ID: W1974006045

TITLE: Particle flux in deep seas: regional characteristics and temporal variability

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ABSTRACT:

Particle flux data have been collated from the literature representing most areas of the open ocean to determine regional trends in deep water flux and its seasonal variability. Organic carbon flux data normalised to a depth of 2000 m exhibits a range of an order of magnitude in areas outside the polar domains (0.38 to 4.2 g/m2/y). In polar regions the range is wider (0.01?5.9 g/m2/y). Latitudinal trends are not apparent for most components of the flux although calcite flux exhibits a poleward decrease. Limited data from polar regions show fluxes of opaline silica not significantly higher than elsewhere. The variability of flux over annual cycles was calculated and expressed as a Flux Stability Index (FSI) and the relationship between this and vertical flux of material examined. Somewhat surprisingly there is no significant relationship between FSI and fluxes of dry mass, organic carbon, inorganic carbon or opaline silica. At each site, net annual primary production was determined using published satellite derived estimates. There is a negative but weak relationship between FSI and the proportion of primary production exported to 2000 m (e2000 ratio). The most variable of the non-polar environments export to 2000 m about twice as much of the primary production as the most stable ones. Polar environments have very low e2000 ratios with no apparent relationship to FSI. At primary production levels below 200 g C/m2/y there is a positive correlation between production and organic carbon flux at 2000 m but above this level, flux remains constant at about 3.5g C/m2/y. A curve derived to describe this relationship was applied to estimates of annual primary production in each of 34 of the open ocean biogeochemical provinces proposed by Longhurst et al. (1995). Globally, open ocean flux of organic carbon at 2000 m is 0.34 Gt/yr which is 1% of the total net primary production in these regions. This flux is nearly equally divided between the Atlantic, Pacific and Southern Oceans. The Indian and Arctic oceans between them only contribute 5% to the total. The eight planktonic climatological categories proposed by Longhurst (1995) provide a most useful means of examining the data on flux and its variability. A characteristic level of FSI was found in each category with highest levels in the tropics and lowest levels in the Antarctic. There is also a characteristic level of export ratio in each category with the highest in monsoonal environments (1.7%) and the lowest in Antarctica (0.1%).

SOURCE: Deep-sea research. Part 1. Oceanographic research papers/Deep sea research. Part I, Oceanographic research papers

PDF URL: None

CITED BY COUNT: 260

PUBLICATION YEAR: 1997

TYPE: article

CONCEPTS: ['Flux (metallurgy)', 'Atmospheric sciences', 'Polar', 'Environmental science', 'Total organic carbon', 'Carbon fibers', 'Carbon flux', 'Range (aeronautics)', 'Chemistry', 'Geology', 'Materials science', 'Physics', 'Environmental chemistry', 'Ecology', 'Organic chemistry', 'Astronomy', 'Ecosystem', 'Composite number', 'Composite material', 'Biology']