

# **Preconditioning and Formation of Maud Rise Polynyas in a High-Resolution Earth System Model**

**Prajvala Kurtakoti**

**Texas A&M University**

**ABSTRACT:** Open-Ocean Polynyas (OOPs) in the Southern Ocean are ice-free areas within the winter ice pack that are associated with deep convection, potentially contributing to the formation of Antarctic Bottom Water. Here, we analyze the processes responsible for the preconditioning and formation of the smaller Maud Rise Polynyas (MRPs) in a high-resolution preindustrial simulation of the Energy Exascale Earth System Model (E3SM, formerly ACME) project. The model simulates an anticyclonic flow around the northern periphery of Maud Rise, and a weaker inner cyclonic circulation directly over and southeast of Maud Rise. Consistently with observations, a halo of low sea-ice concentration and positive relative vorticity emerge over the northern flank of Maud Rise. This feature is correlated with the location of a semi-permanent Taylor cap. During polynya years, the Taylor cap reaches into the ocean surface, causing deep convection and an OOP. Intensification of the Taylor cap is due to weakening of the impinging flow onto Maud Rise, as well as weakening of the upper ocean stratification due to anomalous positive salinities in the upper 100 m, occurring ~six months prior to an OOP event.