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EXTREMELY HIGH BENTHIC ORGANIC CARBON FLUXES AT THE POLAR FRONT (SOUTHERN OCEAN, ATLANTIC SECTOR) BELOW AREAS OF ENHANCED SURFACE PRODUCTIVITY

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In the context of carbon dioxide sequestration, the Southern Ocean was recognized to play an important role. However, carbon export is mostly investigated to depths no deeper than 1000 m.

Here we present benthic carbon fluxes investigated during austral fall 2004 subsequent to the breakdown of the summer plankton bloom at 4 locations between 3300 – 4300 m depth close to the Polar Front (PF).

Sites were chosen to be in areas of 1) intensive and 2) low natural surface productivity, and 3) of the European Iron Fertilization Experiment EIFEX, performed during late summer – early fall. Hereby, the locations were selected on the basis of remote sensing surface chlorophyll-a data (SeaWiFS, NASA).

In situ micro sensor measurements reveal an extraordinary high sedimentary oxygen uptake which translates into high organic carbon fluxes in the EIFEX area as well as underneath the natural high productivity site. The derived organic carbon fluxes are 2-3 times higher than literature data for this area. In contrast, a much lower flux was found at the reference site outside the band of high surface productivity.

The striking correlation of benthic fluxes with remote sensing surface production data suggests an enhanced vertical export of organic material from surface production hot spots. Moreover, the temporal development of surface production values between September 1997 and November 2005 as well as the high sediment accumulation and shallow oxygen penetration (~10 cm) at the natural high productivity site supports the assumption, that this is not a single observation.

We suggest from this multi method approach, that high surface productivity may lead to much higher exports of organic material to the sea floor than previously assumed. Obviously, this phenomenon is associated with rapid vertical transport, possibly enabled by particle aggregation above certain thresholds in surface production.