

The Filchner-Ronne Ice Shelf System

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The Filchner-Ronne Ice Shelf (FRIS), the largest (by volume) floating extension of the Antarctic Ice Sheet (AIS), fringes the southern Weddell Sea known to be the dominant source of the globally relevant Antarctic Bottom Water. As a link between ocean and ice sheet, this ice shelf plays an important role for the stability of the AIS and the preconditioning of water masses participating in the global thermohaline circulation. The dominant process serving this pivotal role of FRIS is the exchange of heat, salt and tracers at the base of the ice shelf. While the southern Weddell Sea has been considered as largely invulnerable to climate warming, recent projections point to a potential tipping of the ocean state from cold to warm by the end of this century. The lack of detailed knowledge about the ocean underneath FRIS and the possibility of dramatic changes in the near future brought together scientists from the UK, Norway, and Germany. In the framework of the Filchner Ice Shelf Project, they intensively investigate the southern Weddell Sea continental shelf, including the FRIS cavity, by means of ship-based observations, moorings in front of and beneath the ice shelf, sub-ice shelf water sampling, and numerical modeling. This presentation reviews the achievements of the Alfred Wegener Institute over the past 6 years focused on observation, modeling, and comprehensive understanding of on-shore flow, dense water formation, sub-ice shelf circulation, meltwater production, and Ice Shelf Water spreading on the southern Weddell Sea continental shelf. All together has an impact on the ice shelf mass balance and thus on the discharge of inland ice with consequences for global sea level rise.