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ANTICYCLONIC EDDIES IN THE SKAGERRAK

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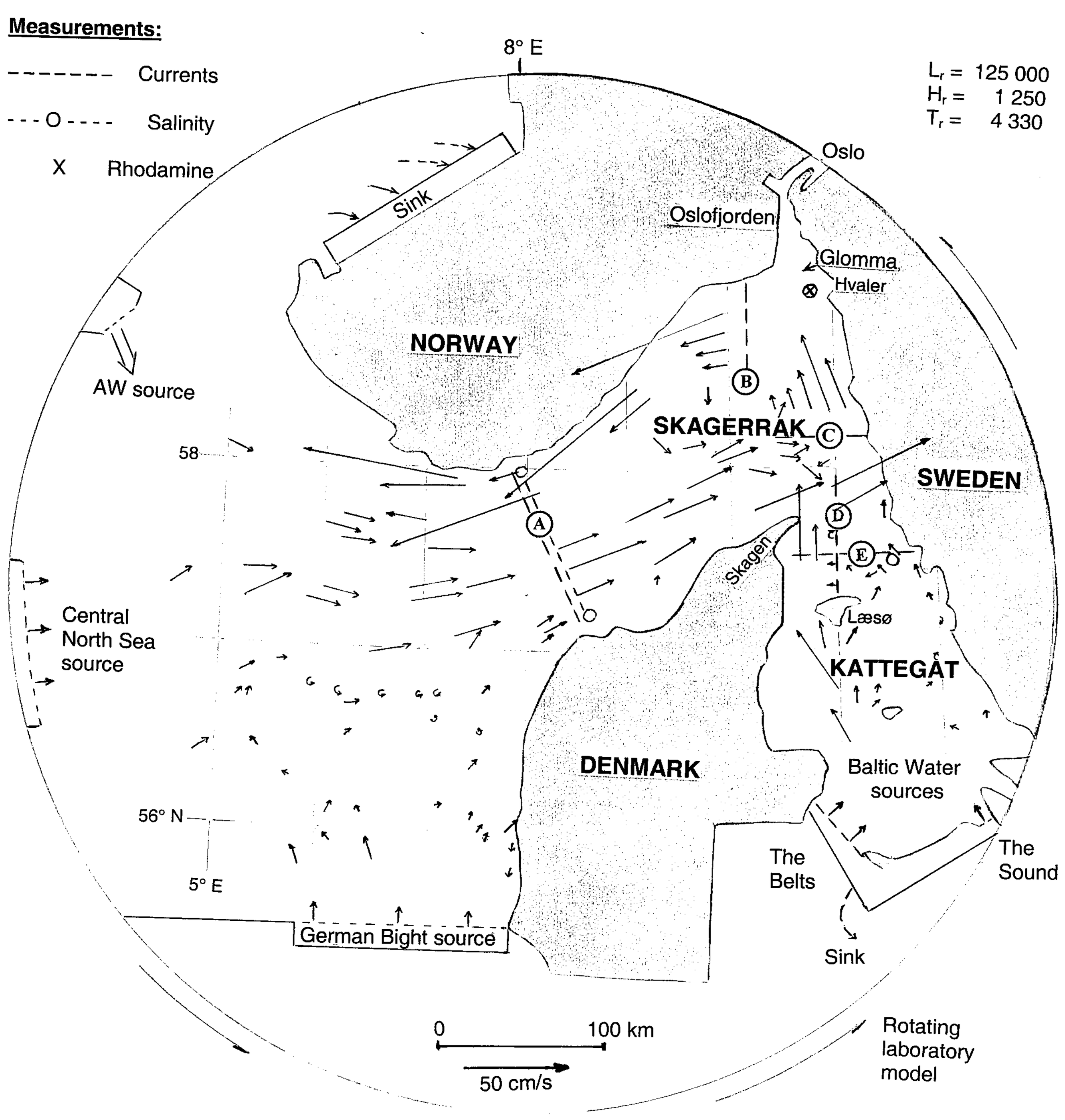
Met.no presented a MODIS (NASA) satellite image of ice floes on their web site 10 February 2010 (Fig. 1). The shape of the floes from the near-shore regions suggests an anticyclone over the deeper basin. Similar results were obtained in the laboratory model of the Skagerrak (Fig. 2) during the EU project DYNamics Of Connecting Seas. Details of this benchmark study, including a 6 min. video program, are given at www.sintef.no/coriolis.

Fig. 2. Laboratory model (McClimans et al., 2000).



After spinup, when the density ρ_{AW} of the inflowing Atlantic water is greater than the ambient ρ_{SK}, the vorticity of the upper layer became more anticyclonic beyond the coastal and slope currents to the south of Larvik. The results (Fig. 3) show that the vorticity becomes more anticyclonic as $\rho_{AW} - \rho_{SK}$ increases.

To see if this can explain the satellite image of Fig. 1, we have modelled seasonal variations of the circulation using SINMOD (Slagstad & McClimans, 2005), with forcing from the ERA-Interim data base, 2005-2008. Snapshots of the surface circulation for a day in early autumn and a day in winter are shown in Fig. 5 a and b.The latter one is an example of simulated anticyclonic circulation in the Skagerrak. Monthly averages of the vorticity at location B in Fig. 2 are shown at the right. Here, the seasonal variations support the speculation that anticyclonic circulation in the inner Skagerrak is a recurrent late winter feature.

Fig. 1. Ice patterns in the Skagerrak (met.no, 2010)

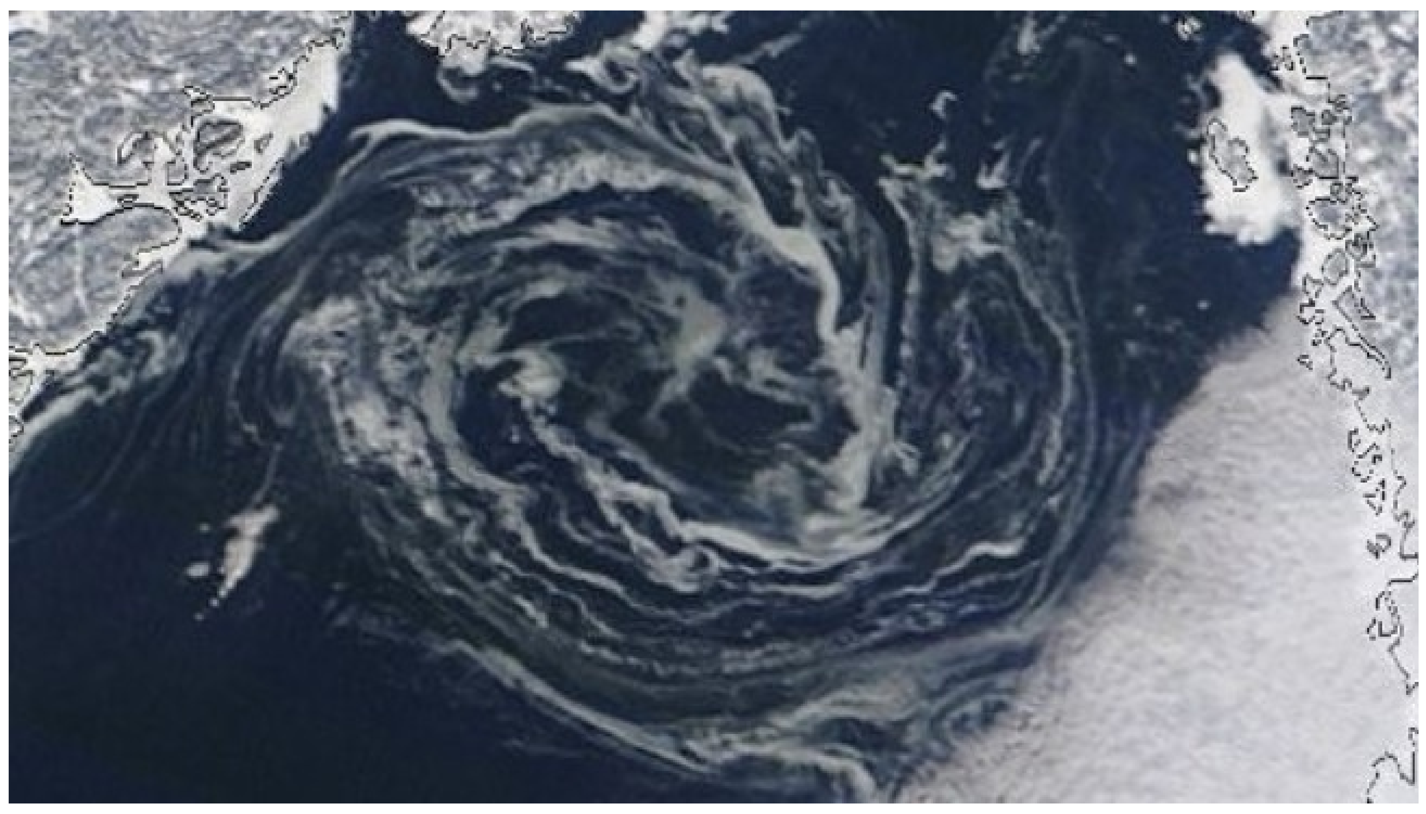
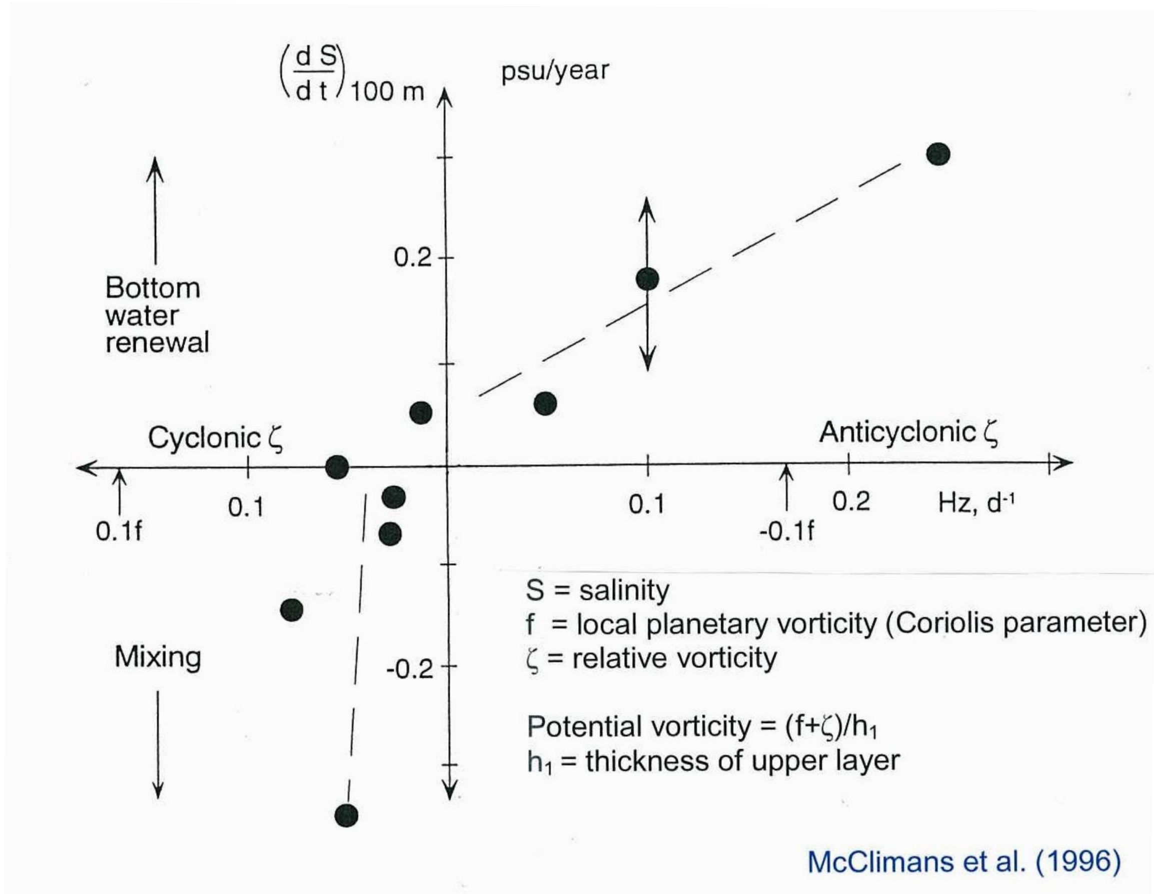
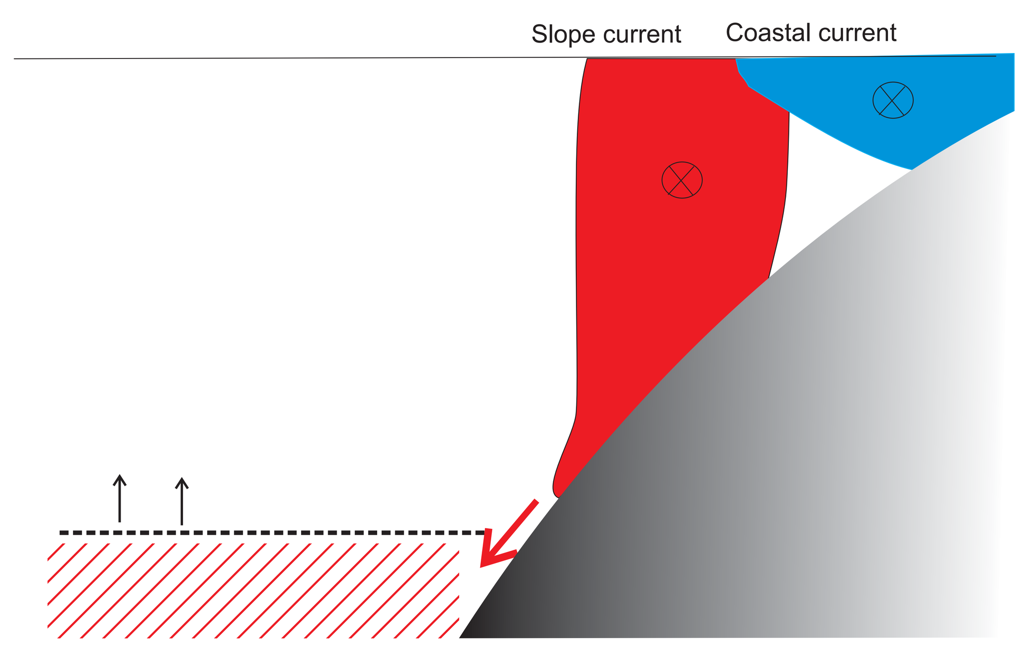


Fig. 3. Surface vorticity at B (McClimans et al., 1996)



The hypothesis is that the cascading of AW to deeper layers compresses the upper layer (Fig. 4) that becomes anticyclonic due to the conservation of potential vorticity.

Fig. 4. Cascading of dense water in section B of Fig. 2



References:
McClimans, T.A., Nilsen, J.H. and Johannessen, B.O. (1996) DYNOCS Task 3 Report 2. Laboratory simulation of the ocean circulation in the Skagerrak. SINTEF Report STF22 F96201

McClimans, T.A., Pietrzak, J., Huess, V., Kliem, N., Nilsen, J.H. and Johannessen, B.O., (2000) A comparison of laboratory and numerical simulations of the ocean circulation in the Skagerrak. *Cont. Shelf Res.* 20:941-974.

Slagstad, D. and McClimans, T.A. (2005) Modelling the ecosystem dynamics of the Barents Sea including the marginal ice zone: I. Physical and chemical oceanography. *J. Marine Sys.* 58:1-18.

Fig. 5. Snapshot of surface circulation in a) September 2006 and b) March 2007(x = location of eddy in Fig. 1). Seasonal vorticities (right) from SINMOD.