The effective carbon flux in the Atlantic Ocean

Wolfgang Koeve

MARUM, FB Geowissenschaften, Universität Bremen, Bremen, Germany, w.koeve@web.de

The mean depth distribution of the POC:PIC ratio of sinking particles, measured with particle interceptor traps deployed in the Atlantic ocean, is fitted by an exponential function ($POC:PIC = 64.3 \cdot Z^{-0.56}$; $r^2=0.69$). The function is successfully evaluated by comparison with (a) estimates of the POC:PIC ratio of export production, computed from seasonal changes of nitrate and alkalinity and (b) estimates of the POC:PIC ratio of remineralisation on shallow isopycnals. The basin mean POC:PIC ratio of export production is 4.2 to 4.37. The POC:PIC-depth function is combined with empirical relationships between the flux of particulate organic matter, primary production and depth, satellite derived primary production data sets and the regional distribution of y (the ratio of released CO_2 vs. precipitated carbonate during $CaCO_3$ formation) in order to estimate the effective carbon flux (J_{eff}) in the Atlantic ocean. Remineralisation of organic carbon above the winter mixed layer (11-17%) and $CaCO_3$ sequestration from the winter mixed layer (13-16%), which is the balance between $CaCO_3$ production and shallow dissolution, are the two main processes which control the difference between export production (0.9 and 2.9 GT C a^{-1}) and J_{eff} (0.64 and 2.2 GT C a^{-1}) on the basin scale (65°N to 65°S). $CaCO_3$ sequestration is the dominant process modulating effective carbon export in the tropics, while shallow POC remineralisation dominates in temperate and polar waters. Observed regional patterns like polarward increases of the POC:PIC export ratio and of y counteract each other largely when J_{eff} is computed.