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Seasonal variability of the Rossby radius deformation in the Hornsund fjord

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The Earth's rotation affects the water circulation in the Arctic fjords. It can be described by means of the baroclinic Rossby radius deformation (R_1) expressed as the ratio of the internal wave velocity to the Coriolis parameter.

The influence of the rotational effects on the water-mass distribution depends on the width of the fjord in relation to the baroclinic radius of deformation (Gilbert, 1983). Most often the Rossby radius deformation in the Arctic fjords is 2-3 times smaller than the width of the fjord entrance, which allows the rotation of water masses within such fjords (Cottier, 2010). Such a situation exists in the small, western fjord of Svalbard - Hornsund, where the rotation makes the Atlantic and the Arctic waters flow from the shelf into the fjord along the southern bank and flow out of the fjord along the northern bank. The impact of the Coriolis force on the Hornsund environment was observed in a sedimentary record from the last century (Pawłowska et al. 2017). Literature estimates indicate that Hornsund is a typical fjord with an internal baroclinic Rossby radius between 3.5 and 6 km (Cottier, 2005, Nilsen, 2008).

The spatial and seasonal variation of the R_1 in the Hornsund fjord was carried out based on data from the numerical model (Jakacki et al. 2017) for the period 2005-2010 and for the selected actual data collected during the AREX survey campaigns. The analysis of the actual data and model data confirms the seasonal variability of the vertical water structure in the fjord, which leads to cyclic changes of the vertical **Brunta-Vaisali** frequency structure and consequently to seasonal variability of R_1 . In the Hornsund fjord seasonality strongly influences the Rossby radius, which reaches maximum values in summertime and minimum values in wintertime. Moreover, R_1 values can be different even at points close to each other. The values of the baroclinic Rossby radius of deformation also differ depending on the adopted calculation method.

Calculations were carried out at the Academic Computer Centre in Gdańsk.