Geophysical Research Abstracts
Vol. 12, EGU2010-1923, 2010
EGU General Assembly 2010

Rotating annulus laboratory experiments with application to baroclinic channel flows with narrows

Uwe Harlander (1), Julia Wenzel (2), and Christoph Egbers (1)

(1) Brandenburg University of Technology (BTU) Cottbus, Aerodynamics and Fluid Mechanics, Cottbus, Germany (haruwe@tu-cottbus.de, 0049 355 694891), (2) University of Leipzig, Department of Theoretical Meteorology, Leipzig, Germany

The differentially heated rotating annulus is a classical experiment of geophysical fluid dynamics that shows many similarities with large-scale atmospheric flows. Still, many features of the annulus flow are not well understood and modern non-intrusive measurement techniques can help to clarify them. Moreover, blocked or partly blocked annulus flows are less well studied although such flows show resemblance with oceanic channel flows.

We present experimental results from a heated rotating annulus with a barrier that constricts the flow along the inner wall and at the bottom [1]. For the experiments a flow regime has been chosen that is characterized by an Eady wave with azimuthal wave number three. Without the barrier, the wave propagates prograde with no significant structural change. In contrast, when the barrier is mounted, wave crests break approaching it but redevelop downstream of the barrier.

We are interested in the transient wave behavior and in particular in the dominant frequencies that occur in the narrow and downstrean or upstream of it. Moreover, we study the impact of a slowly varying radial temperature gradient on the wave's phase speed and the period it takes for the reestablishment of the baroclinic wave downstream of the barrier. It is suggested that the experiments are useful in understanding some features of the flow through the Mozambique Channel. It has been shown that the flow characteristic within the Channel is quite different from the one downstream of it [2].

[1] J. Wenzel (2009): Barokline Wellen in einem rotierenden asymmetrischen Tank, Studienarbeit BTU Cottbus, Univ. Leipzig, 55pp.

[2] U. Harlander, H. Ridderinkhof, M.W. Schouten, and W.P.M. De Ruijter (2009): Long term observations of transport, eddies, and Rossby waves in the Mozambique Channel, J. Geophys. Res., 114, C02003, doi:10.1029/2008JC004846.