A coupled ice sheet – ice shelf – ocean model with an explicit representation of a variable Filchner-Ronne Ice Shelf (FRIS) cavity has been developed, based on a global implementation of the Finite Element Sea Ice Ocean Model (FESOM) and a regional setup of the Parallel Ice Sheet Model (PISM). At the base of the FRIS, melt rates and boundary layer temperatures from FESOM are applied. PISM returns ice thickness, ice temperatures and the position of the grounding line. Building on the Timmermann & Goeller (2017) infrastructure, we run FESOM with a hybrid vertical coordinate and a horizontal mesh that adjusts to the varying cavity geometry. The ice sheet model uses a horizontal grid with 1 km resolution for an appropriate representation of grounding line processes. Enhancement factors for the approximation of the stress balance become obsolete at such high resolution. Ice stream flow is well captured by polythermal coupling of the ice flow and a Mohr-Coulomb yield stress criterion that accounts for properties of the till material and the effective pressure on the saturated till. We present results from model runs with a 20th-century climate forcing and projections until the end of the 22nd century.

The inflow of Modified Warm Deep Water (MWDW) leads to a rapid increase of basal melt rates (see panel on top right of this poster).