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The influence of bottom topography on the decay of Agulhas Rings

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Using a multi-layer isopicnal ocean model we show that a ridge like the Walvis ridge has little influence on the mixing of Agulhas ring water with its environment, contrary to the general believe. Two sets of experiments are done with a barotropic and a two-layer model.

Barotropic ring decay is dominated by bottom friction, with an Ekman timescale of about 40 days. The ring is unable to cross the topography because the amount of potential energy needed to raise the ring water over the ridge is very large. Furthermore, the development of a cyclonic feature induced by water extracted from the ridge tends to propel the ring away from the topography. Without bottom topography the decay is governed by barotropic Rossby waves.

In the two-layer case the mixing is governed by an m=2 instability that together with the separatrix generated by the motion on the beta plane forms one large and one smaller filament. The ring is able to cross the ridge. Interestingly, although vigorous interaction with the ridge takes place in the lower layer, the mixing of ring water with its environment is slightly smaller than with the without a ridge. The reason for this behavior is that the ridge slows down the propagation speed of the ring, such that separatrix is larger.

The consequences for the larger scale picture are discussed also