Geophysical Research Abstracts, Vol. 7, 07692, 2005
SRef-ID: 1607-7962/gra/EGU05-A-07692

Faroe Bank Channel Outflow – Dynamics of a bottom trapped plume

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The Faroe Bank Channel (FBC) is the deepest connection between the Atlantic Ocean and the Arctic Seas. The inflow of cold, dense water from the Arctic through the Faroe Bank Channel eventually to form a part of the North Atlantic Deep Water is one of the important connection points in the global thermohaline circulation. This thesis tried to describe the dynamic properties of the descending deep water plume of overflow water from the Faroe Bank Channel using time series data for velocity and temperature from a network of 25 moored instruments deployed west of the Faroe Bank Channel between July 1999 and February 2001.

The cold water plume was identified using mean velocity and temperature data. A regular pattern of oscillations with 88 hours oscillation period was the most striking feature observed in the FBC overflow plume and different methods were used to quantify this oscillation structure. The main methods used were Fourier analysis and power spectrums, singular-spectrum analysis (SSA) and wavelet analysis. The power spectrums were used to identify the stations with significant 88-hour oscillations. Results obtained by SSA include direction and amplitude of the velocity oscillations and exact values of oscillation periods for each station. Wavelet analysis shows the high time-stability of the velocity oscillations.

The velocity and temperature oscillations could be identified as a continous series of anticyclonic cold core eddies. The size of the eddies was estimated to be of the order of magnitude 50km. The topographic distribution of the oscillations suggested topographic waves as a possible driving mechanism. A simple two-layer model compared the theory for topographic waves with the results obtained in this thesis. The oscillation periods given by the model agree with the measurements for a wide range of possible wave numbers. Evaluation of the phase velocity corresponded well to the es-

timates made for the eddy size. The theoretical group velocity of topographic waves changes direction within the possible range of wavelengths, thus giving rise to the possibility of sudden changes of the plume dynamics with changing Rossby radius.