A Day In The Life Of A Flux Station

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OzFlux09

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Overview

What is a flux station?

Quick look at the Tumbarumba, Virginia Park, Padthaway and Otway stations

Details of the Tumbarumba station

A typical day at RFS Tumb

Data streams

What is a flux station?

A flux station comprises a core collection of instruments that measure:

- CO_2 and H_2O concentrations in air (20Hz)
- 3-D wind vector (20Hz)
- Net radiation (15 min average)
- Incoming and reflected longwave & shortwave radiation (15 minute average)
- RH and air temperature (15 minute average)
- 2-D wind speed and direction (15 minute average)
- Soil temperature (15 minute average)
- Soil heat flux (15 minute average)
- Rainfall

What is a flux station?

Optional instrumentation:

- Soil moisture profile (TDR, capacitance)
- CO_2 and H_2O concentration profiles through & above canopy
- Temperature profile through & above canopy
- Spectrometer (plant canopy reflectance spectra)
- Particle counter (VOC's, dust)
- Gas isotope measurements
- Etc., etc., etc.

The primary limitations on adding instrumentation are:

- Power requirements
- Sanity of those looking after the instruments and collected data

What is a flux station?

A flux station measures the surface flux of CO_2 and H_2O using eddy correlation.

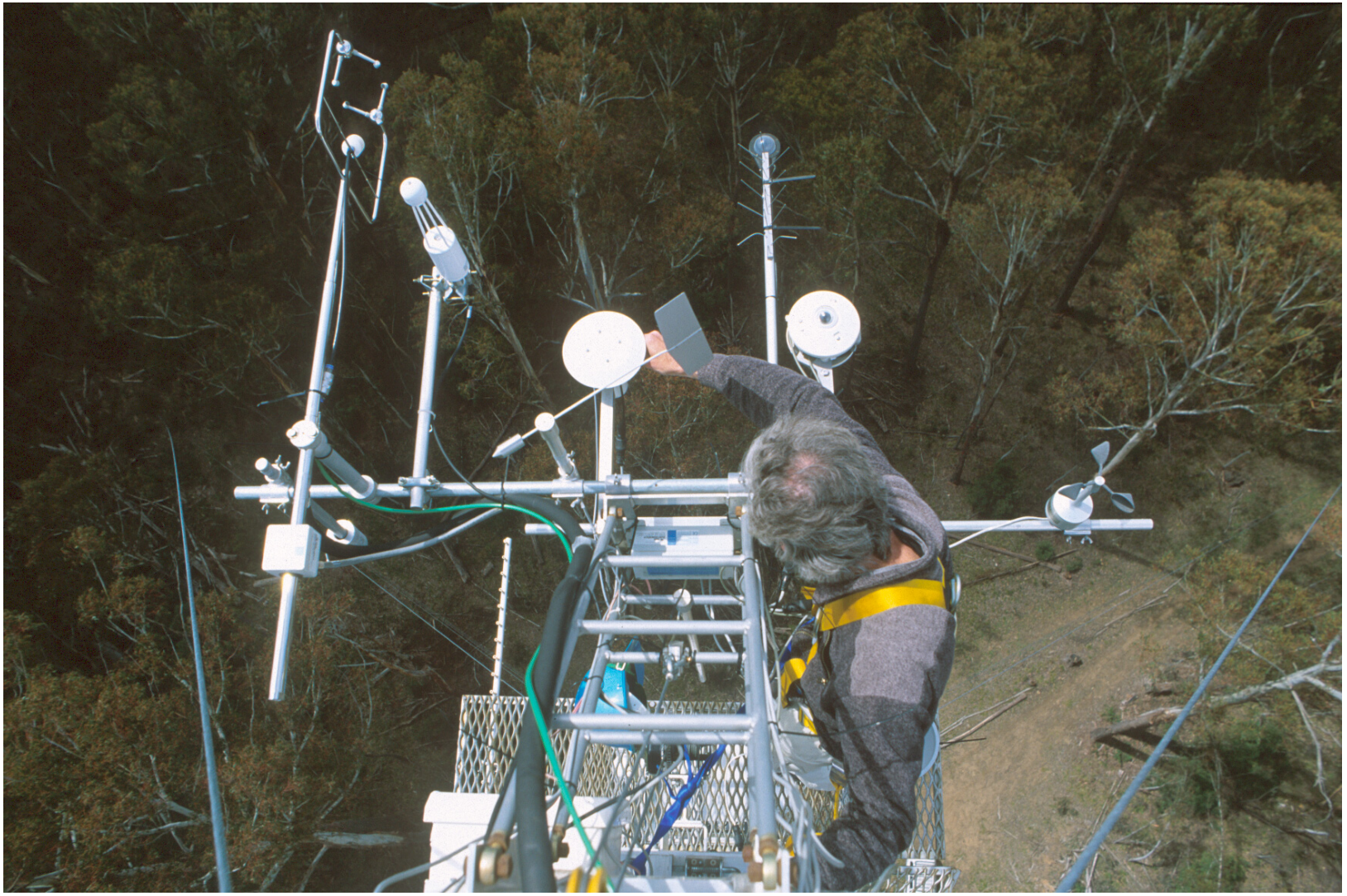
Fluxes are calculated by correlating 3-dimensional air movement with changing concentrations of CO_2 and H_2O.

PyeLab flux stations use a Gill 3-D sonic anemometer to measure wind vector and a Licor 7500 open path IRGA to measure CO_2 and H_2O concentrations (20Hz).

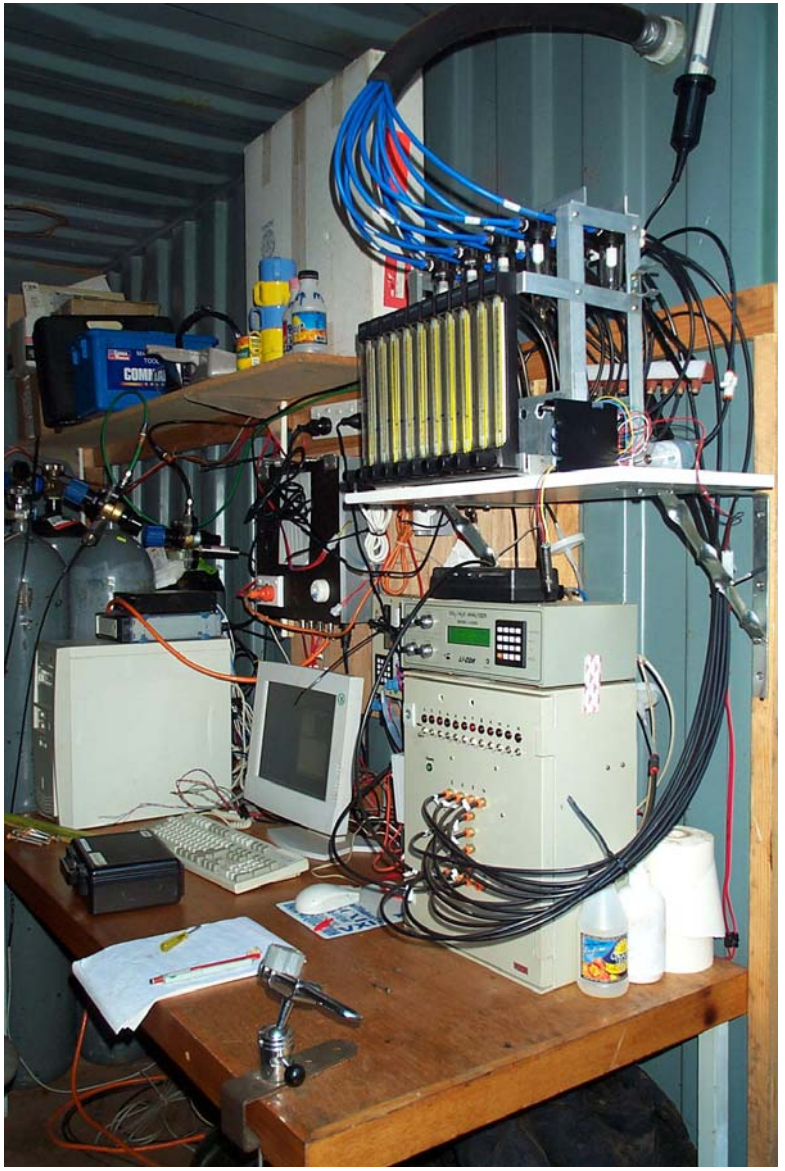
Fluxes of CO_2 and H_2O calculated using software developed in-house.

Tumb mast

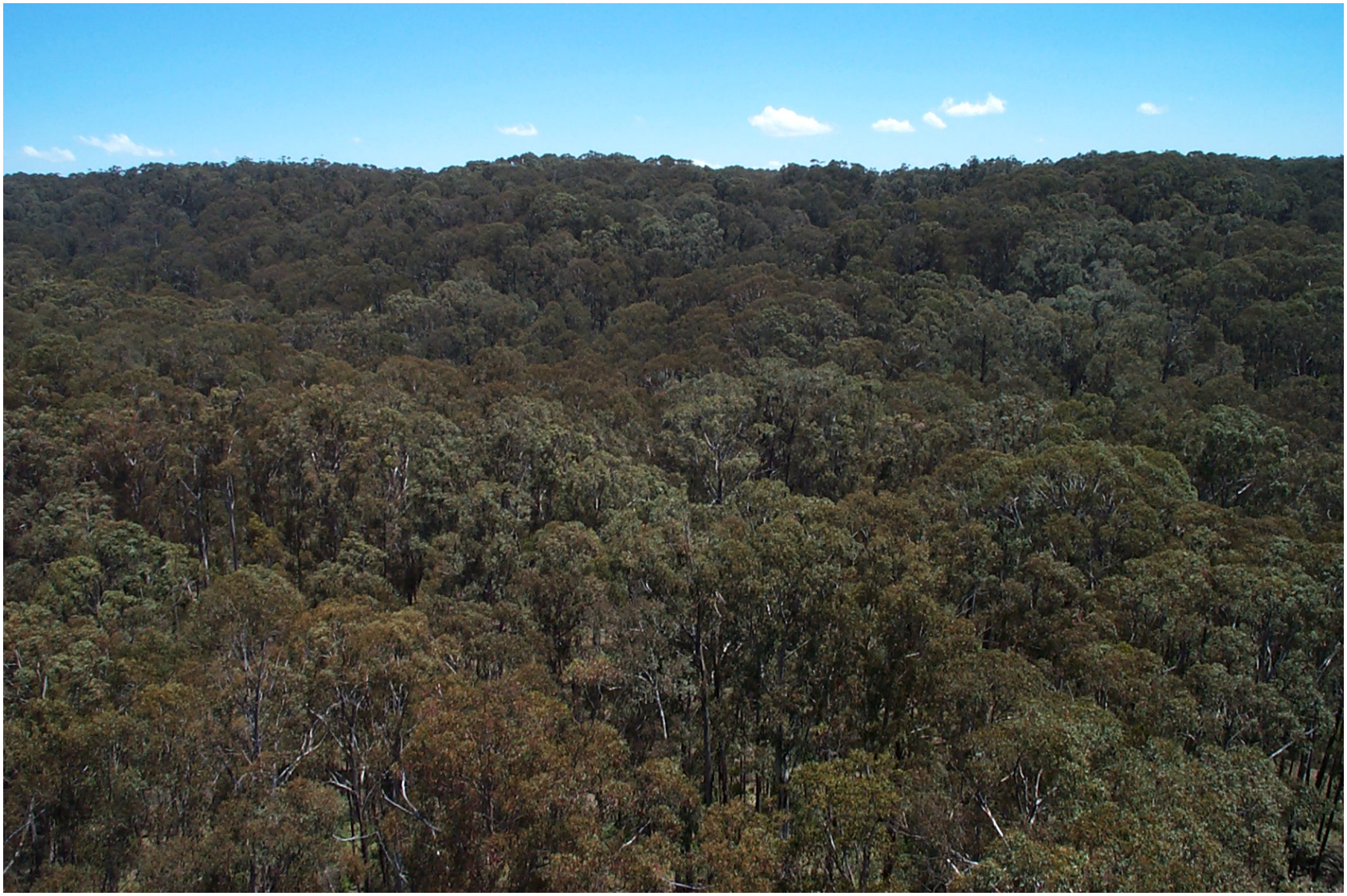
Tumb mast instruments



Tumb containers



Tumb landscape



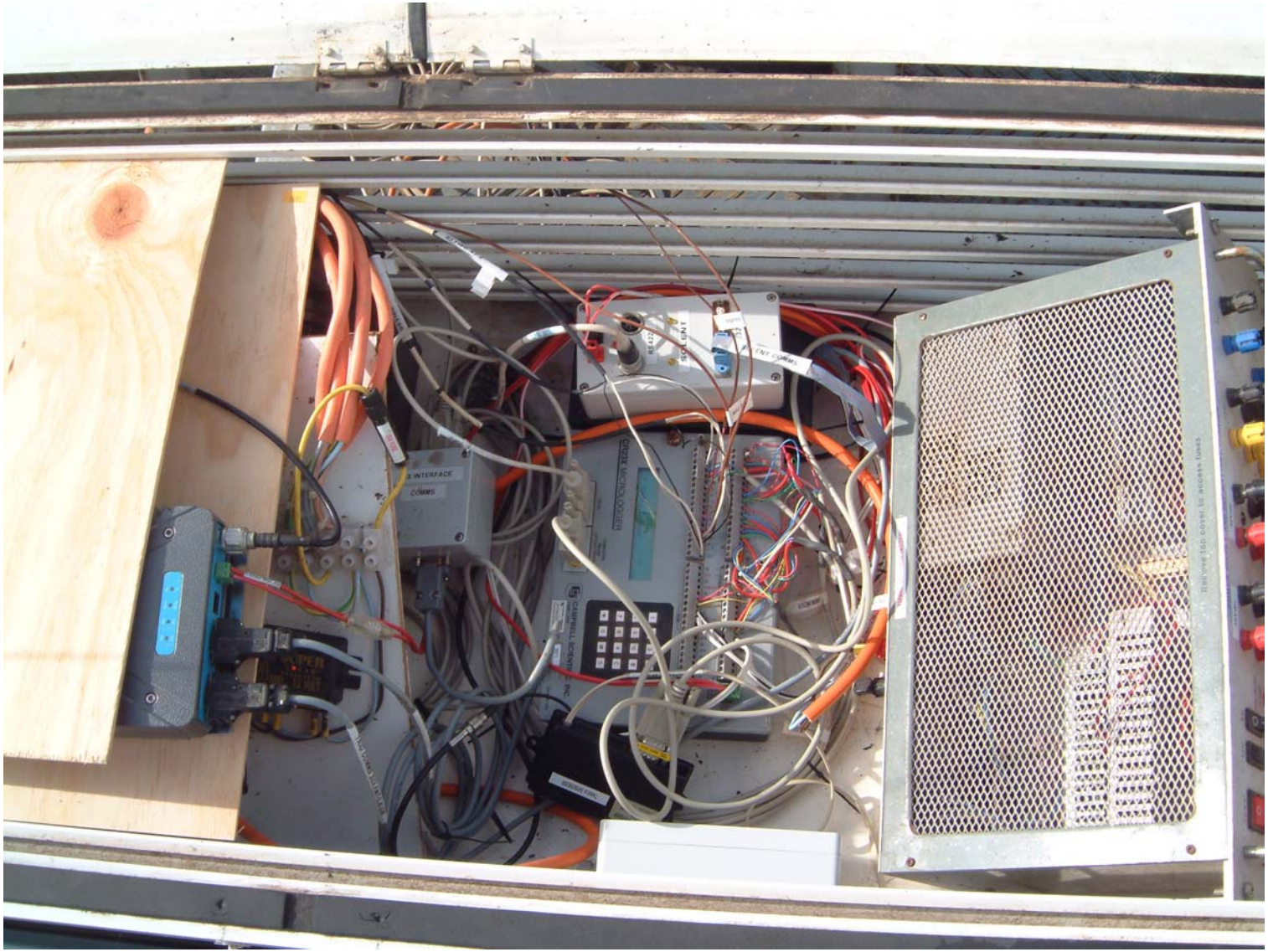
ViPa site

ViPa landscape

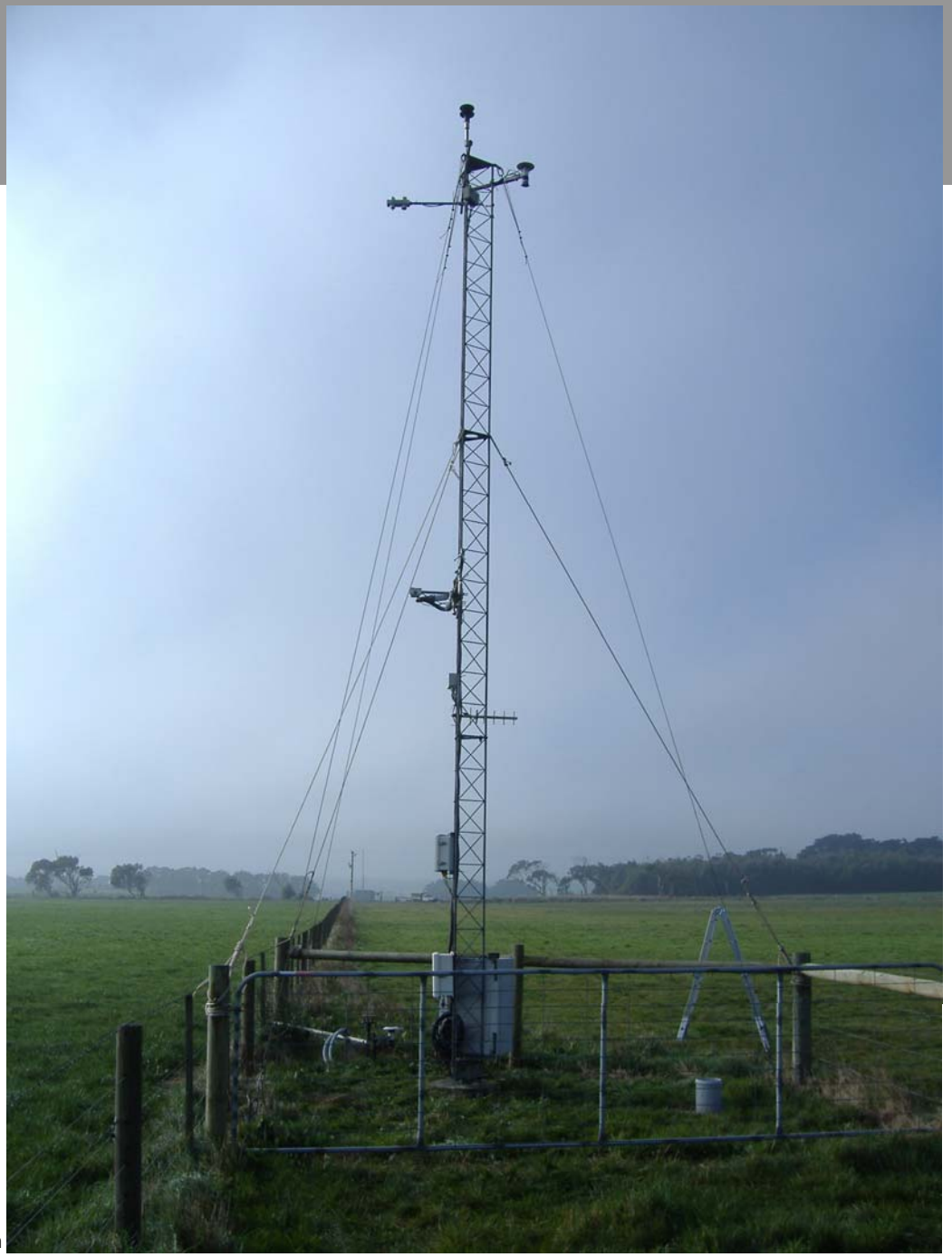
Pady mast lowered

Pady mast raised

Pady white box



Otway site

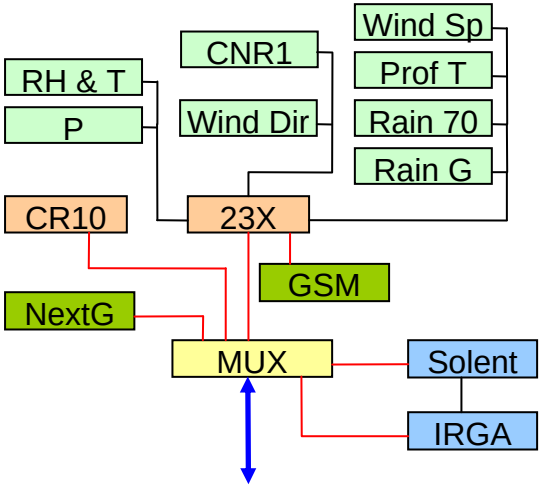


Otway fog

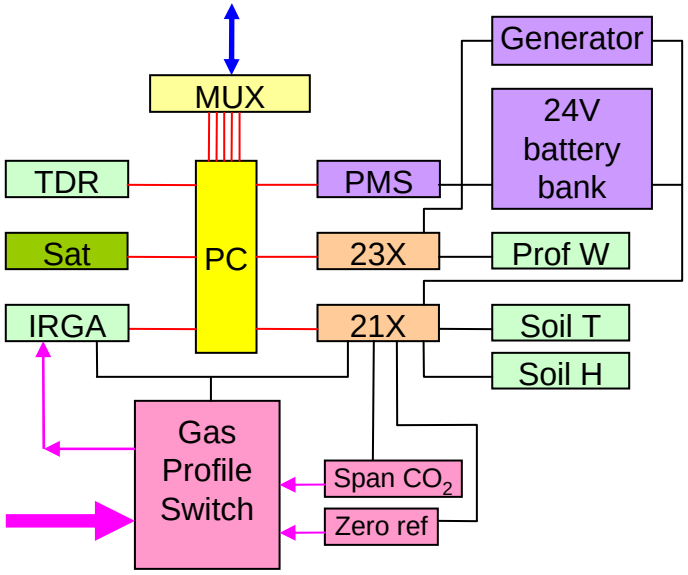
Otway – view to south

Tumbarumba flux station schematic

Mast Instruments



Ground Instruments



ADITLOAFS – midnight (1)

At midnight RFS Tumb is:

- Processing the previous hour “fast” data to calculate the flux of CO_2 and H_2O
- Measuring the profile concentrations of CO_2 and H_2O:
  - 9 heights between 0.5m and 70m
  - 25 second sampling at each height
- Measuring the temperature profile (thermocouples):
  - 9 heights between 0.5m and 70m
  - 1 second samples and 15 minute averages
- Measuring wind vector profile (Gill 2-D sonic anemometers):
  - 8 heights between 0.5m and 70m
  - 1 second samples and 15 minute averages

ADITLOAFS – midnight (2)

- Recording 15 minute averages of
  - Air temperature
  - Relative humidity
  - Wind speed and direction
  - Net radiation, long & shortwave (incoming & reflected)
  - Soil temperature
  - Soil heat flux
- Recording cumulative rainfall during 15 minute period
- Preparing to measure soil water profile (TDR, 16 probes) – hourly
- Monitoring 24V battery bank and generator status
- Transferring data from Campbell loggers to pc

ADITLOAFS – 2am

At 2am RFS Tumb is:

- Continuing with data acquisition and storage
- PC preparing to compress “slow” data and processed “fast” data for transmission to PyeLab via mobile network at 2:10am
- Mast Campbell 23X uploading 15 minute “slow” met data to PyeLab via mobile (GSM) network

ADITLOAFS – 3pm

At 3pm RFS Tumb is:

- Continuing with data acquisition and storage
- Profile gas sampling system running calibration check:
  - Zero reference gas (synthetic air or N_2) switched to profile closed path IRGA for 1 minute
  - Span reference gas (~600ppm CO_2 in air) switched to IRGA for 1 minute
  - Flush with air from level 1 (0.5m) for 1 minute
  - Continue profile sampling

ADITLOAFS – rest of the day

During the rest of the day RFS Tumb is collecting and processing data

Over a 24 hour period we collect:

- 33MB of raw “fast” data
- 16MB of 1 second “slow” data
- 360K of “slow” and processed “fast” data which is compressed (90K) for daily transmission to the Pye Lab

Each day we:

- Use 14.5 KWh of electricity
- Use 12 litres of diesel (generator runs for 7.5 hours @ 1.5 litres/hr)

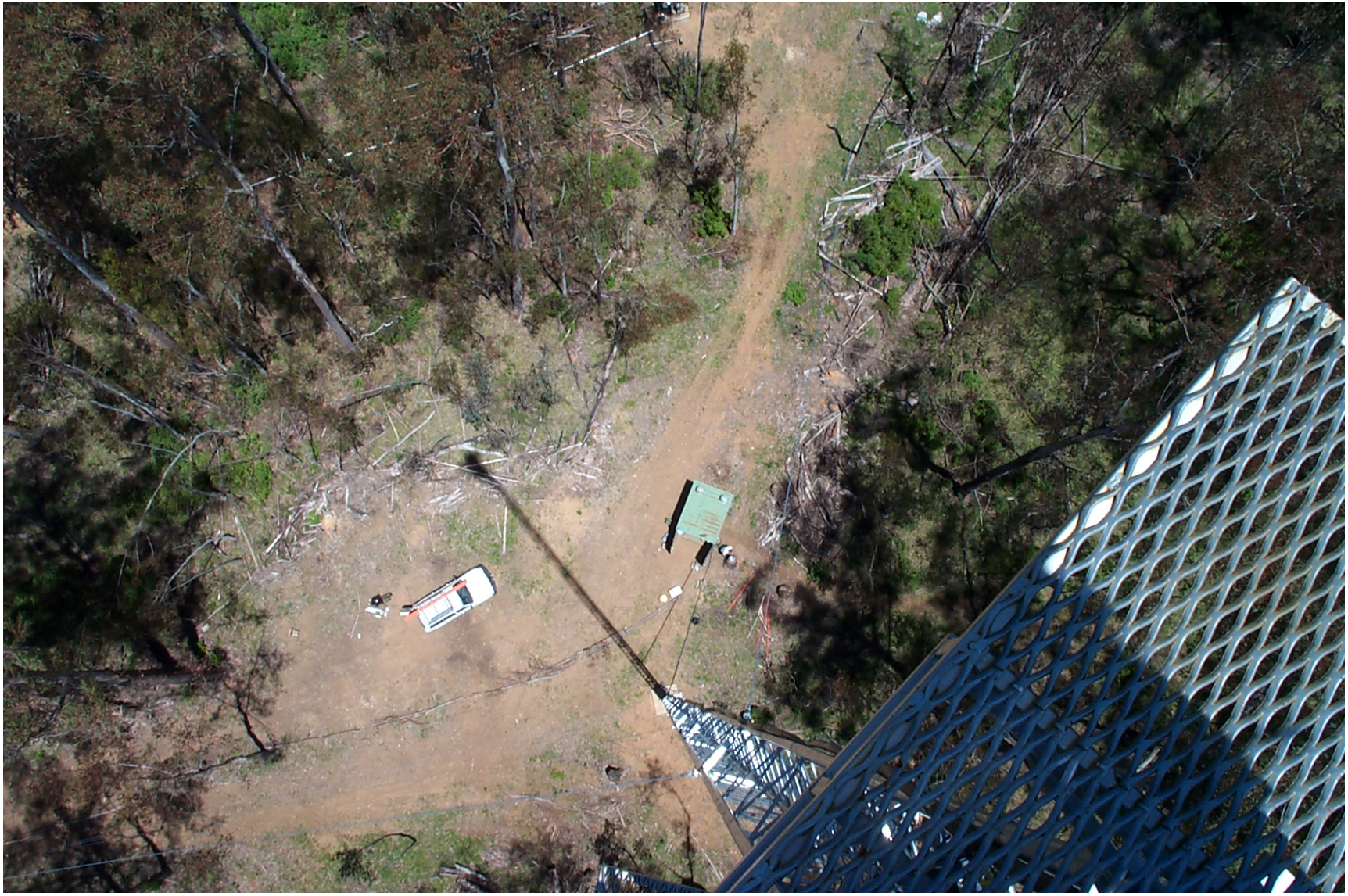
Data streams

Data collected from Tumb RFS is processed as follows:

- Fast & slow data files automatically uncompressed and imported into spreadsheets
- Within spreadsheets:
  - Chart data, check daily values and long term (6-month) trends
  - Flag spreadsheet data outside physical limits
  - Manually perform basic gap-filling
- Save spreadsheets and raw data to working area and to archive
- Import daily data into database

Use database to collate slow/fast data for quality control, gap-filling and output of final data set

Tumb – view from the top (December 2000)



Tumb - footprints in the snow (August 2000)