THE ANNUAL CYCLE OF ANTARCTIC SEA ICE THERMODYNAMICS: STRUCTURING THE BIOGEOCHEMICAL RESPONSE AND FLUXES

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Time series studies on sea ice during late-winter spring were conducted on Ice Station Belgica (ISB)(Sept-Oct 2007). By combining these measurements with midwinter (AnzFlux 1994), spring-summer transition (ISPOL 2004), and summer-autumn transition (ISW 1992) measurements, we develop a conceptual model of the complete annual cycle of Antarctic sea ice thermodynamics and the biogeochemical response. Particularly, ISB results (Sept-Oct) show that the nutrient recharge during "flood-freeze" induced upwelling causes enhanced algal and microbial activity, leading to up to 3000nmol/kg of DMS concentration in the upper sea ice layer. Cold brine, containing microbial material and the DMS, are later flushed into the upper ocean increasing concentrations under the ice. Three to seven cycles take place , based on temperature results from an autonomous buoy on the site until early December. For biogeochemical fluxes, the most active phase is spring where flood-freeze and light optimize to produce several strong episodes of air-ice-ocean interaction. This period of highest fluxes per unit area also coincides with maximum winter sea ice extent, making the total biogeochemical contribution of the ice cover particularly high.