Geophysical Research Abstracts
Vol. 16, EGU2014-3641, 2014
EGU General Assembly 2014

Is the overflow across the Iceland-Faroe Ridge coupled to the Atlantic inflow across the Ridge ?

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The volume transport of the overflow across the Iceland-Faroe Ridge (IF-overflow) is generally considered to be on the order of 1 Sv and thus around 15% of the total overflow from the Nordic Seas into the Atlantic. The IF-overflow is, however, difficult to monitor and no observational time series of its variation are available. The inflow of Atlantic water to the Nordic Seas across the ridge (IF-inflow), in contrast, has been monitored since 1997 and its variations are known. Here, we argue that these two flows are positively correlated through a common link to sea level height (SLH) east of the Ridge. The link between SLH and IF-inflow is well documented: when sea level east of the Ridge is low, the IF-inflow is high, and vice versa. As might be expected from baroclinic adjustment, the SLH variations are also linked to depth variations of the interface that separates the dense overflow water from the upper water masses east of the Ridge. Using hydrographic observations and satellite altimetry, we have verified that a low sea level is followed by a high interface. Thus, a strong IF-inflow is linked to a high interface east of the Ridge, and a high interface should induce increased IF-overflow. The scarcity of observational data makes it hard to test this hypothesis, but measurements from an ADCP moored for two years in the overflow current south of Iceland do support it. The existence of an overflow-inflow coupling across the Iceland-Faroe Ridge may perhaps explain some puzzling results from numerical ocean models and may be important for the ability of climate models to forecast changes in oceanic heat transport towards the Arctic as well as the North Atlantic thermohaline circulation.