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Distribution of lipid biomarkers and their stable carbon isotope ratios in the remote marine atmosphere: implications for atmospheric transport pathways and C_3/C_4 plant sources

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In this communication we describe the results of our studies to constrain temporal and geographical changes in the long-range atmospheric transport of biomarkers over the open ocean. Firstly, marine aerosol samples were collected on a biweekly basis from 1990 to 1993 at a remote island, Chichi-Jima (27˚04'N, 142˚13'E) in the western North Pacific. Strong seasonal changes in the δ^{13}C values of the C_{29} and C_{31} n-alkanes (biomarkers for higher plants) were evident. Lighter δ^{13}C values were observed in winter – with a transition to heavier values in summer. Using a mixing equation, we suggest this is due to relative increases in the contributions from C_4 plants in the summer season. Using backward air mass trajectory analyses we relate the biomarker data to the seasonal changes, prevailing westerly or easterly winds and source areas. Secondly, we investigated latitudinal changes in the long-range atmospheric transport of organic matter to the western Pacific and Southern Ocean (27.58˚N to 64.70˚S) collected during a research cruise. The geographical source areas for each sample were estimated from air-mass back-trajectory computations. Compound specific isotopic analysis of the C_{29} and C_{31} n-alkanes revealed heavier δ^{13}C values in the northern latitudes with a transition to lighter values in the Southern Ocean. By comparing the isotopic measurements with back-trajectory analysis it was generally possible to discriminate between different source areas. A synthesis of the biomarker data suggests that a subset of the southern most samples may con-

tain a southern hemisphere background of well mixed higher plant organic material, with an inclusion of C_3 plant rich material transported aloft to the Antarctic from lower latitudes by the large scale tropospheric meridional circulation. We also report preliminary compound specific $\delta^{13}C$ measurements on biomarkers extracted from a Greenland ice-core.