

Iron fuels vast phytoplankton bloom along 40°S in the Atlantic Ocean

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A phytoplankton bloom noticeable from space occurs year round along a narrow zonal band at 40°S, stretching the full width of the South Atlantic Ocean and beyond. The bloom is situated between the high nitrate low chlorophyll waters of the Southern Ocean and the low nitrate low chlorophyll waters of the subtropical South Atlantic Ocean. Iron (Fe) supply in both the Southern and South Atlantic Oceans is low and the source of the Fe that sustains the zonal 40°S bloom remains unclear. We present high-resolution dissolved and total dissolvable data for Fe, manganese, aluminium, and dissolved inorganic phosphorous in the surface and subsurface waters along 40°S, collected as part of the UK GEOTRACES program (GA10). Together with satellite observations, we estimated that, with the exception of the South American coastal zone, annual DFe fluxes lag the annual Fe requirements of the phytoplankton community in the Cape Basin and in the Argentine Basin. Elevated total dissovable Fe concentrations in surface waters along the 40°S transect suggest that the zonal phytoplankton bloom is in addition sustained by leachable particulate Fe (= total dissolvable - dissolved). We suggest that this labile Fe fraction is formed by two main DFe sources: DFe from South American shelf sediments and DFe entrained into the euphotic zone by seasonally restricted deep winter mixing. The regeneration of labile Fe satisfies the biological Fe demand along the eastward flow of the South Atlantic current that transports the bloom.