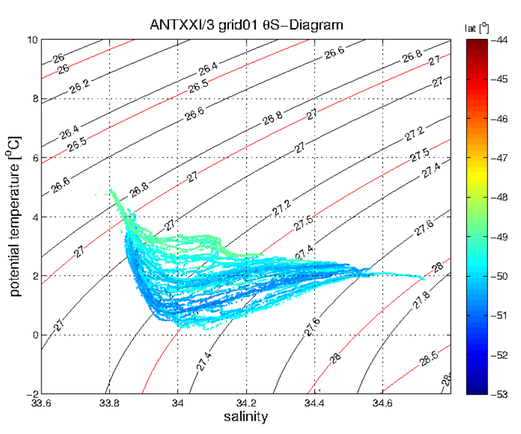


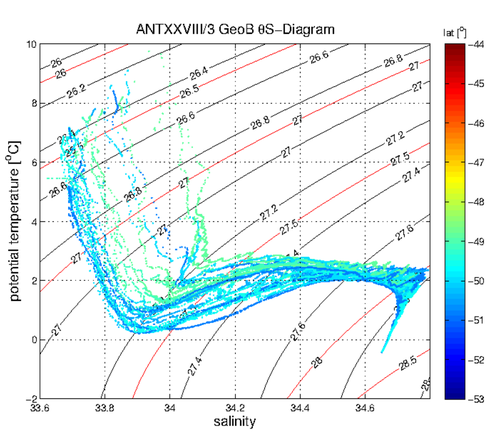


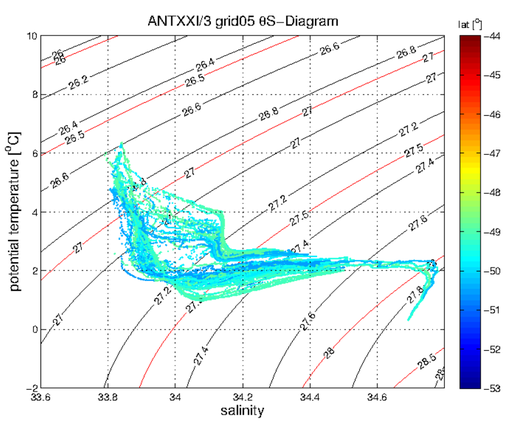


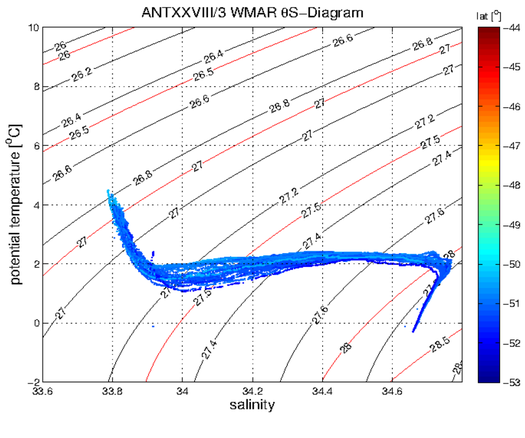


4. Mixing processes within the eddy homogenise the water so that the temperature-salinity relationship becomes tighter:









5. Small scale variability, such as temperature interleavings and density inversions, which are initially spread throughout the eddy, also become concentrated around the edges: