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Variability of the Rossby radius of deformation in the Hornsund fjord

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Hornsund is a small, southernmost fjord of Spitsbergen – the biggest island of the Svalbard archipelago. The entire system is about 30 km long and 12 km wide, and its mouth opens to the Greenland Sea. It has a complicated shoreline and bottom topography. It comprises the main basin and multiple inlets, particularly in the inner parts. Maximum depth of the main fjord basin exceeds 290 m (average 90 m). The sills on the bottom separate the main fjord from the inner bays. The coast line of the Hornsund fjord covers several glaciers.
The Coriolis force causes deflection of the shelf water entering the fjords of the Northern Hemisphere towards the right-hand shore, which affects the distribution of salt water in the fjord. The influence of the rotational effects on the water-mass distribution depends on the width of the fjord in relation to the internal radius of deformation (Gilbert, 1983). Usually, the widths of the outer parts of the Arctic fjords exceed the Rossby radius by 2–3 times, thus allowing for rotation of water masses within the fjords (Cottier, 2010).
Two types of Rosby's deformation radius,: barotropic and the baroclinic, for the Hornsund fjord are going to be taken into account and presented. Its variability has been determined on the basis of 3D hydrodynamic model results for the years 2005–2010. In the analysis, Brunt-Vaisala frequency profile (VB) has been calculated from the temperature and salinity profiles and then, the Rossby radius of deformation was computed using the Wentzel-Kramers-Brillouin (WKB) method.
The fjord's dynamics strongly depend on the season. The results show that the internal Rossby deformation radius is between 2 and 6 km. The effect of rotation is better visible in the summer months, in the warm season, when the waters tend to be strongly vertically stratified.