Arcturus, Queensland: An Introduction

Ivan Schroder

Acknowledgements

Australian Government

Geoscience Australia

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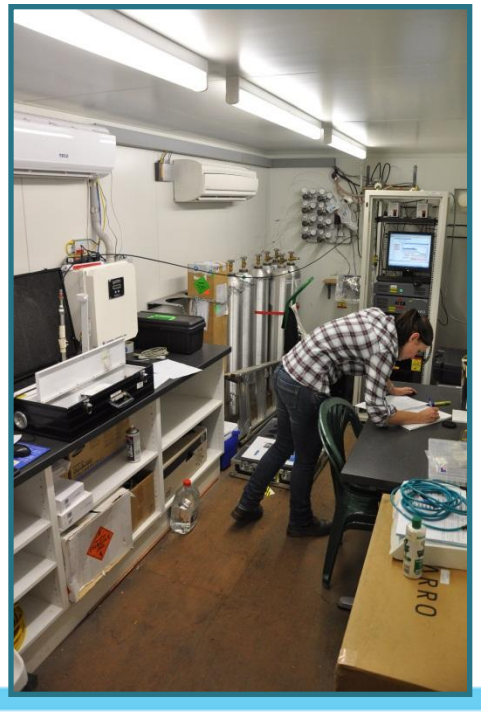
- Zoe Loh
- David Etheridge

We are voluntary contributors to OzFlux/TERN

Arcturus: Semi-arid cropping and grazing

Arcturus, Central Queensland, Australia

GHG atmospheric monitoring station



Purpose

Baseline greenhouse gas monitoring station established July 2010

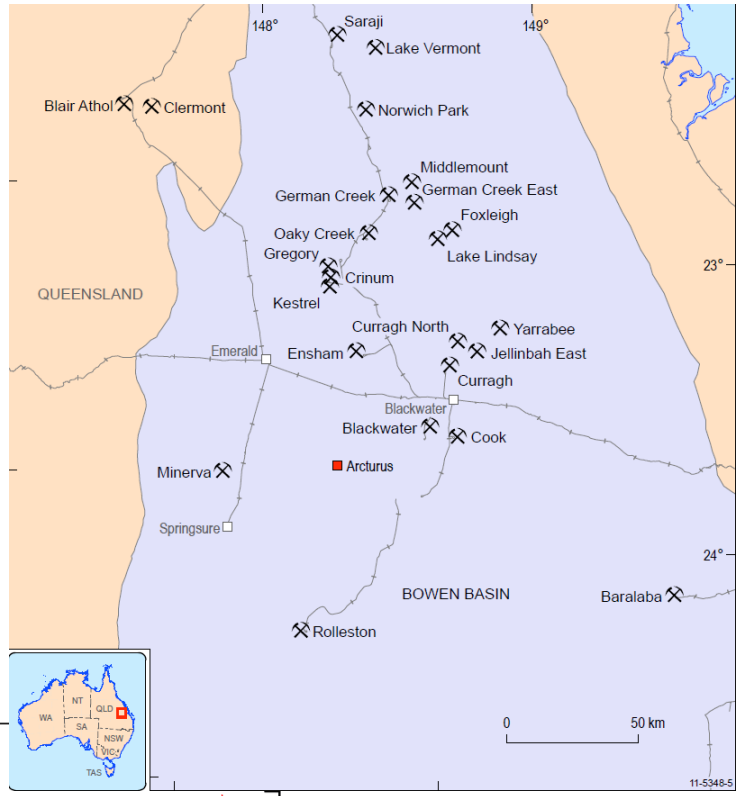
(EC established April-June 2011)

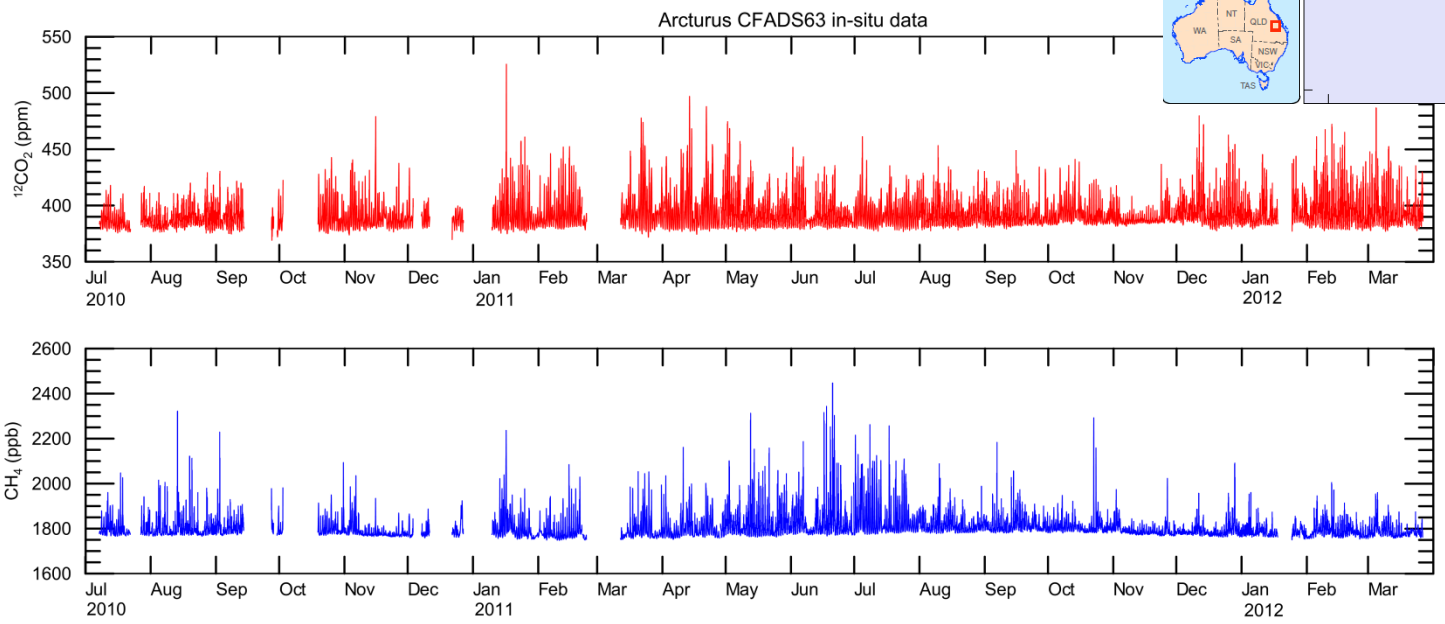
Collaborative project between Geoscience Australia and CSIRO Marine and Atmospheric Research (CMAR)

- Established in a high priority geological storage CO_2 region
- Field test newly developed GHG monitoring technology
- Demonstrate best practice for regional baseline atmospheric monitoring for geological CO_2 storage
- Container: gas analysers continuously monitor GHGs and CO_2 isotopes (CH_4, H_2O, CO_2, ^{12}C and ^{13}C)
- EC to compliment these measurements

Purpose

- Moving to coal mine emission quantification
- Significant coal mining in the Bowen Basin
- Focus on fugitive CH_4 emissions



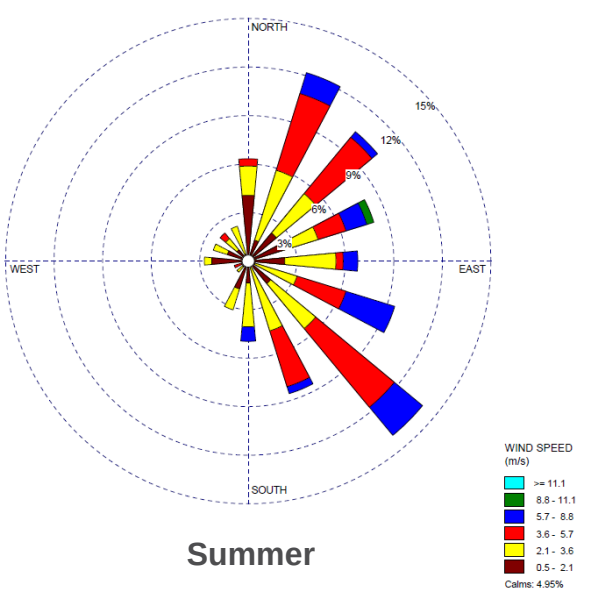


Site Characteristics

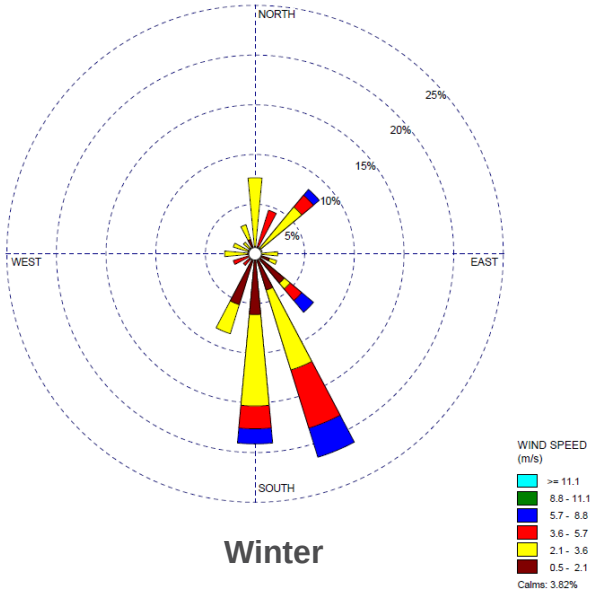
- 48 km southeast of Emerald, QLD
- EC site 250 m south of GHG container
- Cropping to the east (chickpeas)
- Pasture to the west (cattle)
- Summer wet, winter dry season
- 170 m above sea level
- Mean annual precipitation 572 mm

Site Characteristics

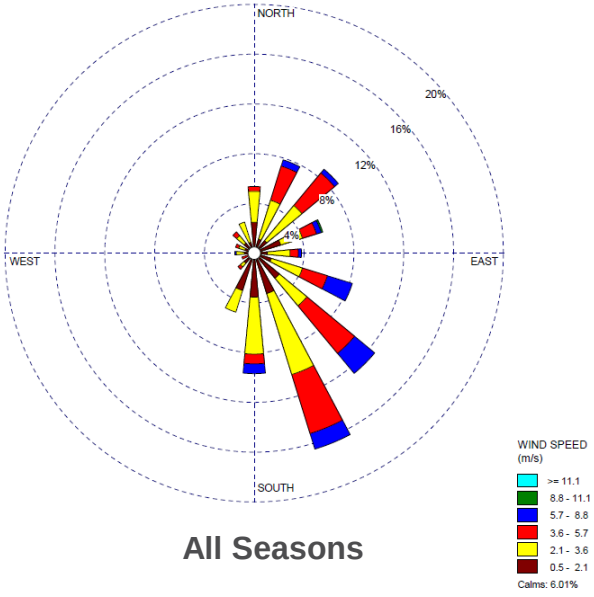
- **Predominant wind directions:**
  - South-south East, South East
- **Nearest BOM stations:**
  - Arcturus Downs 20 km South
  - Wyntoon 17 km West



Summer



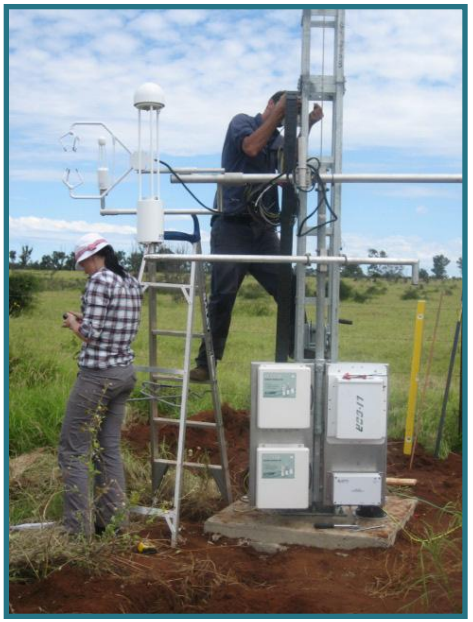
Winter



All Seasons

Tower Installation (April – June 2011)

- **Tower:**
  - Steel construction with winch system
- **Sensor direction:**
  - South-south East (predominant annual wind direction)
- **Measurement heights:**
  - CSAT3 and Li7500A: 6.7 m
  - Radiation: 6.7 m
  - 2D wind speed/direction: 6.9 m
  - Temperature/RH: 6.4 m
  - Ground heat flux: 5 and 10 cm
  - Soil temp: 2.5, 5 and 15 cm
  - Soil moisture: 5, 15, 22 and 30 cm



Tower Installation (April – June 2011)

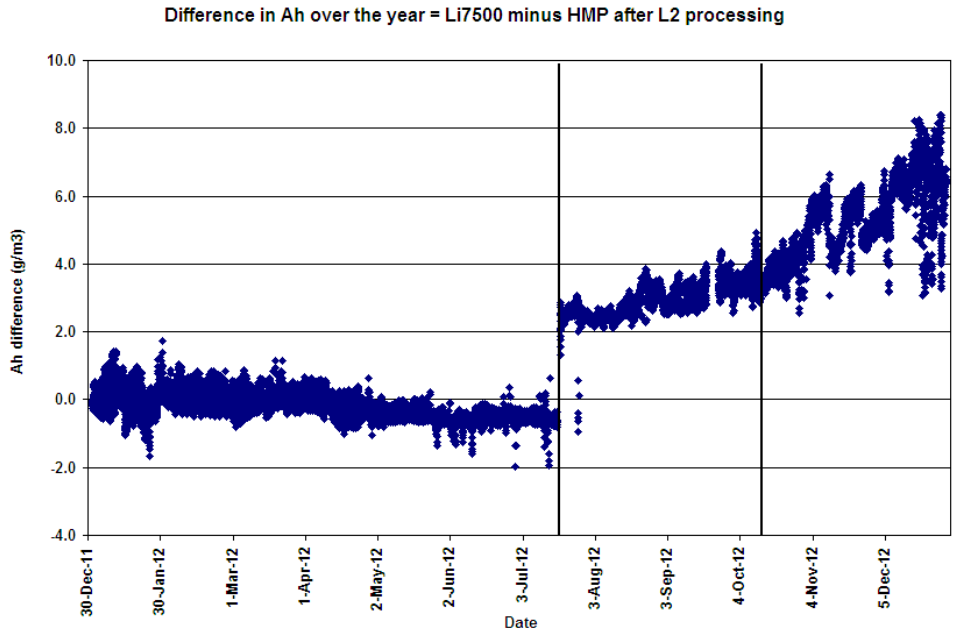
- **LI-7700 CH_4 sensor installed but still not recording!**
- **Telecommunications:**
  - Direct Wifi connection to container for storage of 10Hz & 30 min data
  - Data automatically downloaded to CSIRO server daily
- **Power:**
  - 240 W Solar panel with 2 batteries

Data Processing

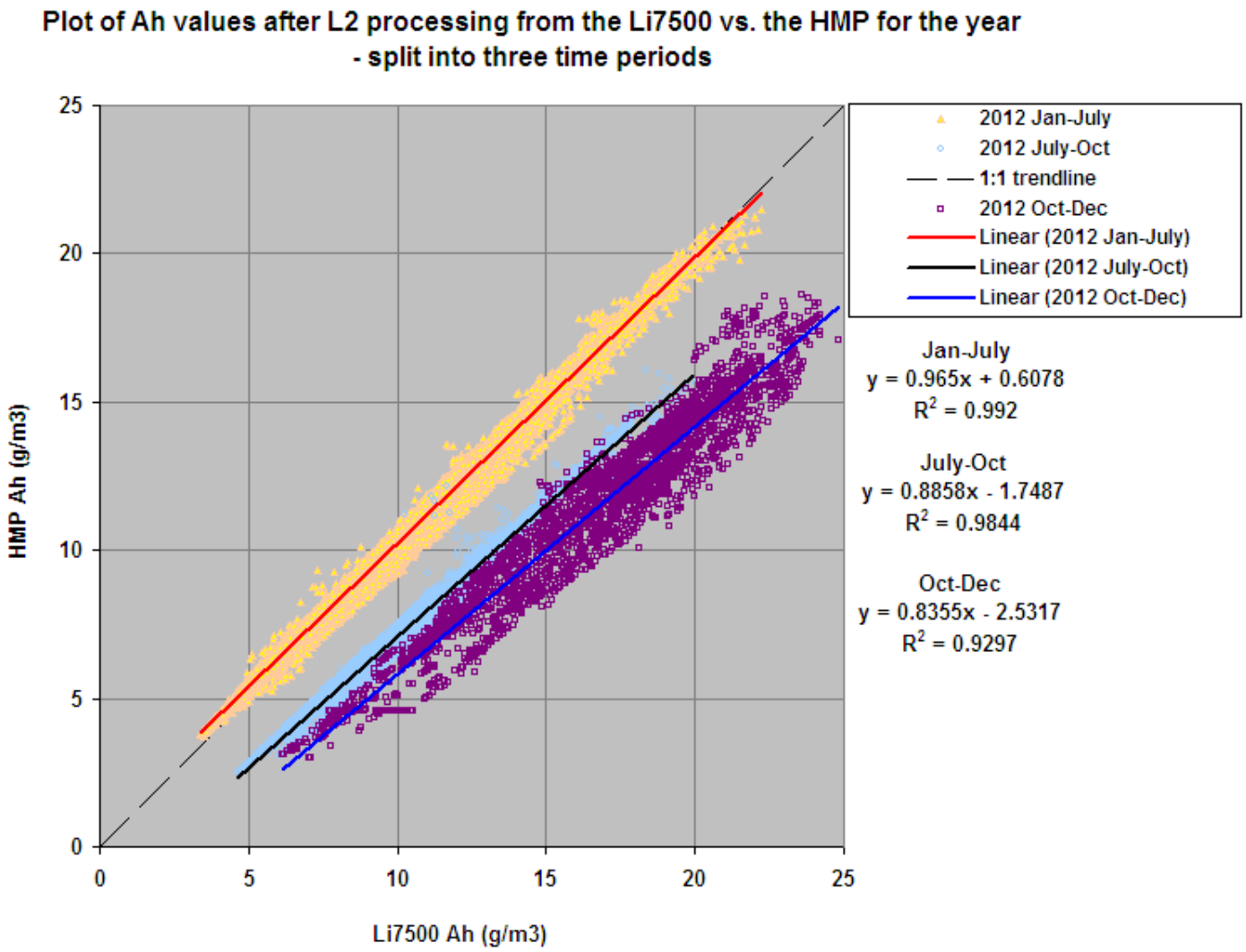
- **Currently have ~2 years of EC data from 10 June 2011**
- **Processing method used:**
  - OzFlux v2.5
  - Has been reprocessed up to Level 3
  - No gap-filling applied yet
- **Loaded to the OzFlux Data Portal every 3-4 months**
  - Waiting on lab calibrations for final corrections to Li7500A data before submission of reprocessed data to portal

Li7500A problems

- **Our Li7500A was behaving markedly different to replacement CSIRO sensor**
  - Sensor drift a major problem and source of uncertainty
  - In 2013 were getting drop-outs at high T's
- **Applied linear corrections to correct H_2O measurements**
- **The effect on CO_2…?**

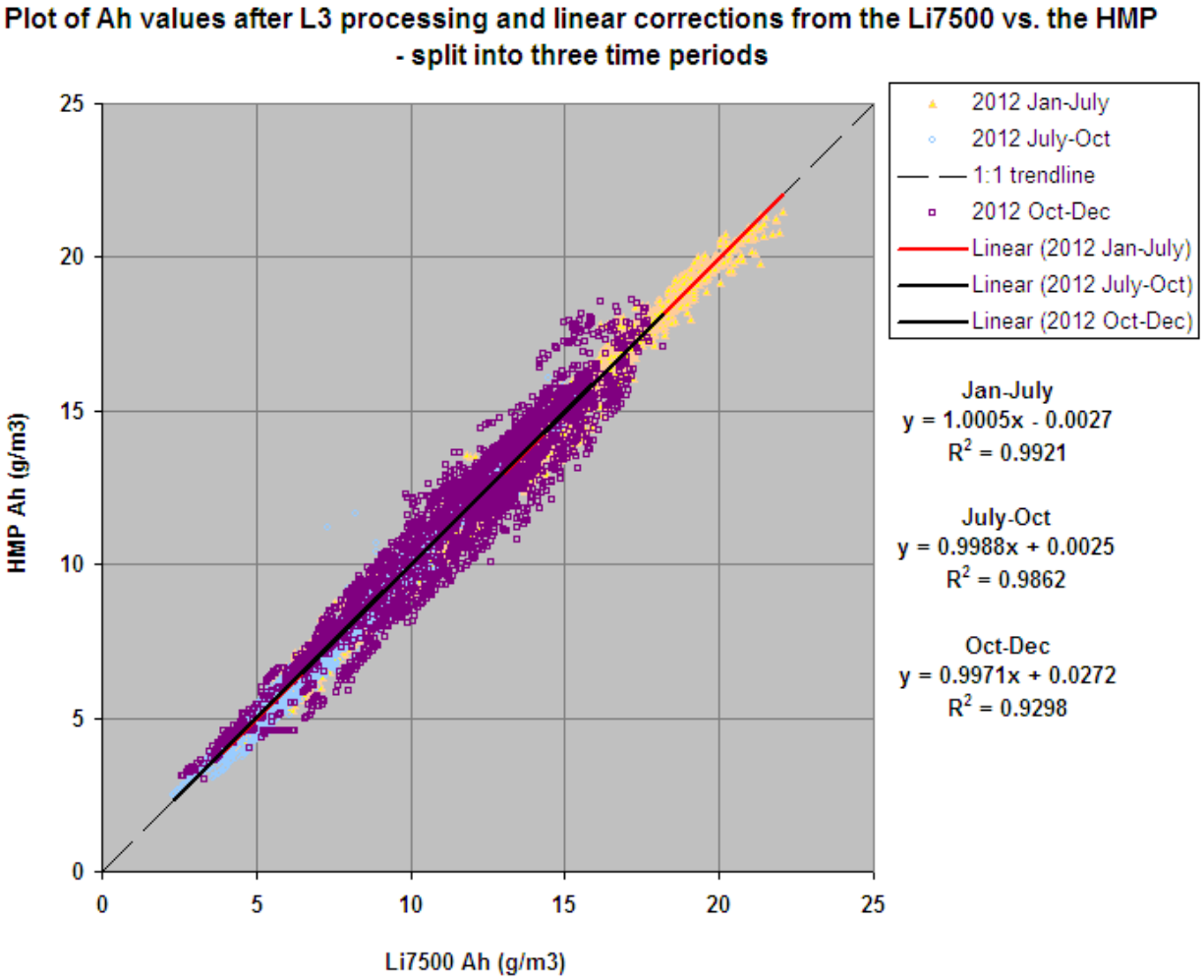


Li7500A problems

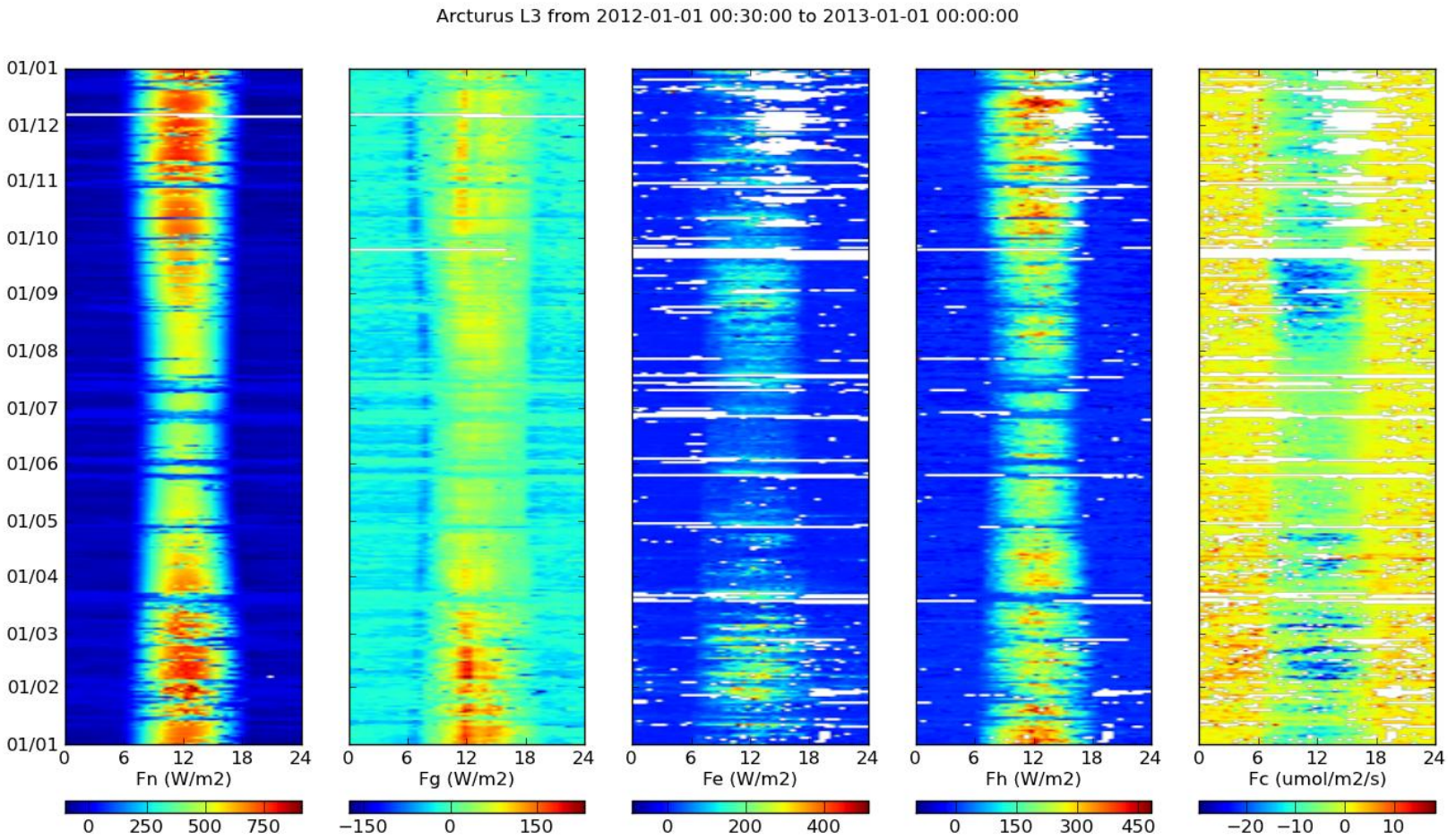


Li7500A problems

- Linear corrections account for most of sensor drift in H_2O
- Sensor problem identified as being in winter mode
- Instrument calibration coefficients assume summer mode

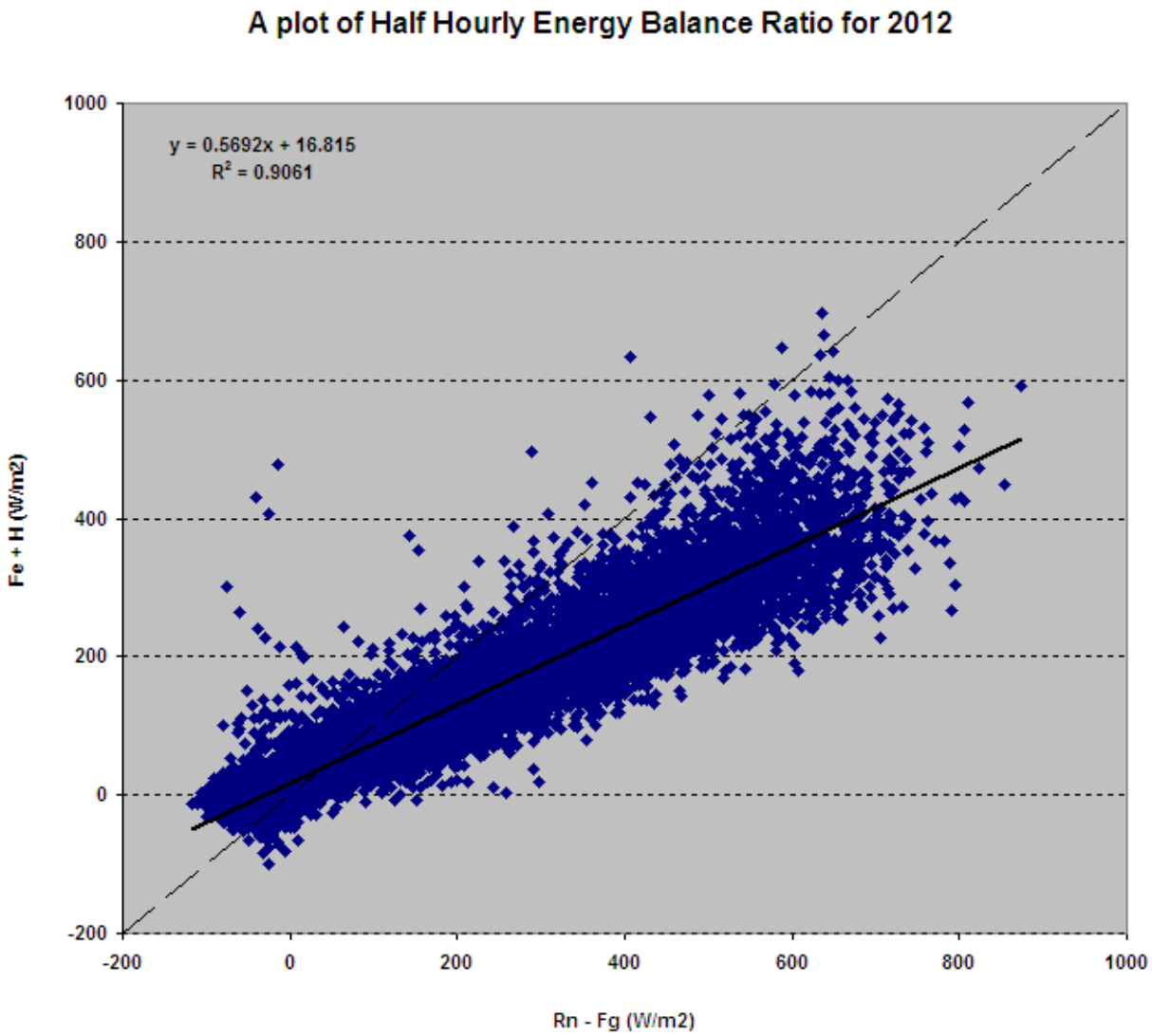


Preliminary Results: Energy Balance

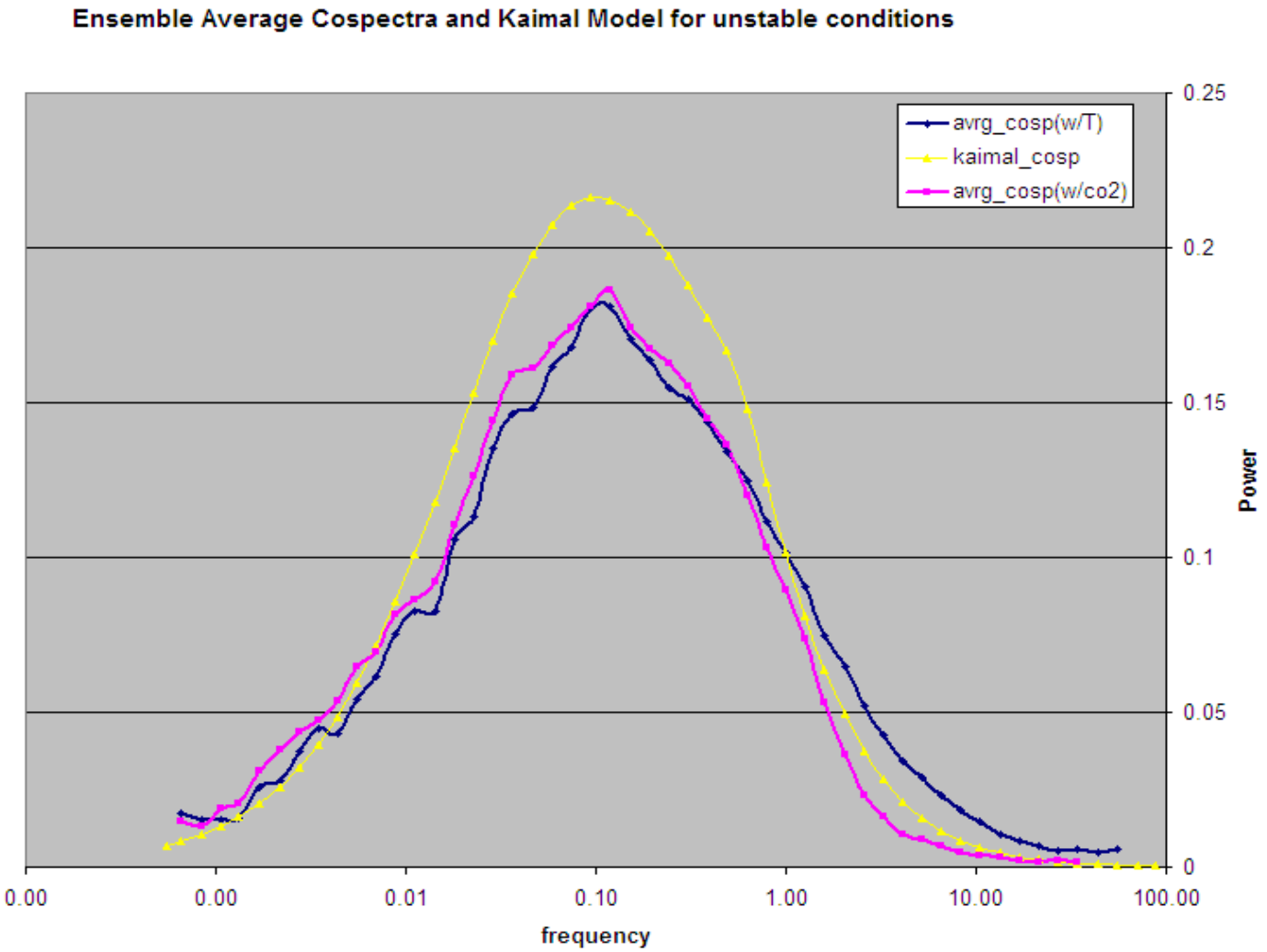


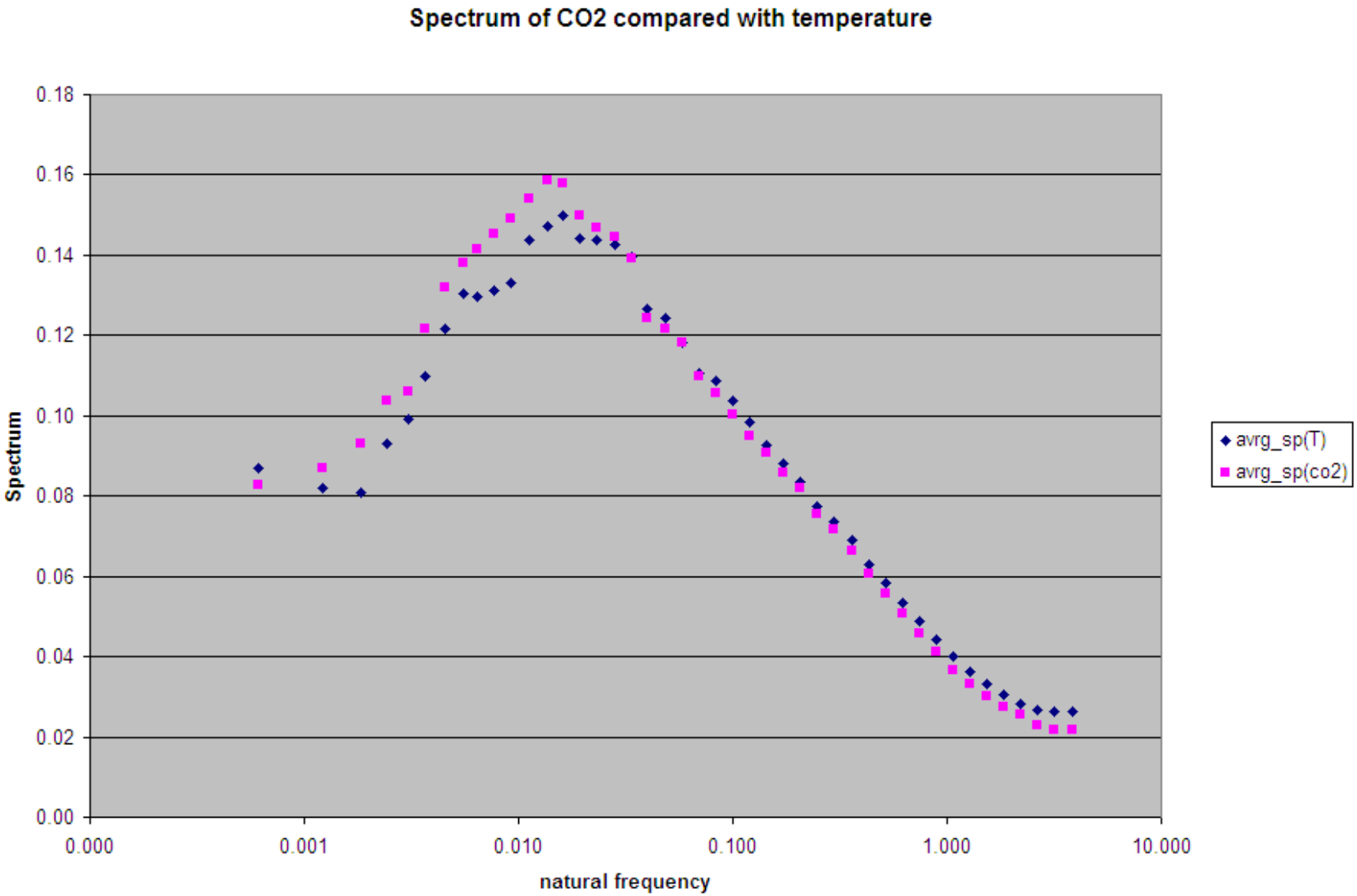
Energy Balance

2012 Energy Balance Ratio = 0.704

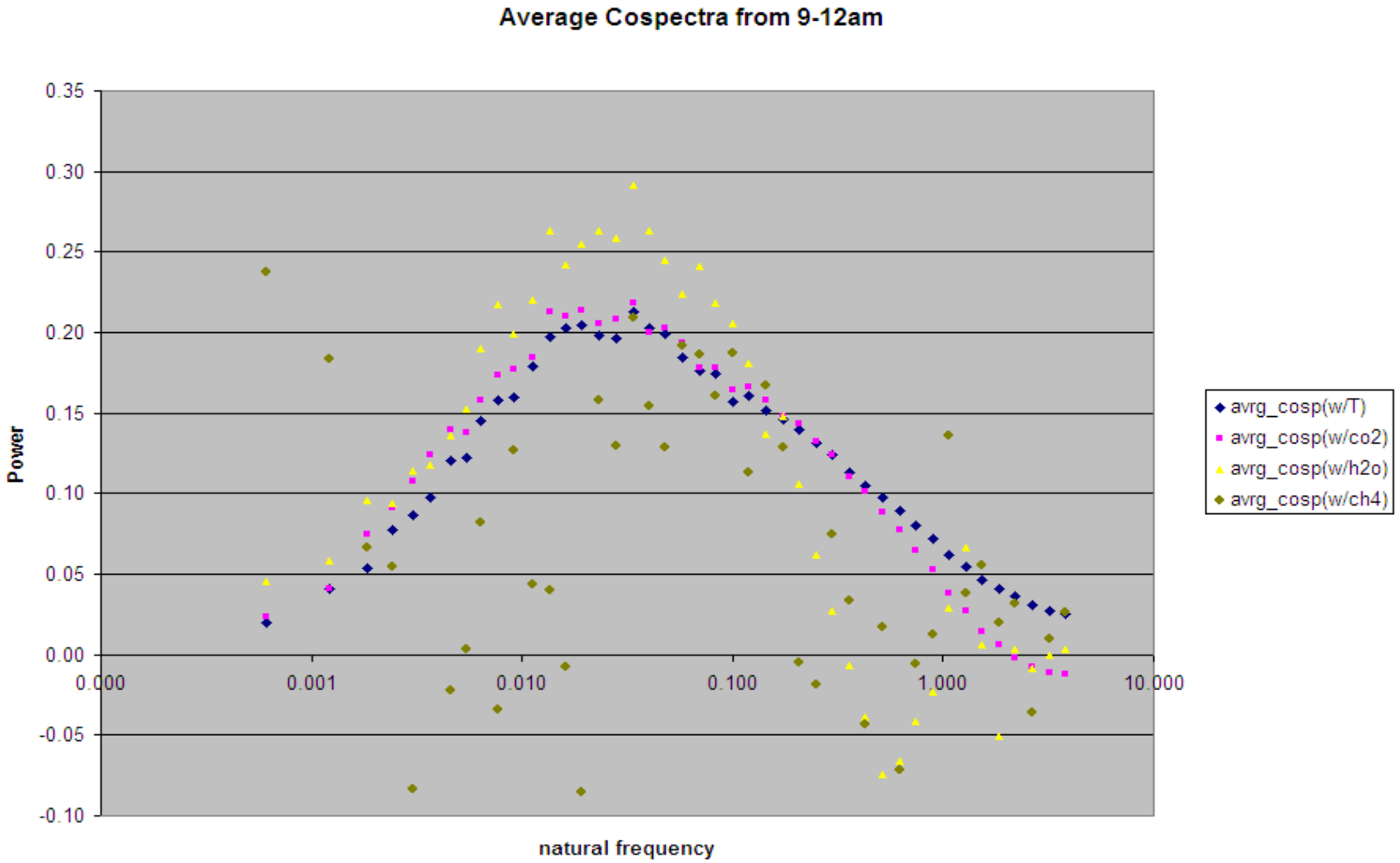


Preliminary Fast Data Analysis





Good agreement in spectra and cospectra



CH_4 cospectrum variable, grouped around zero

H_2O cospectrum drops off at high frequencies

Where to next?

- Obtain calibration coefficients for the Li7500A winter mode and correct H_2O/CO_2
- Get the LI-7700 reinstalled and working to pursue CH_4 fugitive emission studies
- Test and assess the suitability of gap-filling methods for our data

Australian Government
Geoscience Australia

Discussion and suggestions

Ivan Schroder

Phone: +61 2 6249 9741
Web: www.ga.gov.au
Email: ivan.schroder@ga.gov.au
Address: Cnr Jerrabomberra Avenue and Hindmarsh Drive, Symonston ACT 2609
Postal Address: GPO Box 378, Canberra ACT 2601