Explanation of site information

Calperum – Chowilla OzFlux Tower

The instruments mounted on the OzFlux tower in the Mallee vegetation area of Calperum Station record data at 10 times per second. This stream of information is stored with an on-site data logger and processed to half hourly totals or averages. Every 6 hours the data logger sends the half hourly values via phone data to the computer in the Adelaide laboratory. These values are then plotted and downloaded to a web site that can be accessed to check that all the instruments are working correctly and to keep researchers up to date with weather conditions and plant activity. These notes provide explanation of the information that is displayed on the web site (http://www.calperumchowilla.com.au/) TERN OzFlux.

Opening screen titled Home, CALPERUM OZFLUX SITE, Site Data / Daily Weather or Home / Data, Current Data / Daily Weather:

This page features basic weather data either for the preceding 24 hours or for the previous 7 days.

In the top left of the page the date and time of the last update and the next is given. The time is always as Australian Central Standard Time (ACST).

Immediately below this are two "thermometers" that show the maximum and minimum ambient temperature measured for the previous 24 hours.

In the central top of the page are three wind roses that indicate the proportion of the recorded wind velocities in particular directions. The colour coding given in the legend indicates the velocity classes in units of metres per second (m/s). Each rose is compiled from the last 7 days of wind direction and strength from the three anemometers, one at 20m, one at 8.5m and the other at 2m above the ground. **Please note that the north position (N) is different in each rose.** [This is caused by a limitation in the Loggernet software that is used to generate this graphic output].

The lower three graphs show the measurements for the last 7 days with vertical dotted lines indicating 12 hour periods from 12PM to 12AM to 12PM.

- The top graph has **ambient temperature** (°C) as a **blue line**. The varying **red line** is the **tree canopy temperature** (°C) for the recovering mallee that is recorded with an infra-red thermometer.
- The middle graph is recorded **rainfall** as millimetres for each half hour (mm per 30 mins). The precision of the tipping bucket rain gauge is 0.2mm.
- The bottom graph shows the components of the **incoming and outgoing solar radiant energy**.
    - All values are in Watts per square meter (W/m^2). The largest values in **red and grey** colours are the incoming shortwave radiant energy measured from two instruments at the top of the 20m tower. Some of this incoming shortwave energy is reflected back (outgoing) from the ground and vegetation surfaces – this is shown in the **green line**.
    - The **orange line** is the incoming longwave radiant energy that is generated by the temperature of the atmosphere, while the **blue line** is the outgoing longwave radiant energy generated by the temperature of the ground and vegetation surfaces.
    - The sum of the difference between the incoming and outgoing shortwave and the incoming and outgoing longwave radiant energy is the **net radiant energy**. This net energy is that which is available to heat up the ground and vegetation surfaces and to provide the energy (latent energy) to evaporate water from plants (transpiration) or from the ground surface.

Explanation of site information

The page Home / Data, Site Data / Atmospheric Measures is made up of 7 graphs all of which are displaying results from the previous 7 days.

- The **top graph** shows the average momentum flux (**green line**) that indicates the level of turbulence and hence energy associated with the transfer of water vapour and CO2 to and from the ground and vegetation surface and the atmosphere. The units of momentum are given in kg m^{-1} s^{-2} on the left axis.
  Closely related to this derived measure is the derived average "ustar" value (**red line**), that is an integrated measure of turbulence and hence gaseous exchange. Note that ustar is larger during the day time and is often close to or at zero during calm nights.
  The third line on this graph (**blue line**) is the "raw" value of the latent energy flux (Fe) that is the calculated value of the evapotranspiration in units of energy W m^{-2}. The unit axis for Fe is on the right side of the graph. With clear days the general trend is for Fe to increase during the daytime and to be close to zero at night when evaporation is minimal.
- The **second graph** shows the calculated average flux of CO2 (**green line**) with units of mg_{CO2} m^{-2} s^{-1} on the left axis. The expectation is that on clear days when the green vegetation is photosynthesising it will be taking up CO2 and hence the flux value will be negative during the day. At night the CO2 flux will be small and positive.
  This graph also shows the half hourly rainfall values (**as blue dots**) with the axis in mm on the right side. The tipping bucket rain gauge has an accuracy of 0.2 mm.
- The **third graph** (headed "Meteorological") has two lines showing the absolute humidity in units of g m^{-3}. The **red line** is determined by calculation of water vapour concentration and air temperature from the LI-7500. The **blue line** is a more direct measure obtained from the Vaisala HMP-45C humidity sensor.
- The **fourth graph** has 3 lines, each displaying different temperatures through the system. All temperatures are in °C given on the left axis. The temperature within the instrument box (**blue line**) is referred to a T_{panel} and shows the effective ambient operating temperature of the data logger. The **green line** (Ta_HMP_01) is the ambient temperature of the air at 2m height while the **red line** (Tv_CSAT_Avg) is the temperature of the CSAT-3 sonic anemometer recorded at 20 m height.
- The **fifth graph** has two lines, both showing prevailing atmospheric pressure. The **light blue** line comes from a pressure sensor in the LI-7500 instrument and the **dark blue** line from the Pressure 106 sensor within the instrument box at the base of the tower. The units are given in hPa (= 100 Pa) on the left axis and in kPa (= 1000 Pa) on the right axis.
- The bottom two graphs are used as diagnostic indicators, hence headed as "Diag". The upper of the two give the charge value (Vbat) of the instrument power battery. It is charged during the day time from the site solar panels and will discharge during the night as it powers the instruments. The axis value is in volts (V).
  The lower graph is an indication of the clarity or cleanliness of the infra red window of the LI-7500 instrument. When the window is clear the AGC-7500 value is 50. With a film of water (from rain or dew) or with dust deposited on the window the AGC value will increase. If values persist above 65 then it is necessary to climb the tower and gently clean the instrument window.

Explanation of site information

The page Home / Data, Site Data / Daily Soil is made up of 4 graphs all of which are displaying results from the previous 7 days.

- The **top graph** displays the temperature of the soil at different depths in the soil profile at three locations within 20 m of the base of the tower. The measurements have units of °C shown on the left axis. The three soil profiles are labelled A, B and C. At each location there is a sensor located at 100, 250, 500, 1000 and 1800 mm below the ground surface. Hence the labelling of the sensor channels follows the convention Sws_T100_A_Avg to indicate the output Temperature (T) of the soil water sensor (Sws) at the appropriate depth (100 mm) for site A as an average value (Avg).
  It is obvious that the largest daily amplitudes of diurnal changes in temperature are associated with the shallow depths, especially at 100 mm while at the deepest depth (1800 mm) only a small seasonal variation is noted throughout the year.
- The **second graph**, headed Soil Heat Flux shows the output from HFP01 sensors buried at 80 mm below ground at three separate locations within 10 m of the tower. Output from the sensors is given in Wm^{-2} on the left axis. Labelling of the sensors follows the convention Fg_HFP01_01_Avg indication that it is soil or ground heat flux (Fg) measured from the HFP01 instrument, number 1 (01) of three sensors with the average (Avg) value for the previous half hour of measurement.
- The **third graph**, headed Volumetric Soil Water shows the output as the volumetric soil water content ratio, hence with an axis value between 0 and 1. The naming convention is the same as that for values in the top graph. To distinguish these outputs they are labelled as Sws_VWC_100_A_Avg with the depths and locations as above. The soil water sensors (CS-650) combine three measures in the same instrument – soil temperature, soil water content and soil salinity.
- The **fourth or bottom graph** headed Electrical Conductivity shows the output as the electrical conductivity as a measure of soil salinity. The axis value has a range of 0 to 0.35 with units of $dS.m^{-1}$ (deci-Siemens per metre). The naming convention is the same as that for values in the top graph. To distinguish these outputs they are labelled as Sws_EC_100_A_Avg with the depths and locations as above.