



Estimates of net ecosystem exchange using measurements from two continuous CO₂ analysers

V. Sherlock, D. Smale, A. Mc Millan, B. Stephens, G. Brailsford

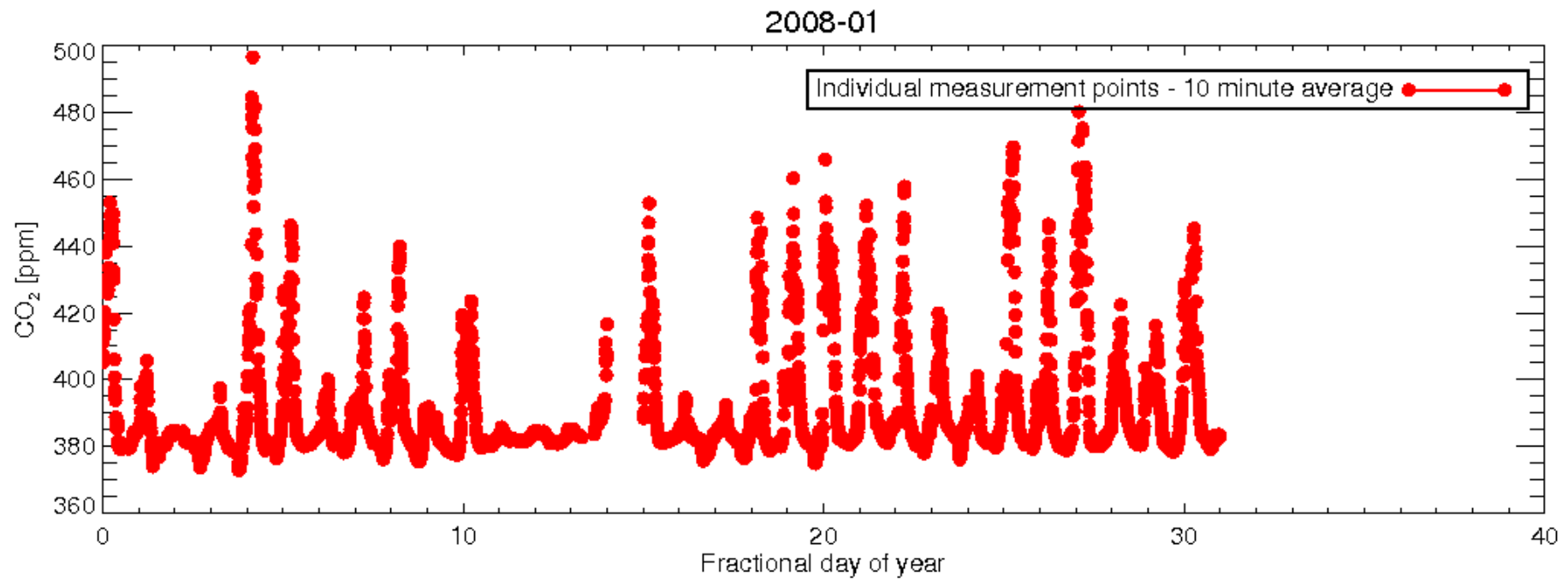
M. Kotkamp, A. Gomez, R. Moss, M. Harvey

National Institute of Water and Atmospheric Research

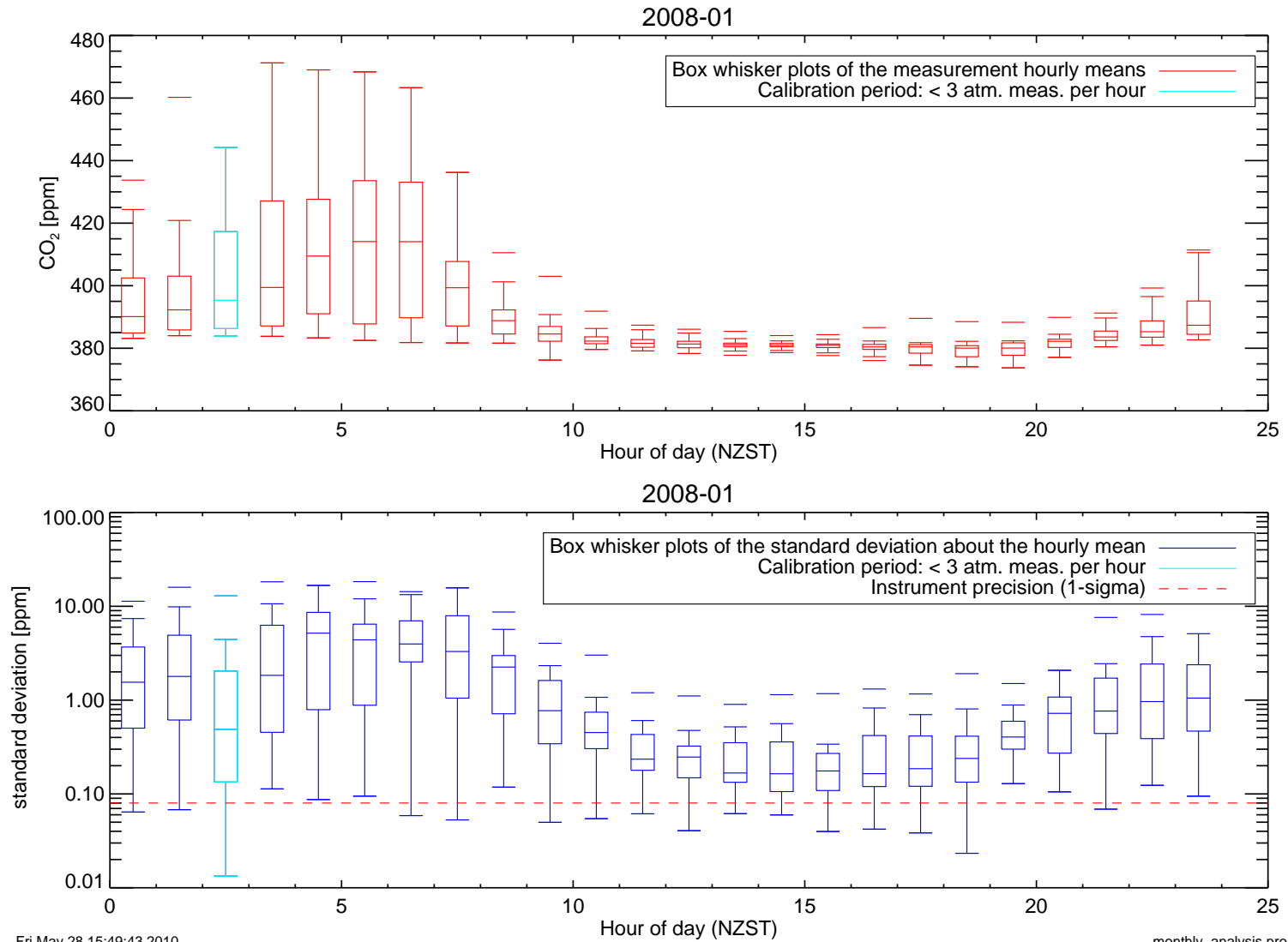
Overview

- interpreting the Lauder continuous analyser data to generate a timeseries of concentrations in a well-mixed PBL
- comparison with measurements from the NZ clean air monitoring station at Baring Head
- comparison of the LDR-BHD difference with the timeseries of the MODIS Enhanced Vegetation Index (EVI) at the Lauder site
- back-of-the envelope estimates of net ecosystem exchange (NEE)
- conclusions

Raw IFTS timeseries



Monthly diurnal cycle



New Zealand surface trace gas monitoring sites

continuous analysers

- Baring Head

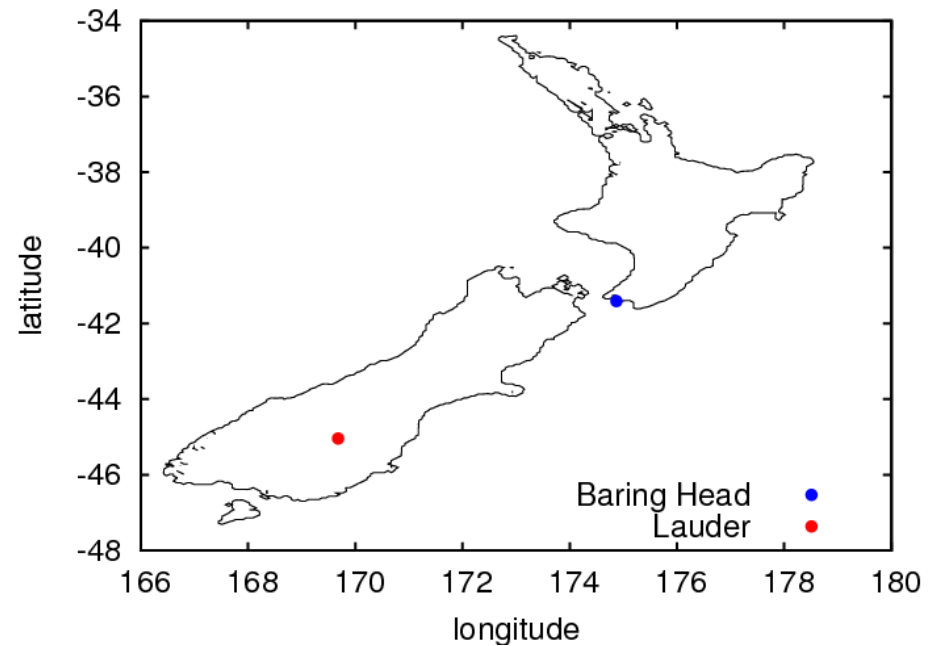
NDIR CO₂

steady interval data

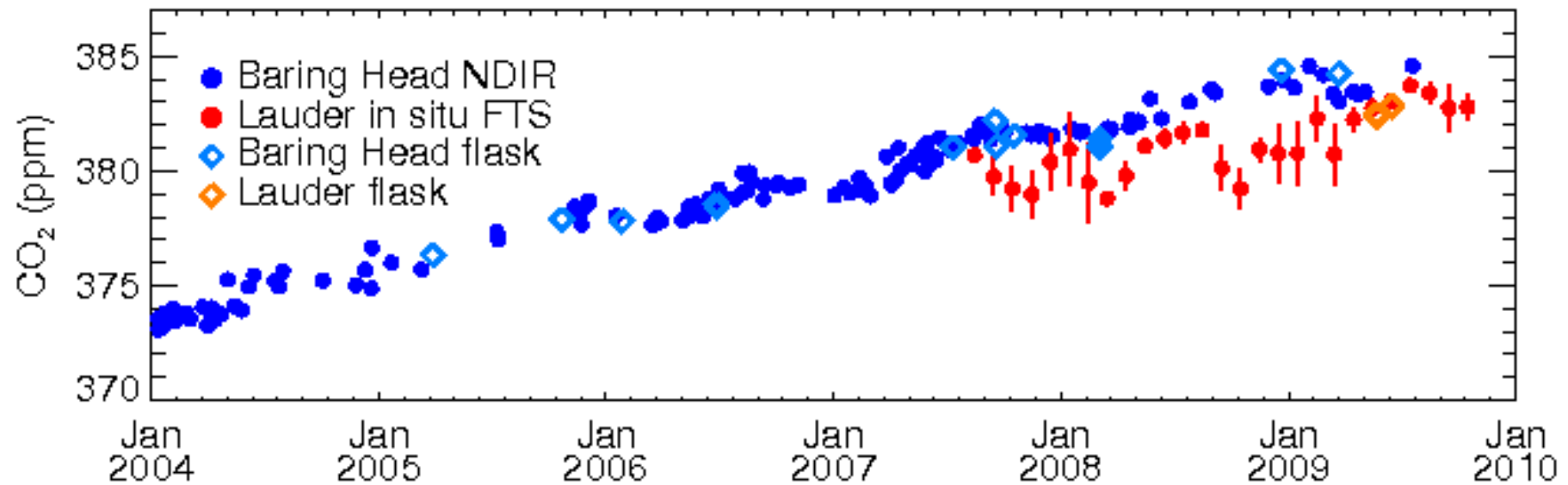
- Lauder

IFTS CO₂, CH₄, N₂O, CO

regionally representative data

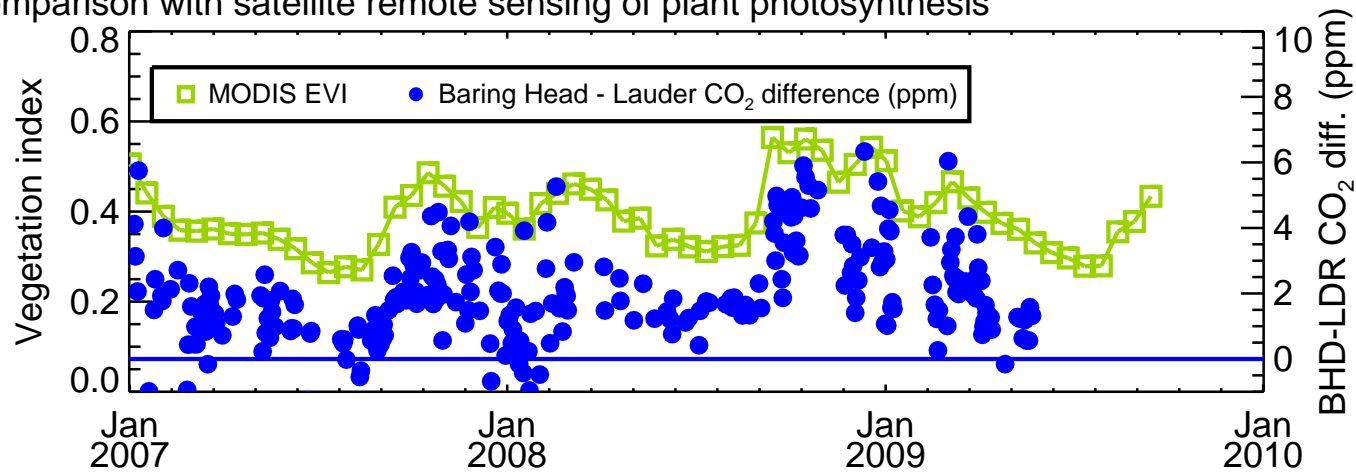


Comparison of IFTS regional timeseries with Baring Head steady interval data

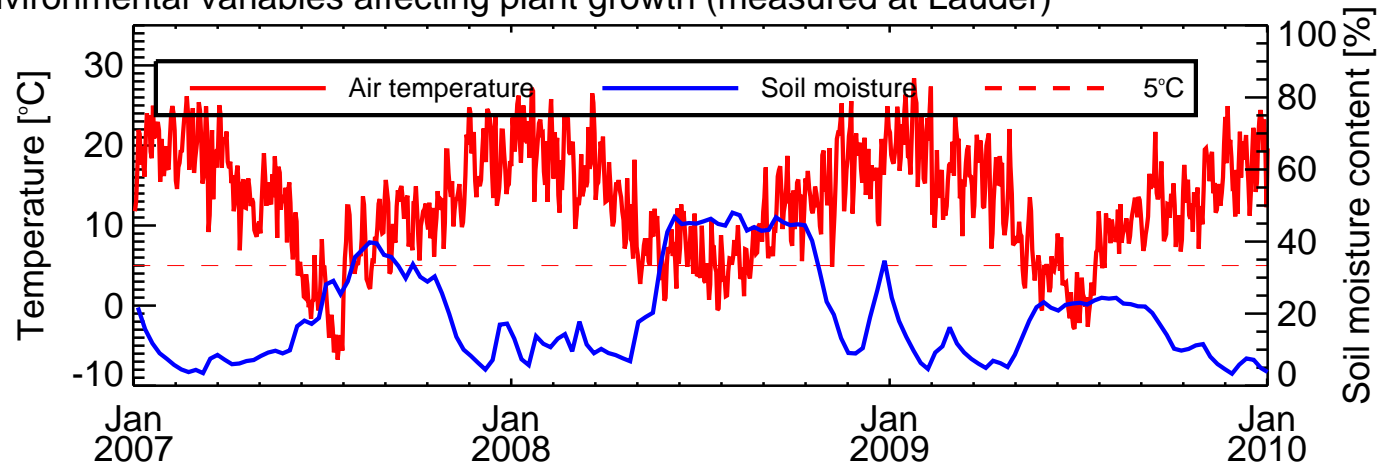


Comparison of ΔCO_2 and MODIS EVI

Comparison with satellite remote sensing of plant photosynthesis



Environmental variables affecting plant growth (measured at Lauder)



Estimating net ecosystem exchange

Back of the envelope in situ analyser estimate
in $\mu\text{mol}/\text{m}^2/\text{s}$:

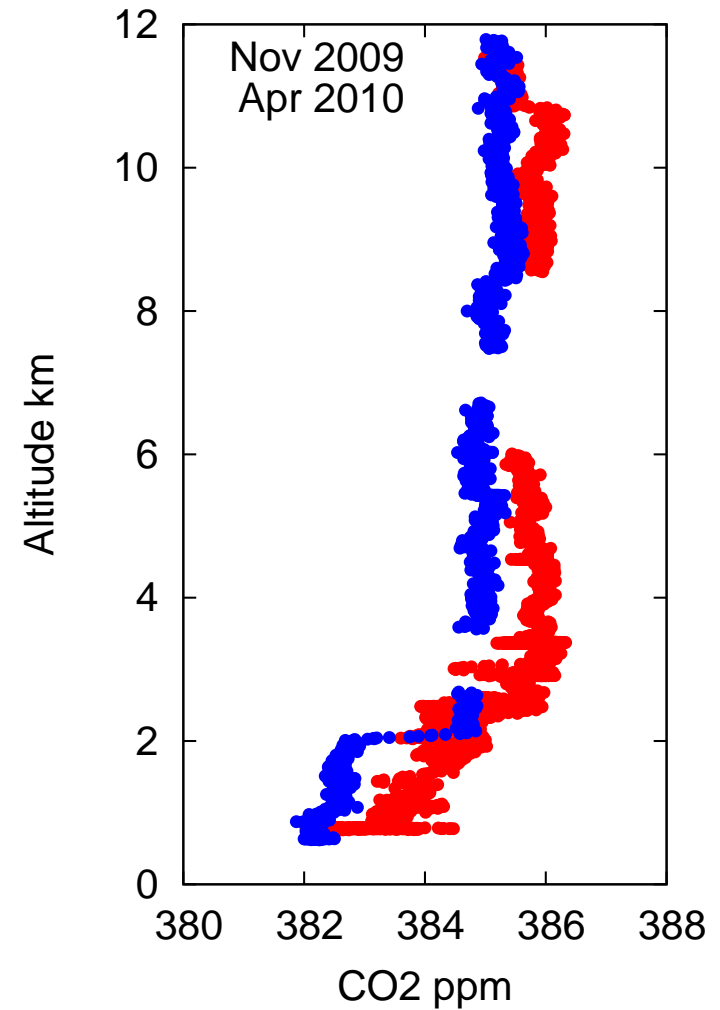
$$\text{NEE} \sim (C_{\text{bg}} - C) \frac{P}{RT} \frac{z_{\text{pbl}}}{\tau} \quad (1)$$

MODIS estimate:

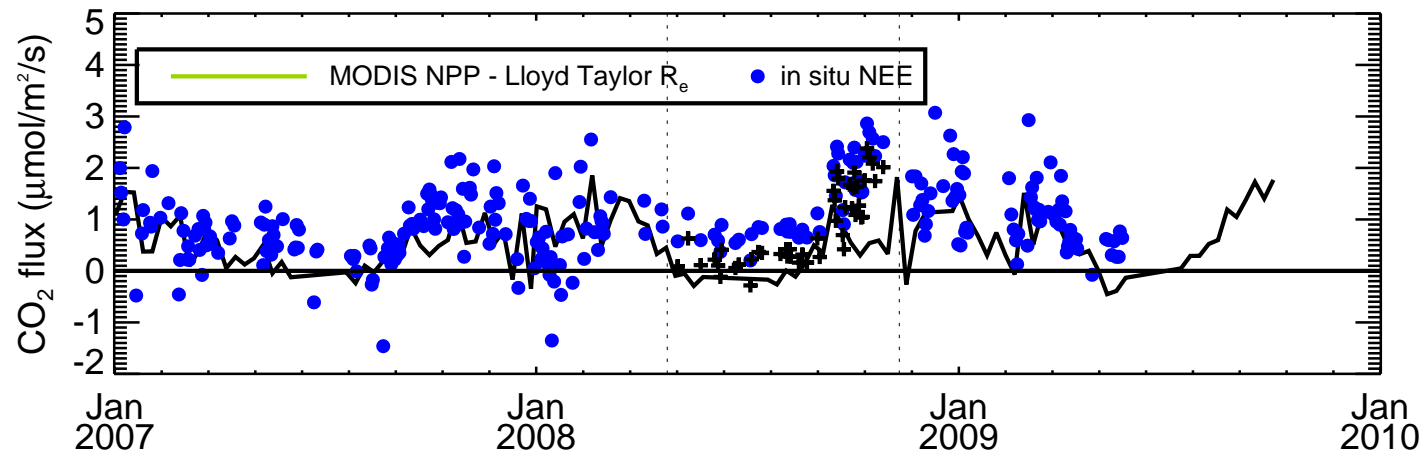
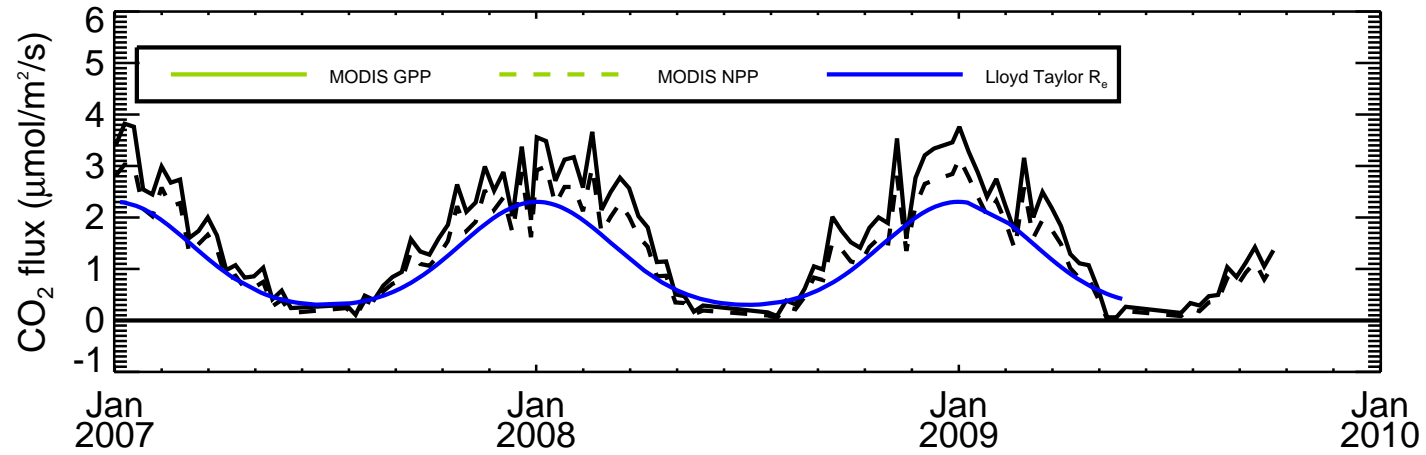
$$\text{NEE} \sim \text{GPP} - (R_a + R_h) \quad (2)$$

Lloyd-Taylor parameterisation of soil respiration:

$$R_h = R_{10} \exp\left(E_0 \left(\frac{1}{a} - \frac{1}{T-b}\right)\right) \quad (3)$$



NEE inferred from in situ measurements and MODIS NPP



Conclusions

- carbon cycle
 - likely environmental factors controlling plant photosynthesis drive much of the seasonal and interannual variability in LDR-BHD difference
 - soil respiration term is large, but poorly known: should we be doing more to measure it?
 - * chambers
 - * flux gradient estimates of nighttime respiration
 - * eddy covariance measurements
- improving on the back of the enveloped NEE estimate
 - high resolution Lagrangian back-trajectory analysis
 - assimilation of NZ continuous analyser data in CarbonTracker Australasia (Sara Mikaloff-Fletcher, NIWA)