

Air-sea exchange of CO₂ in the Polar Regions

Part of the Galtathea 3 cruise

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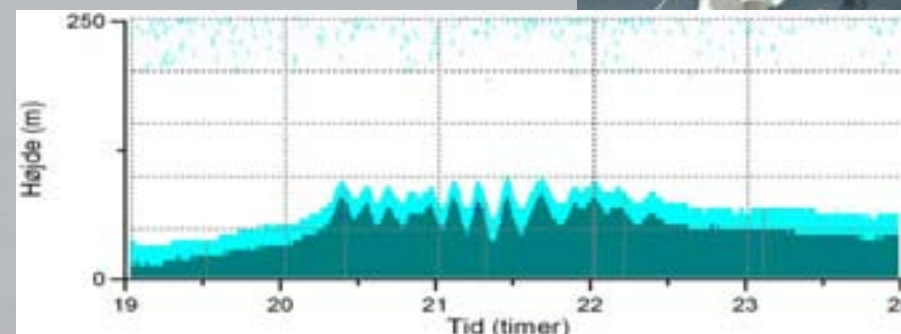
Danish Galathea 3 project 2006-2007



Risø participates in the project: “The marine carbon cycle from North to South along the Galathea route”

Measurements of:

- CO₂ in air and water
- CO₂ fluxes
- Latent, sensible heatflux
- Aerosol size distributions
- Aerosol composition
- particle fluxes
- boundary layer heights



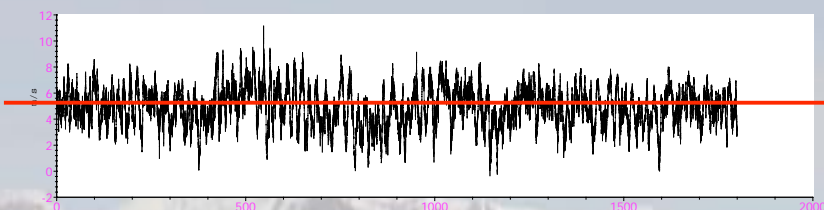
Measurements of the Air-Sea exchange of CO₂

DTU

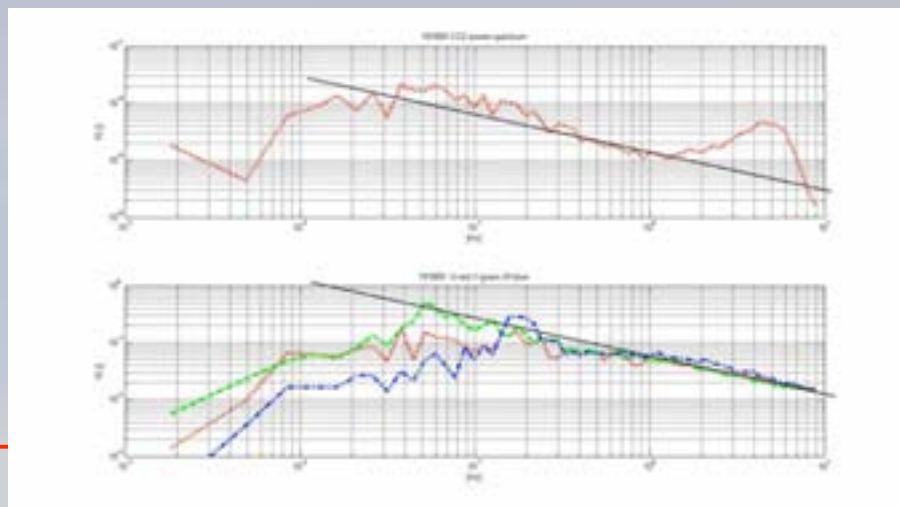
RISO

Eddy covariance
technique:

$$F = \overline{w'c'}$$



dissipation technique:



bulk method:

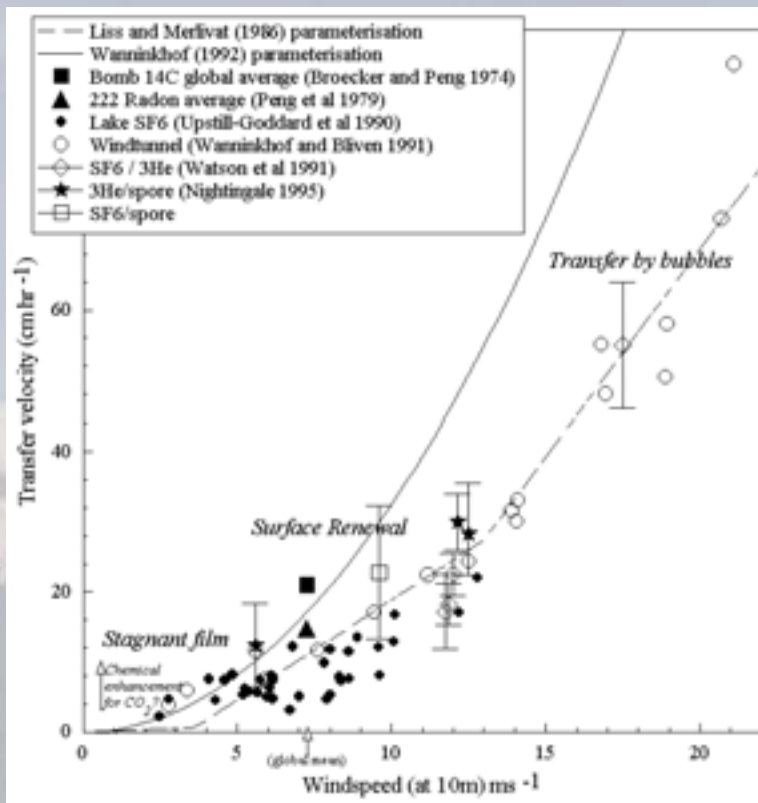
$$F = k \alpha (\Delta p\text{CO}_2)_{\text{sea-air}}$$

k = gas transfer velocity

α = solubility

Aim to examine the Gas transfer velocity

k (surface/capillary waves turbulence/windspeed spray/bubbles)

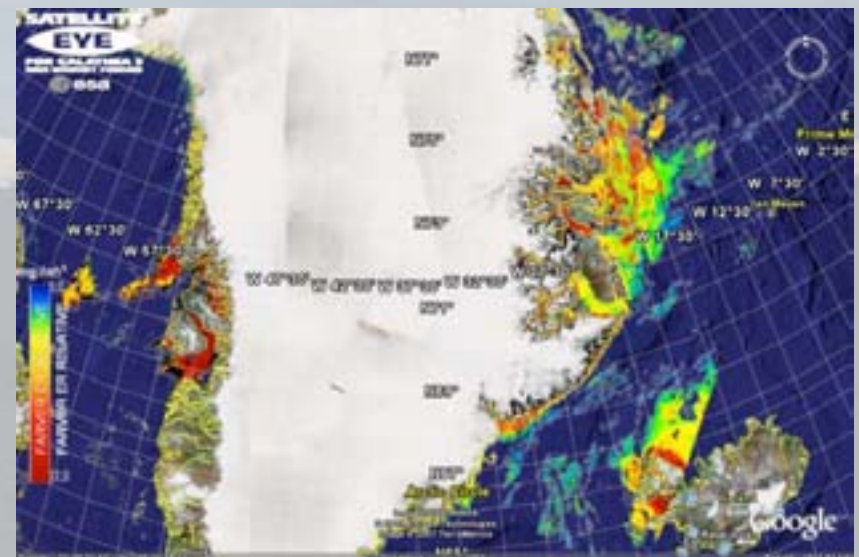
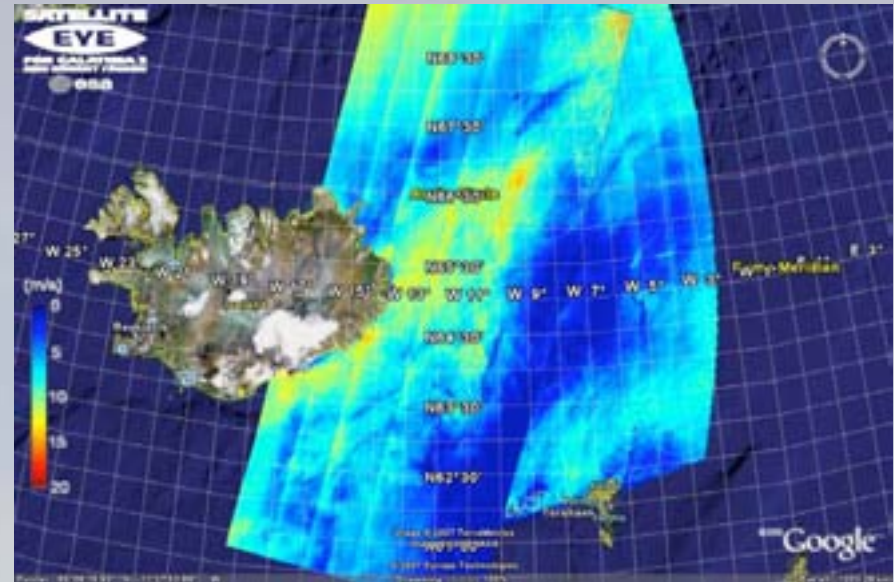
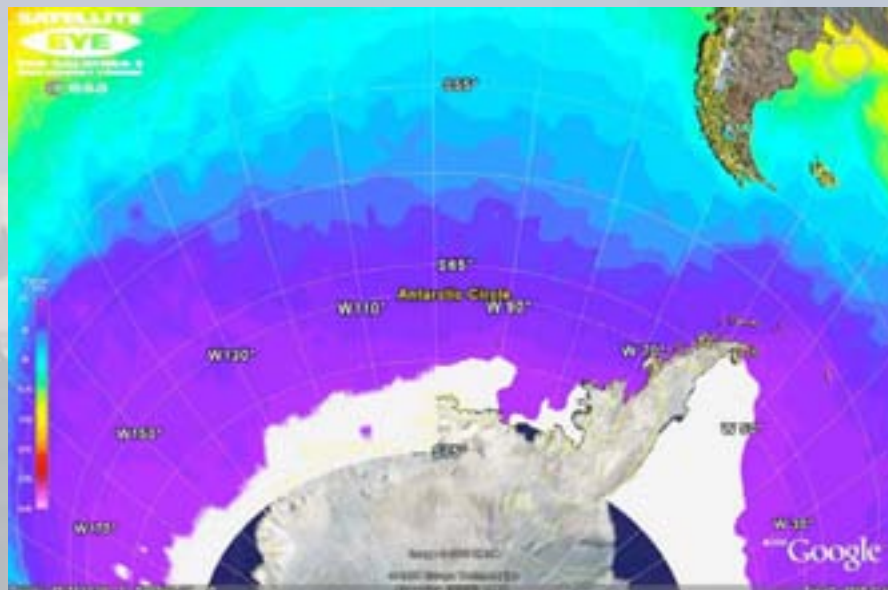


k is estimated in many different studies

$$\text{Flux(dissipation)} = k \cdot (\Delta p\text{CO}_2)_{\text{sea-air}}$$

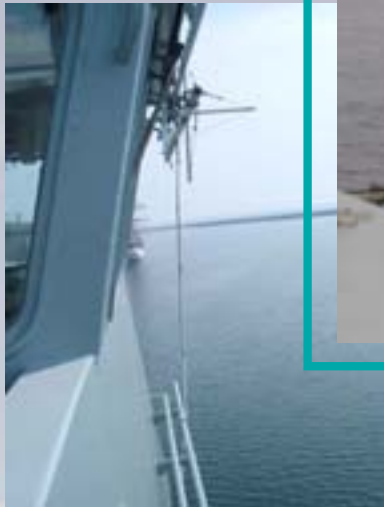
Aim to evaluate the Arctic and Antarctic as CO₂ sinks

Using satellite images and insitu data

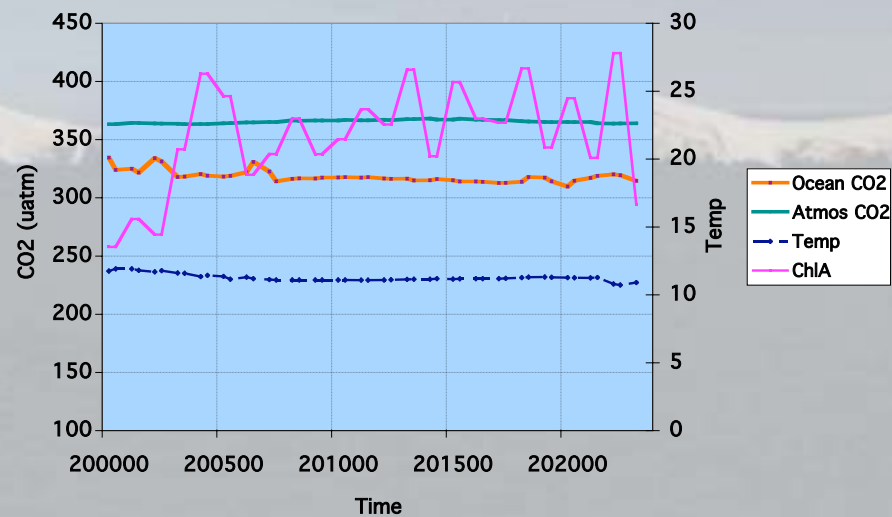
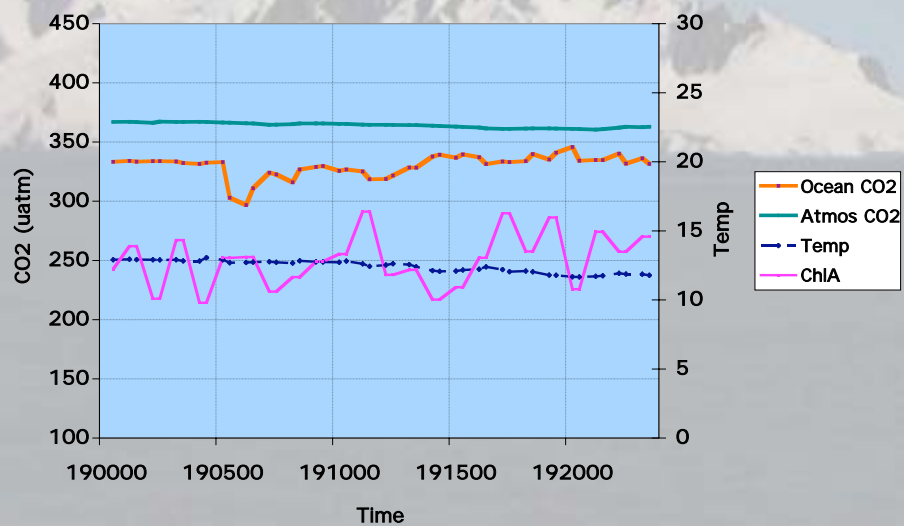
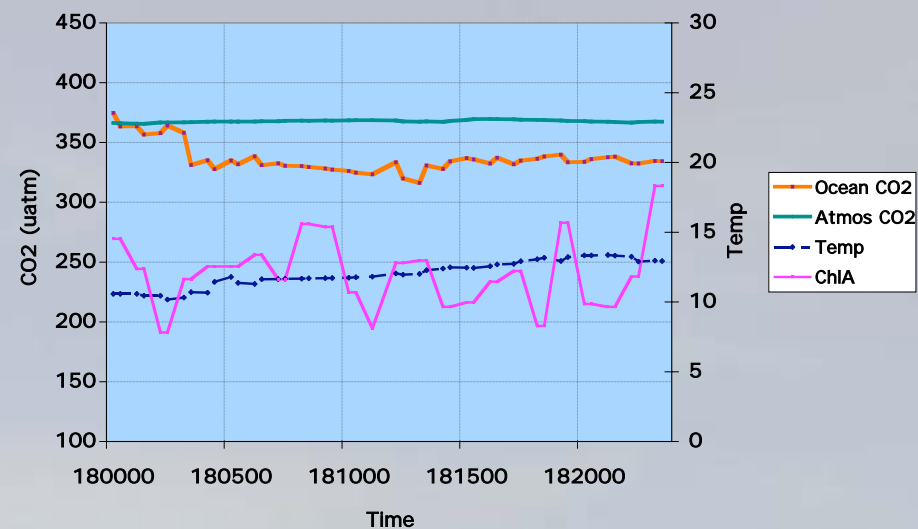


Dissipation and Covariance

pCO₂ in water and atmosphere



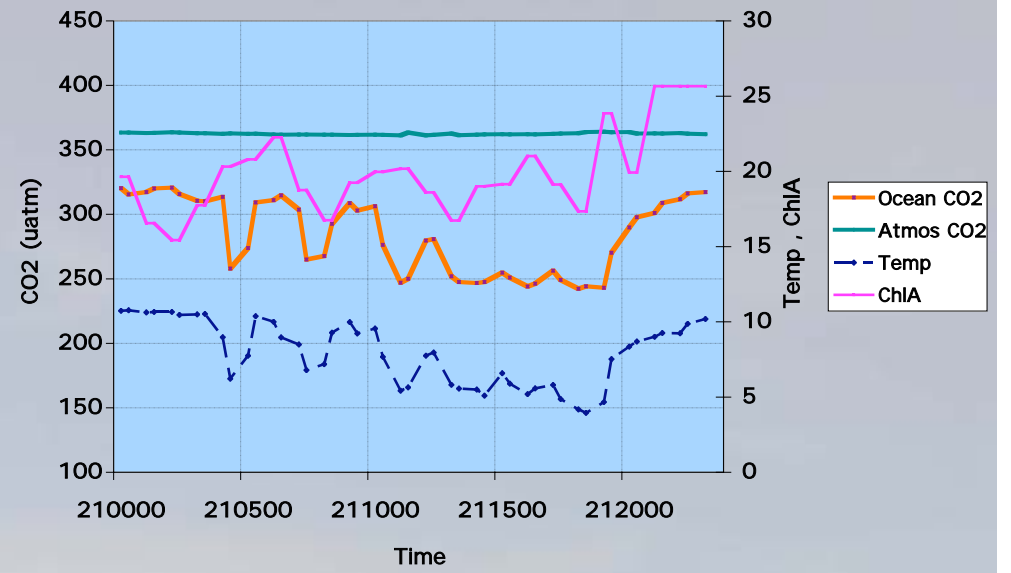
dpCO₂ around Greenland





En del af DTU

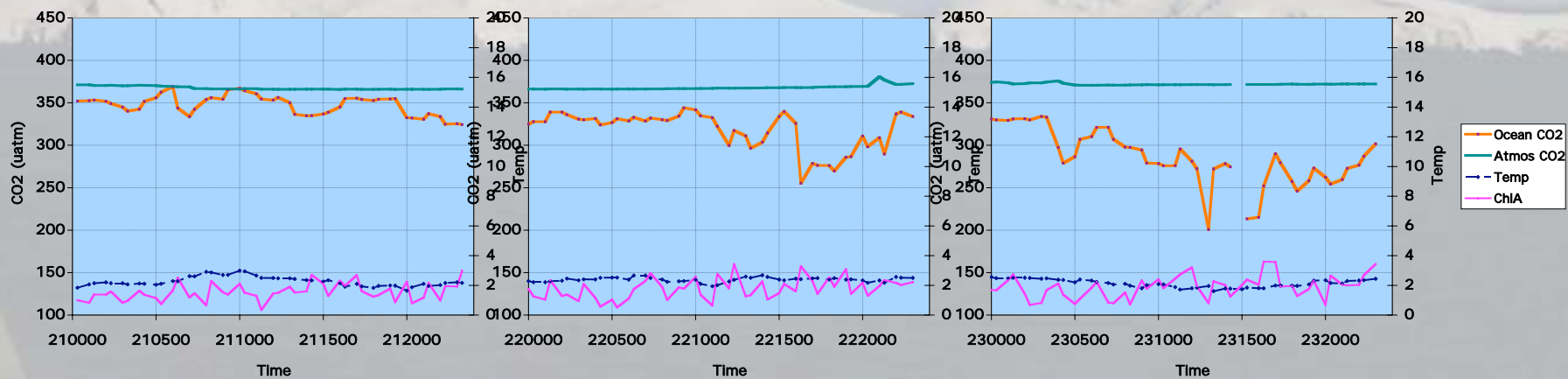
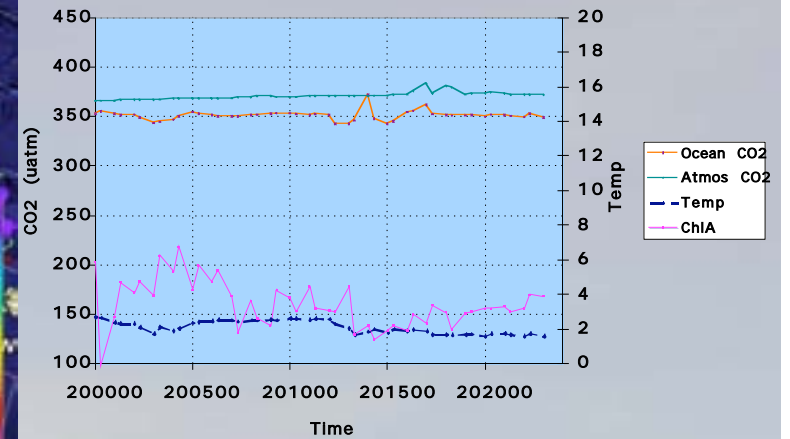
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dpCO2 Antarctica

Erin del af DTU

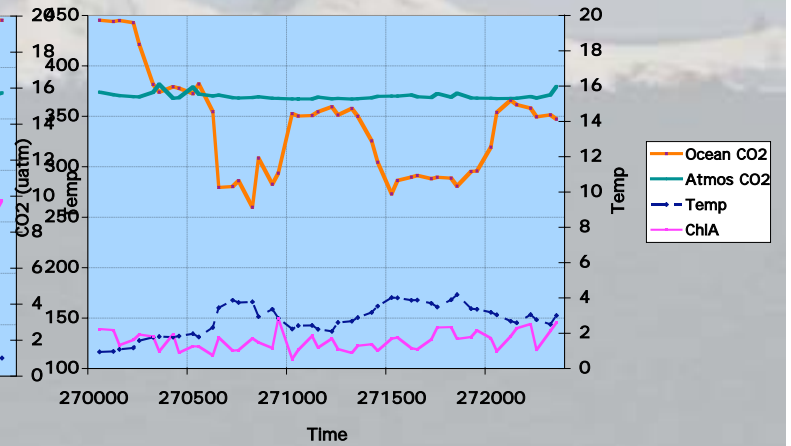
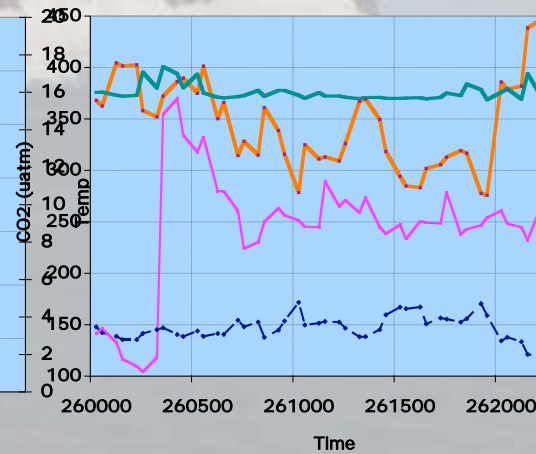
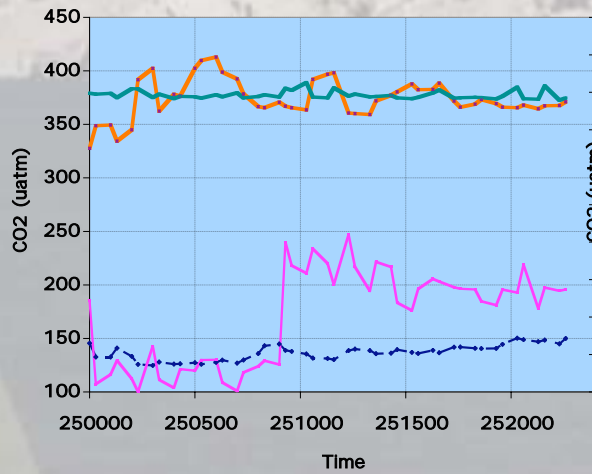
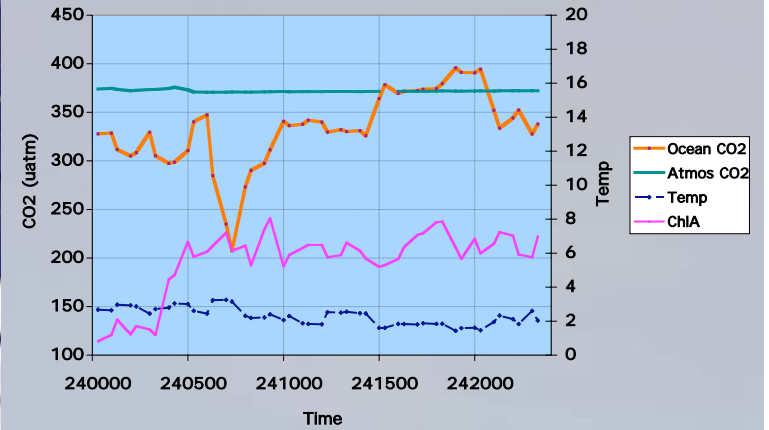
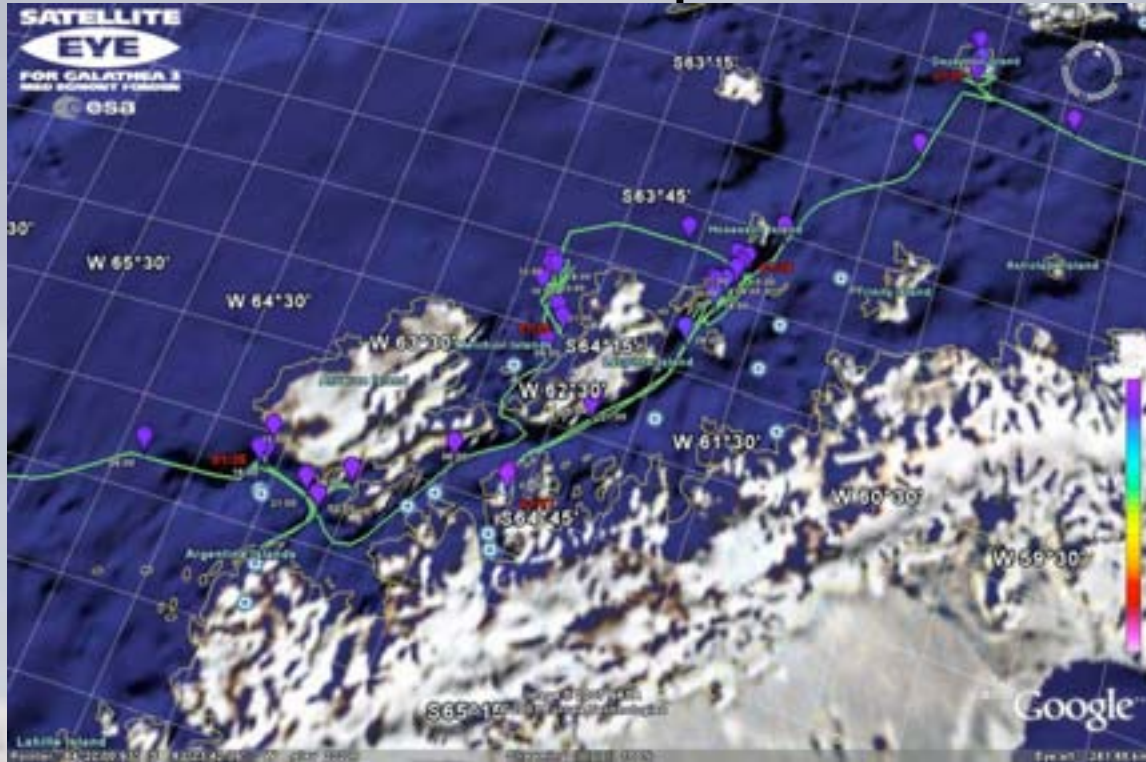
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dpCO2 Antarctica

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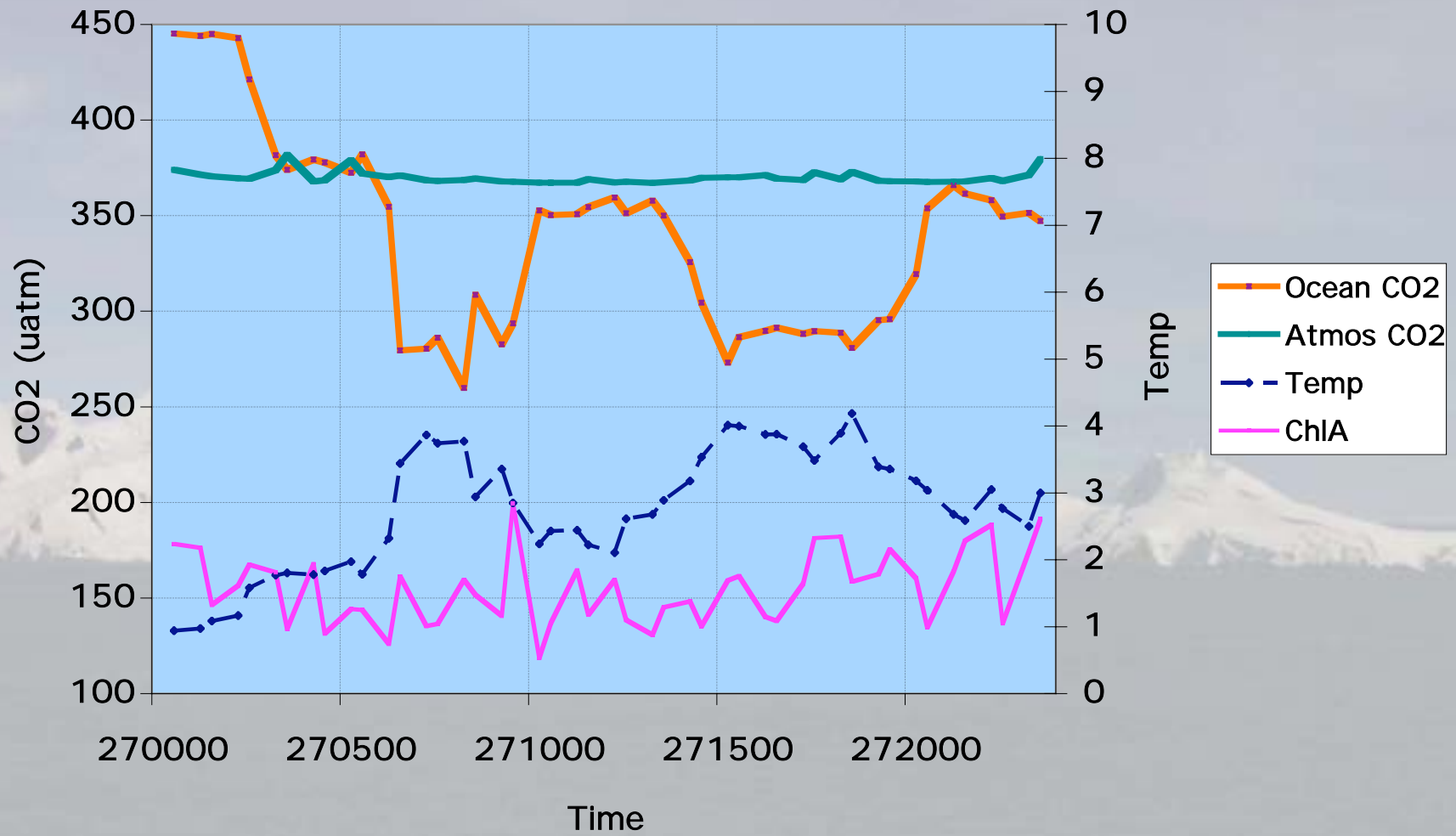
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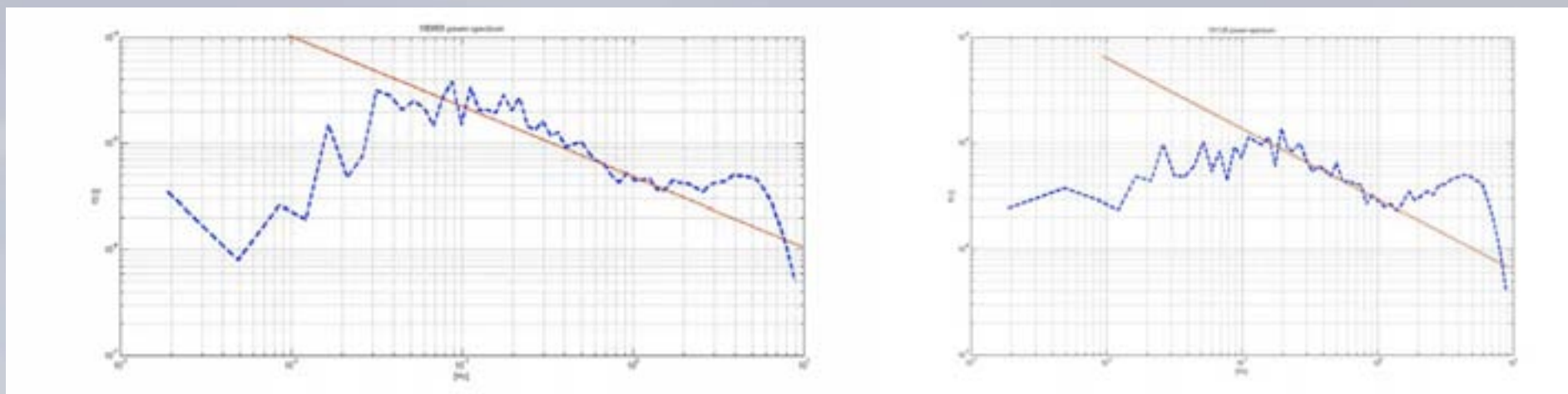
dpCO2 Antarctica

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micromet Fluxes



Discussion/Conclusions

- Arctic/Antarctica which is the larger sink.

(high wind speeds in the fjordsystems can cause high transfer velocity in Greenland)

- Upwelling areas in the polarfront can cause high emissions at Antarctica

(Upwelling areas can explain some of the CO₂ emissioner we see in the Antarctica. Detailed study on the upwelling areas and their CO₂ emissions are needed)

- k values.....