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Ice Shelf Water plume flow beneath Filchner-Ronne Ice Shelf, Antarctica

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A two-dimensional plume model is used to study the interaction between Filchner-Ronne Ice Shelf, Antarctica, and its underlying ocean cavity. Ice Shelf Water plumes are initiated by the freshwater released from a melting ice shelf and, if they rise, may become supercooled and deposit marine ice due to the pressure increase in the in-situ freezing temperature. The aim of this modeling study is to determine the origin of the thick accretions of marine ice at the base of Filchner-Ronne Ice Shelf and thus improve our understanding of Ice Shelf Water flow paths. The model domain is defined from measurements of ice shelf draft and from this the model is able to predict Ice Shelf Water plumes that exit the cavity in the correct locations. The modeled plumes also produce basal freezing rates that account for measured marine ice thicknesses in the western part of Ronne Ice Shelf. We find that the freezing rate and plume properties are significantly influenced by the confluence of plumes from different meltwater sources.