Variations and distributions of $p\text{CO}_2^{sw}$ in the western North Pacific during 1990 to 2003

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Surface current system south of Japan
pCO$_2$ observation along 137°E during 1968 to 2003
Time series of surface properties during winter of 1983-2003

(a) SST (°C)  (b) Salinity  (c) Wind speed (m s\(^{-1}\))
(d) \(p\text{CO}_2\)\(_{\text{sea}}\) (µatm)  (e) \(\Delta p\text{CO}_2\) (µatm)  (f) CO\(_2\) Flux (mol m\(^{-2}\))
Seasonal variation in the growth rate of mean concentration from 1990 to 2003
Contour plot of the growth rate of $p\text{CO}_2^{\text{sw}}$

Growth rate of $p\text{CO}_2^{\text{sw}}$ (µatm/yr)

Latitude

Jan/Feb  Mar/Apr  May/Jun  Jul/Aug  Sep/Oct  Nov/Dec
Long-term and seasonal variations in $pCO_2^{air}$ and $pCO_2^{sw}$

$$pCO_2(t) = a + bt + ct^2 + \sum_{i=1}^{2} \{d_i \cos(\omega_i t) + e_i \sin(\omega_i t)\}$$

$$\Delta = pCO_2^{obs} - pCO_2(t)$$

Low pass filters were used to smooth $\Delta$

$$pCO_2 = pCO_2(t) + \Delta_{smooth}$$

Method of analysis: Thoning et al. (1989)
Calculated $pCO_2^{\text{air}}$ and $pCO_2^{\text{sw}}$ at 28°N
Calculated $pCO_2^{\text{air}}$ and $pCO_2^{\text{sw}}$ at 5°N

![Graph showing calculated and observed $pCO_2^{\text{sw}}$ values at 5°N from 1984 to 2003. The graph displays a clear upward trend over the years, indicating increasing $pCO_2^{\text{sw}}$ values.](image-url)
Three dimensional representation of the latitudinal distribution of $p\text{CO}_2^{\text{air}}$ of the western North Pacific (137°E)
Three dimensional representation of the latitudinal distribution of $p\text{CO}_2^{sw}$ of the western North Pacific (137°E)
Contour plot showing the temporal and spatial variations in the $\Delta pCO_2$ in the western North Pacific