

Introduction: JGOFS scientific objectives and time-series stations

One of the most important goals of JGOFS is to improve our estimations of how much the ocean takes up the carbon dioxide (CO₂) released into the atmosphere through human activity and of the processes that control this flux. A recent review of oceanographer's current comprehension and quantification of this flux, underlines our ignorance about the detailed behavior of the solubility and biological "pumps" that move a portion of the carbon that crosses the air-sea interface from the surface waters to depth. In addition, the amplitude of seasonal variations of carbon fluxes relative to that of the anthropogenic signal makes sampling difficult (Sarmiento, 1995).

To understand the mechanisms governing the carbon fluxes, two measurement approaches are possible. The first consists in organizing research cruises in characteristic biogeochemical provinces and in different seasons to constrain the seasonal variability. Such studies allow to understand the processes at play and to quantify their relative importance. The second approach involves the continuous acquisition of parameters from one sampling location in the ocean; it is less frequently applied because of the logistical overheads.

Yet, time-series' observations conducted over many years are essential to our understanding of seasonal, interannual and longer-term trends and cycles. Indeed, long-term monitoring allows to evaluate the seasonal and interannual variations in the key parameters used to estimate: i) the surface gas flux (CO₂, O₂) at the ocean/atmosphere interface, ii) the primary production and transient particle fluxes in the water column, and iii) their evolution at depth. Garçon *et al* (1992) estimated that a minimum of 24 measurements per year is required to constrain the average air-sea CO₂ flux at station P. Nevertheless, calculated averages derived from monthly measurements allow to estimate annual fluxes with a better precision than with data acquired during a one-off research cruise. The key parameters describe the physics, the biology and the chemistry of the water column; the data acquired over many years, in addition to processus data acquired in biogeochemical provinces, will also allow to calibrate coupled physics/chemistry/biology models in one dimension. The resulting better understanding of the 1 dimensional processes occurring in the water column will make easier the development of such coupled models in 3 dimensions.

One of the first multi-year time series station was the Ocean Weather Station P, located in the middle of a large horizontal expanse of the sub-arctic North Pacific oceanic body. It was not planed in the framework of JGOFS and the sampling strategy will not be detailed here; it was focused on surface