FRANKLIN CRUISES FR 8/90, 5/92 AND 8/93
DATA DOCUMENTATION
JGOFS WESTERN EQUATORIAL PACIFIC PROCESS STUDY

[1] General:

Parameter:	Primary production modelling
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List of Parameters:	Water column modelled primary production estimates.
List of Units	Cloud: adjustment of the theoretical clear-sky irradiance to match the mean monthly short-wave radiation estimates from Bishop and Rossow (1991). Daily PAR: Calculated surface irradiance (Mole m^{-2} d^{-1}). Chlorophyll a in the mixed layer, and in the below mixed layer as mg Chl a m^{-2}. Gross and net daily production: mg Carbon m^{-2} d^{-1} Assimilation number: mg Carbon (mg Chl a) $^{-1}$ averaged for the depth of the mixed layer or below the mixed layer, or for the water column. Net production calculated using a 10% respiration figure.

[2] Sampling:

Gear (e.g. CTD, pump, etc.):	CTD; 10 litre niskin bottles
Standard Depths:	Hydrochemistry depths: see Hydrochemistry data
Chemicals used:	none
Special Procedures:	Niskins with silicone rubber o-rings and closure rubbers. Chlorophyll-a samples on Whatman GFF filters, stored in liquid nitrogen until analysed by hplc. Carbon fixed vs light intensity (P vs I) incubations (one hour standard) done in a photosynthetron, using ^{14}C and incubations were started within one hour of the CTD coming on deck.
Comments and Notes:	Units:

[3] Analysis:

Instrument:	None
Method:	Modelling described in Mackey et al., 1995, 1997.
Precision:	Estimated as ± 30% (see Clementson et al, 1998).
Comments:	FR 9308: Due to loss of all pigment samples on FR 9308, chlorophyll *a* data can be estimated using fluorescence profiles from FR 9308 and fluorometer calibration from FR 9205

[4] Results:

Quality of Data: FR 9008 and FR 9205: good. FR 9308: loss of HPLC pigment samples; chlorophyll *a* was calculated from fluorometric data calibrated using FR 5/92 data.

Known Problems: Loss of pigment samples for FR 8/93.

[5] Brief description of analytical methods

The production vs light intensity estimates were obtained using a photosynthetron (see Mackey et al., 1995, 1997) and the photosynthetic parameters were obtained using a non-linear curve fitting program (Systat) to fit the models of Platt et al., (1980). The gross, daily integrated water-column production at 1 m intervals to 150m was estimated using a simple model incorporating the photosynthetic parameters (alpha, P_m^B, P_s^B beta), attenuation coefficients, fluorescence profiles (converted to chlorophyll-a profiles) and surface irradiance. The fluorescence paramters were linearly interpolated between sampling depths. Depth-integrated production was calculated in two ranges: from the surface to the upper boundary of the deep chlorophyll maximum (the chlorophyll mixed layer) and from the upped boundary of the deep chlorophyll maximum to 150m including the deep chlorophyl maximum (below the mixed layer). The gross production estimates do not include the intercept, and make no allowance for respiration. A net production value is also calculated, and this assumes a 10% respiration figure. Vertically integrated daily production was calculated. Surface irradiance as function of time of day was calculated for clear-sky irradiance following Kirk (1983), and the effects of cloud cover were incorporated by adjusting the theoretical clear-sky irradiance to match the monthly mean irradiance estimates for the station latitude and longitude produced by Bishop and Rossow (1991). Photosynthetically active radiation (PAR) was calculated as 50% of the surface irradiance.

References:

Bishop, J.K. and W.B. Rossow, Spatial and temporal variability of global surface solar irradiance, *J. Geophys. Res. 99*, 16839-16858, 1991.

Kirk, J. T. O. (1983) Light and photosynthesis in aquatic ecosystems. Cambridge University Press, Cambrige, U.K.

Mackey, D. J., Higgins, H. W., Mackey, M. D. and Holdsworth, D. (1998) Algal class abundances in the western equatorial Pacific: estimation from HPLC measurements of chloroplast pigments using CHEMTAX. *Deep-Sea Research,* **45**, 1441-1468.

Mackey, D. J., Parslow, J. S., Griffiths, F. B., Higgins, H. W. and Tilbrook, B. (1997) Phytoplankton productivity and the carbon cycle in the western equatorial Pacific under ENSO and non-ENSO conditions. *Deep-Sea Research,* **44**, 1951-1978.

Platt, T., Gallegos, C.L., and Harrison, W.G. (1980) Photoinhibition of of photosynthesis in natural assemblages of marine phytoplankton. Journal of Marine Research **38**, 687-701.

[6] Comments:

The photosynthetic rates calculated are believed to be closer to gross photosynthesis that net photosynthesis because of the very short incubation times (one hour) used.

Results of the modelling have been presented for both as a mixed layer, below mixed layer, and column total (Modelled column primary production estimates) data set, and in 2 metre bin data for modelled production in 2 m bins, assimilation number in 2 m bins, and PAR in 2 m bins. The units used in the 2 m binned results are:
Production in 2 m depth bins: mg Carbon m^{-3} d^{-1}.
Assimilation number in 2 m depth bins: mg Carbon (mg Chl a).
PAR: Moles m^{-2} d^{-1} at each depth.