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Processes governing the supply of iron to phytoplankton in the Southern Ocean: a model study

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An upgraded version of the biogeochemical model SWAMCO4 (Pasquer et al., 2005) is coupled to the ocean-sea-ice model NEMO-LIM (Timmermann et al., 2005) to explore processes governing the supply of iron to phytoplankton. The 3D NEMO-LIM-SWAMCO4 model, constrained by chemical (Fe, N, P, Si), physical (light, temperature, salinity) and biological (zooplankton grazing) controls, explicitly details four relevant phytoplankton (diatoms, nanophytoflagellates, coccolithophorids and *Phaeocystis*) and three heterotrophic (bacteria, heterotrophic nanoflagellates, microzooplankton) functional groups with respect to C, N, P, Si, Fe cycling and climate change. The 3D NEMO-LIM-SWAMCO4 model is implemented in the ocean domain south of latitude 30˚S and runs are performed for the period September 1990 - August 2000, making use of climatological fields for N, P, Si, DIC and alkalinity initial conditions. For iron and biological state variables, initial conditions are retrieved from published observations and transformed for adjustment to the model currency when necessary. Model scenarios include and cross-compare different iron sources (inputs from atmospheric deposition, iceberg melting and continental sediments) and iron accumulation mechanism in the sea ice. Model results are analysed with respect to observed iron and phytoplankton bloom distributions and point the key role played by continental sediments as iron source and as process for the winter transient storage in the ice of iron, released and made available to phytoplankton in spring when ice melts.