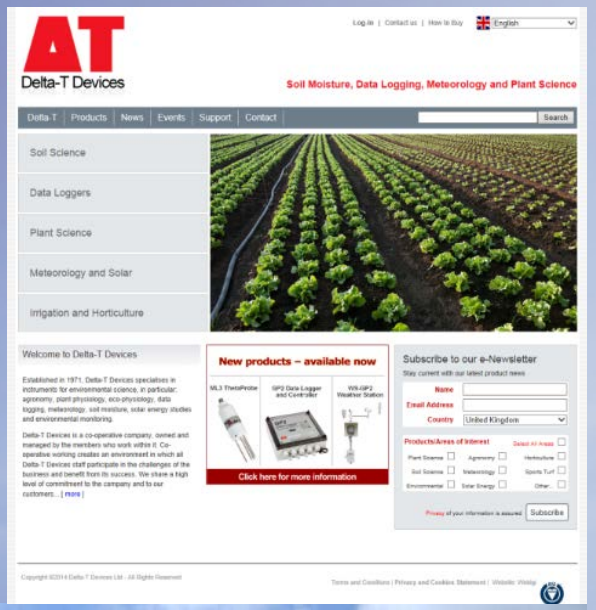
Delta-T Devices

Founded in 1971

Based in **Cambridge, UK**

Currently 39 employees



Dick Jenkins

Delta-T Devices

Delta-T Devices

Agenda

- A bit about Delta-T Devices
- Sensors from Delta-T for growers
- Features of GP2 logger/controller
- ***Free*** to use DeltaLINK Cloud remote data collection
- Devices used with DeltaLINK cloud
- How to use data from DeltaLINK cloud

Delta-T Devices

Delta-T International Sales

- 80-90% of revenue is from international sources
- Delta-T has over 80 distributors and agents worldwide
- Sales to China alone have grown:
  - £10k in 1995
  - £900k in 2015

Dynamax is Delta-T Distributor in USA

Quality Tools for Growers

PR2
Profile
Probe

SM300 Soil
Moisture &
Temperature
Sensor

HH2
Meter

SM150
Soil
Moisture
Sensor

WET
Sensor

Delta-T Devices

Profile Probe PR2

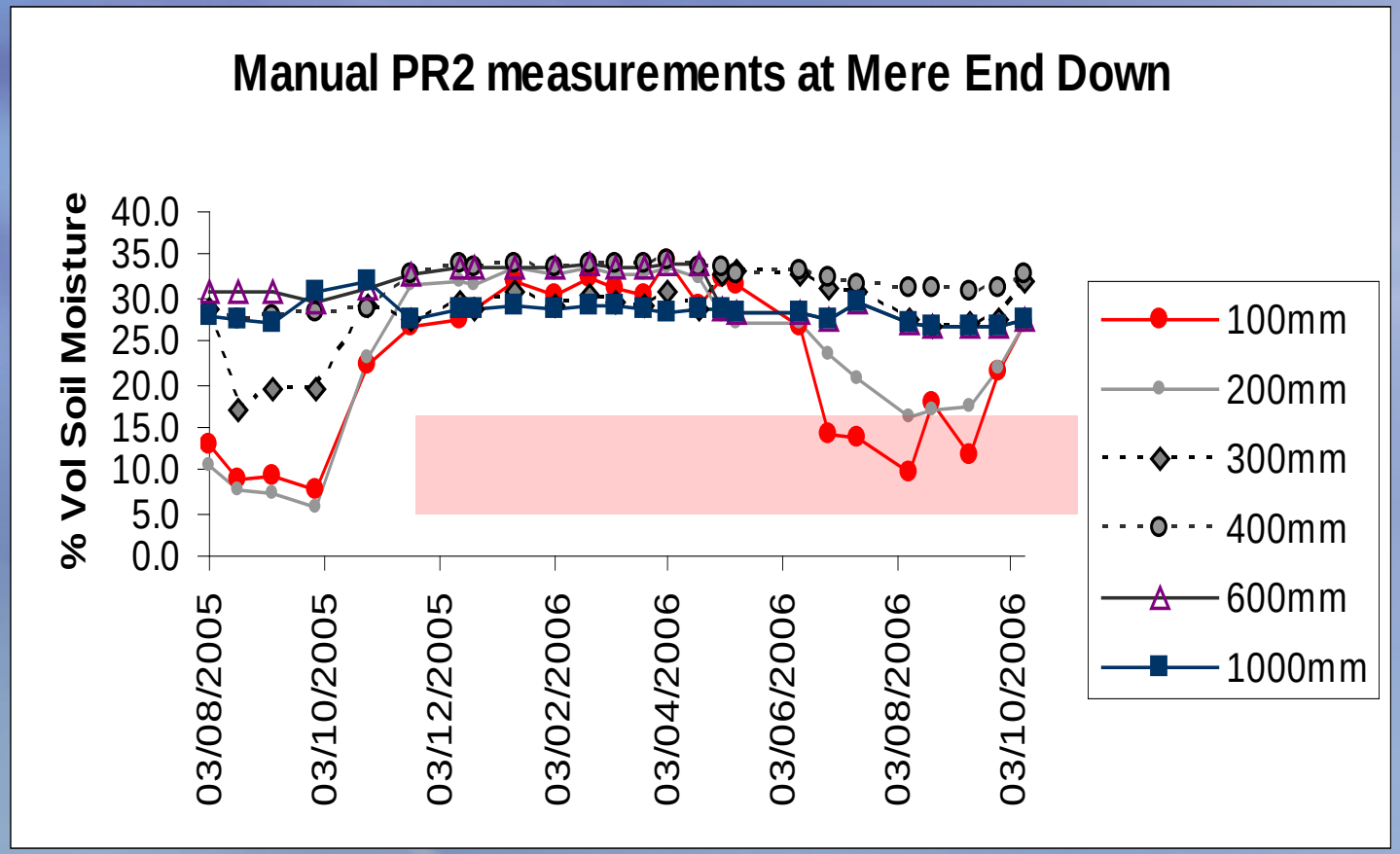
- Portable
- Simple
- Accurate

PR2/6 sensors at 10,20,30,40,60 & 100cm

PR2/4 sensors at 10,20,30 & 40cm

Delta-T Devices

Land management and Hydrology



Centre for Ecology & Hydrology, Wallingford, UK

Delta-T Devices

Data Acquisition

8 channels

1 channel instant read & store

GP2 Logger

12 Analogue

4 Digital

SDI-12 Data bus

Up to 6 Control Relay

6 channels

Delta-T Devices

GP2 Irrigation Control

GP2 controller to control the GP2 relay:

Irrigation ON when:

–SM300 Soil Moisture < Soil Moisture Trigger Threshold

Irrigation OFF when: Timer ≥ Irrigation Duration

–Where: Soil Moisture Trigger Threshold: 30% Vol. irrigate and 20% Vol. Stop Irrigate

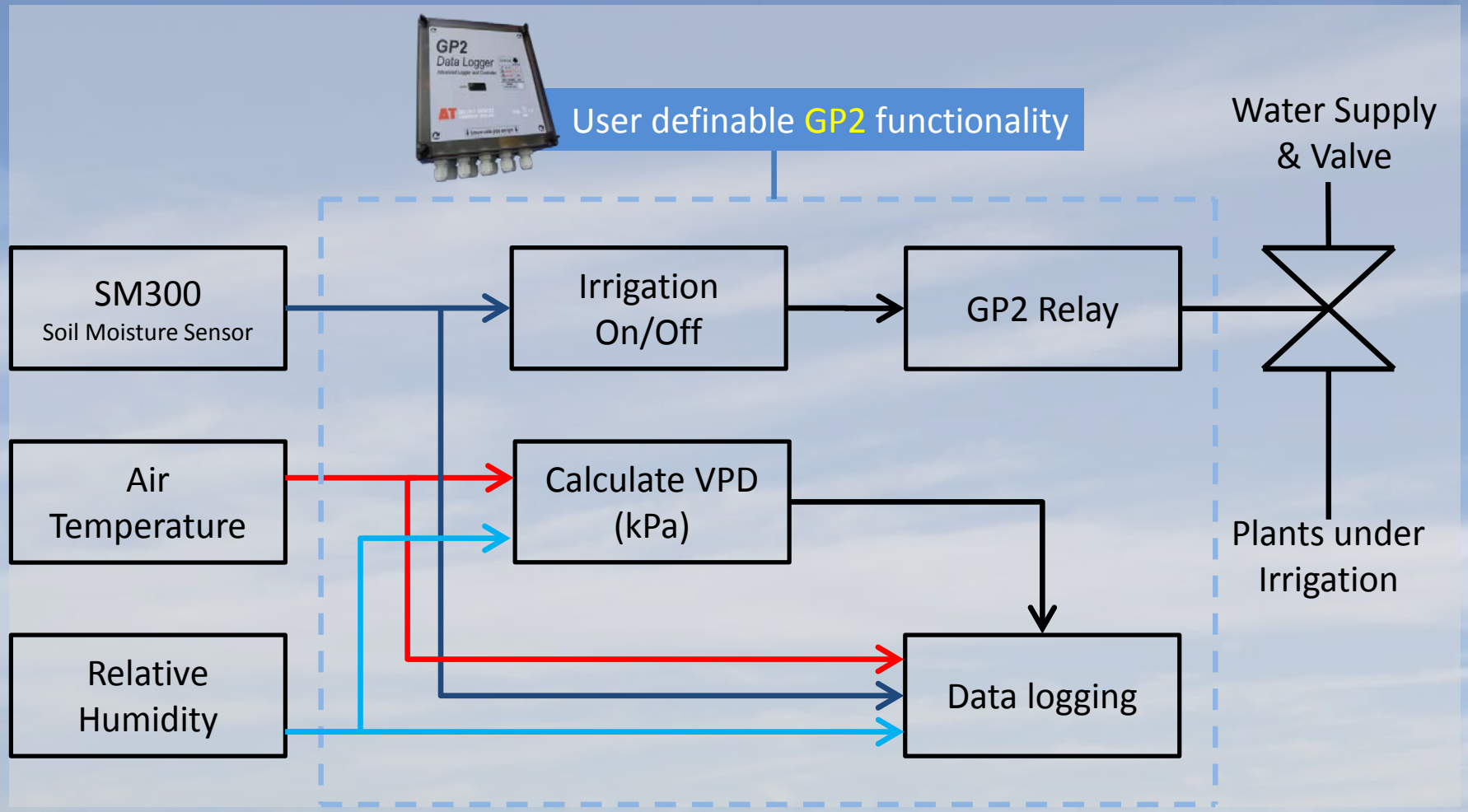
–Irrigation Duration : 5 seconds

–Minimum Irrigation Interval: 2 minutes

Irrigation Duration 5 seconds irrigation to achieve a 1.5% to 2% Vol. change in soil moisture.

Irrigation volume per plant 50 to 60ml, single dripper.

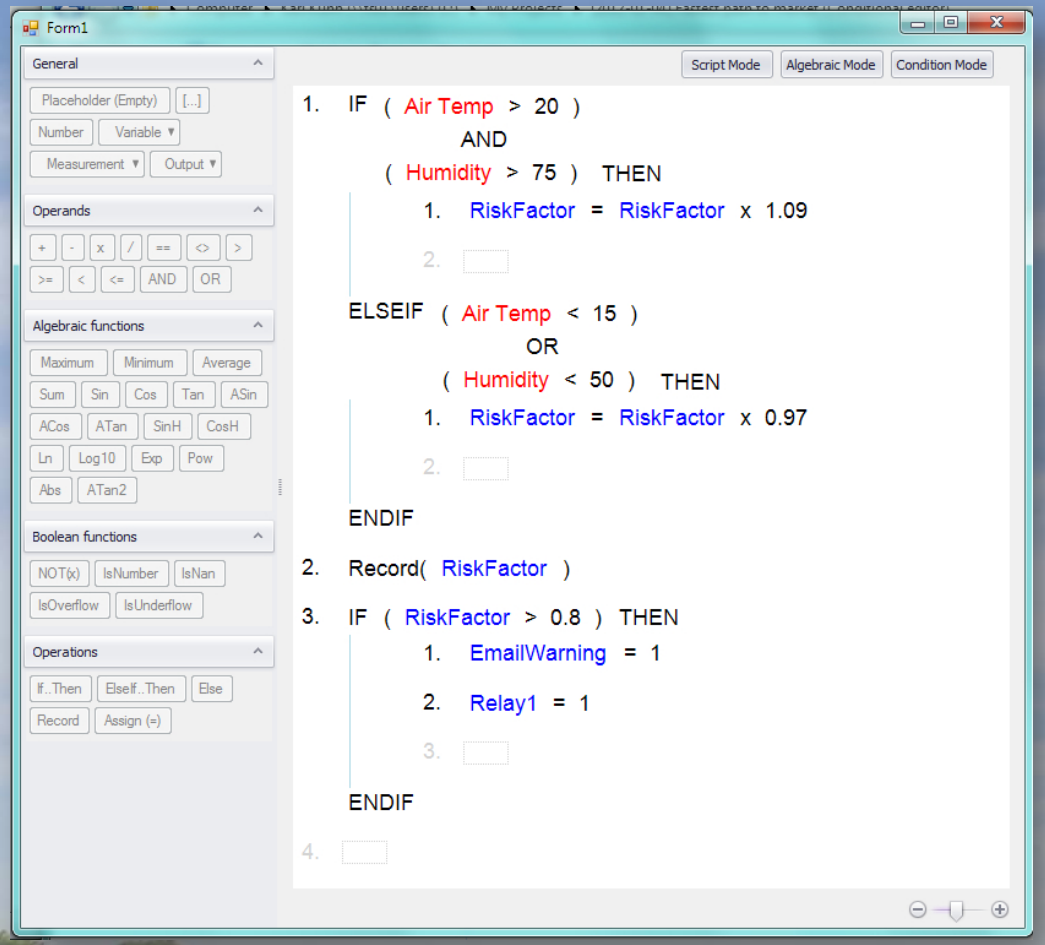
GP2 Data logger and Controller



GP2Logger/Controller Specifications

- GP2 has input channels for Voltage, Resistance, Digital, SDI-12
- GP2 up to 6 output Relays e.g. **6 irrigation zones via output relays**
- Set points **easily changed** whilst controller is running
- Programmed with a much simplified script editor using simple Boolean logic e.g. :
  - IF, WHEN, AND, THEN etc.

GP2 Script editor



- Dynamax team in Fresno will install and commission irrigation system
- Using:
  - Soil Moisture Sensors
  - ET
  - Solar Radiation
  - Etc.

GP2 VPD Calculation

Calculation of VPD from air temperature and humidity data was implemented using equations below (Allen et al. FAO 56).

$$e_s = 0.6108\, exp^{\left[\frac{17.27T}{T+237.3}\right]}$$

where:

- e_s is saturated vapour pressure at temperature T (kPa)
- T is air temperature (°C)

and,

$$VPD = e_s - \frac{RH \times e_s}{100}$$

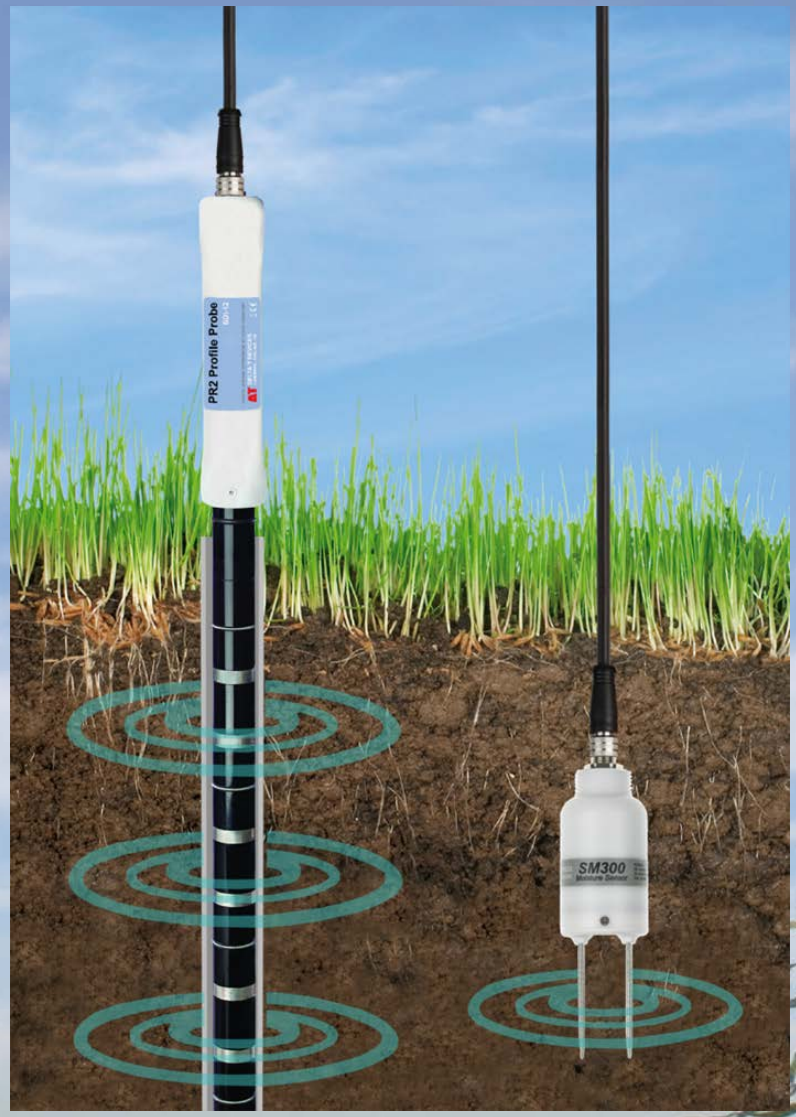
where:

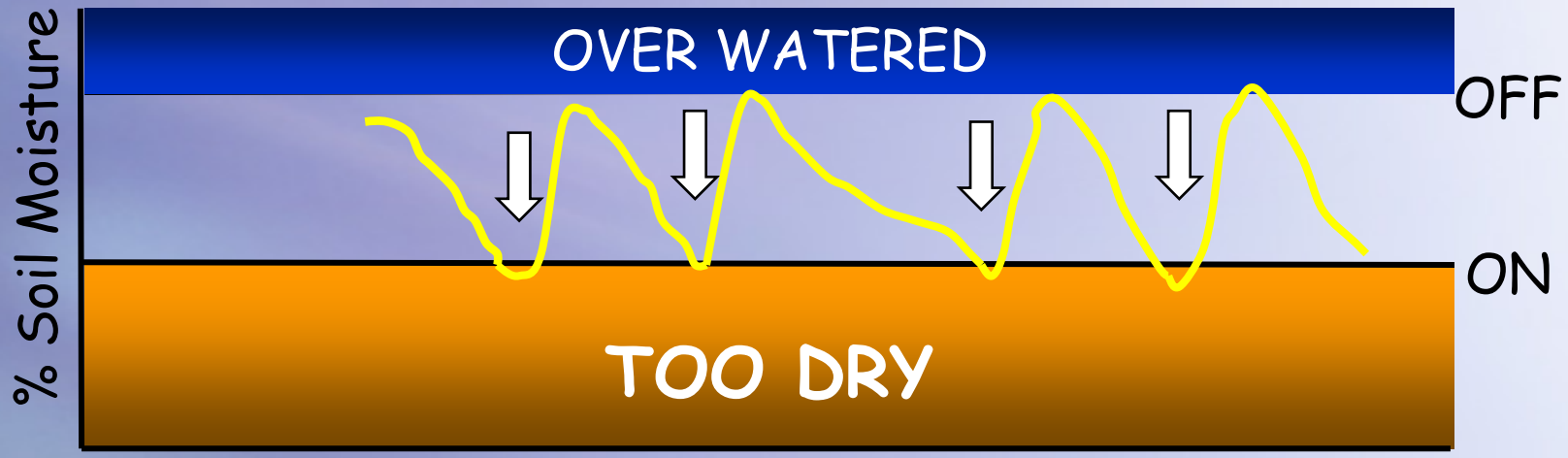
- RH is relative humidity (%).

The calculations above, used to determine VPD, were applied to each set of air temperature & relative humidity data providing VPD measurements every 2 minutes.

Sensor Placement

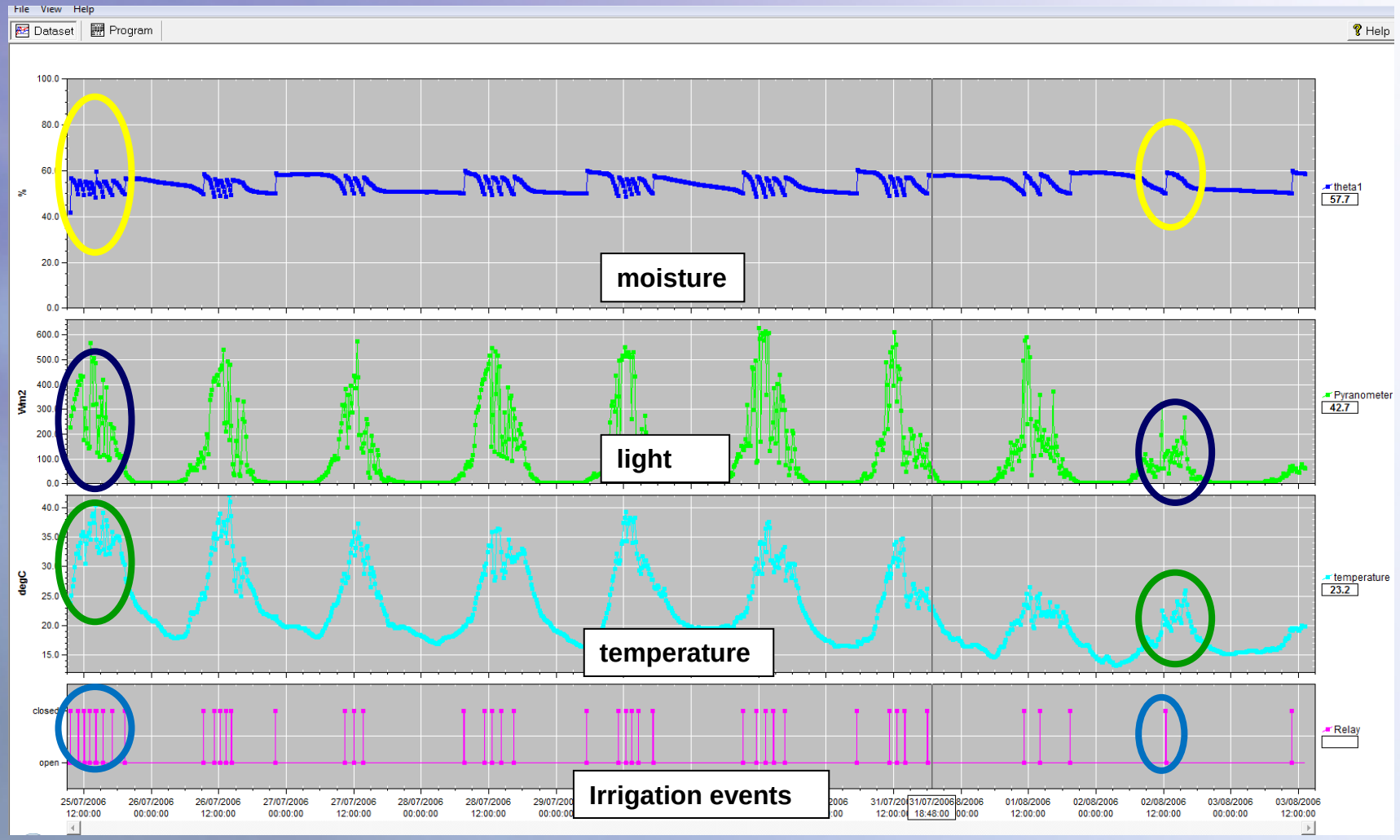
- Sensors placed in root-zone
- Water use is monitored by sensors
- Set points in the controller control when irrigation valves are opened & closed
- GP2 logger irrigates only when soil water content is depleted
- Irrigation is stopped when suitable soil VWC is detected





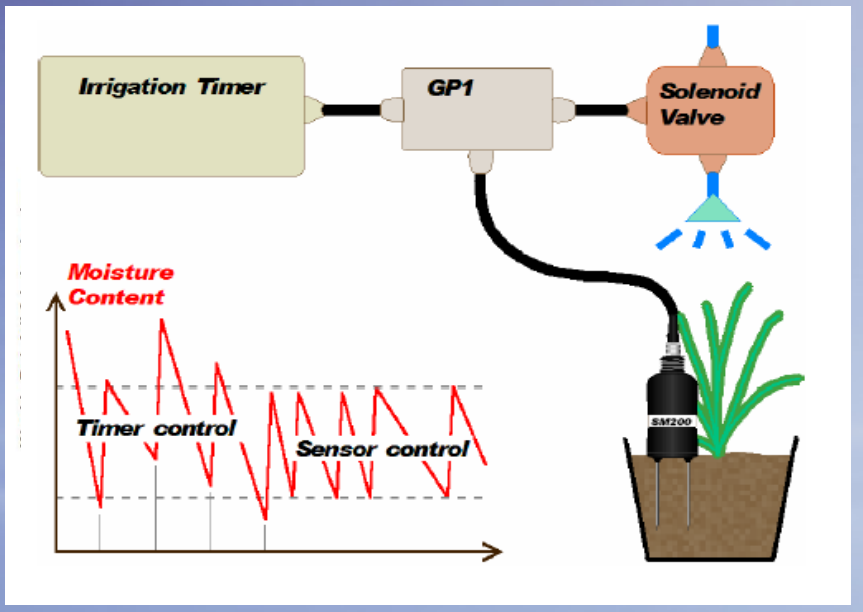
Irrigation is turned ON when soil moisture drops to trigger level, and turns OFF when it reaches a higher level

Delta-T Devices



GP1 Irrigation control for 9 days

Delta-T Devices



When soil moisture drops below trigger level, the GP1/SM300 system allows irrigation of the crop

Irrigation controlled by soil moisture levels in pot.

60% water savings

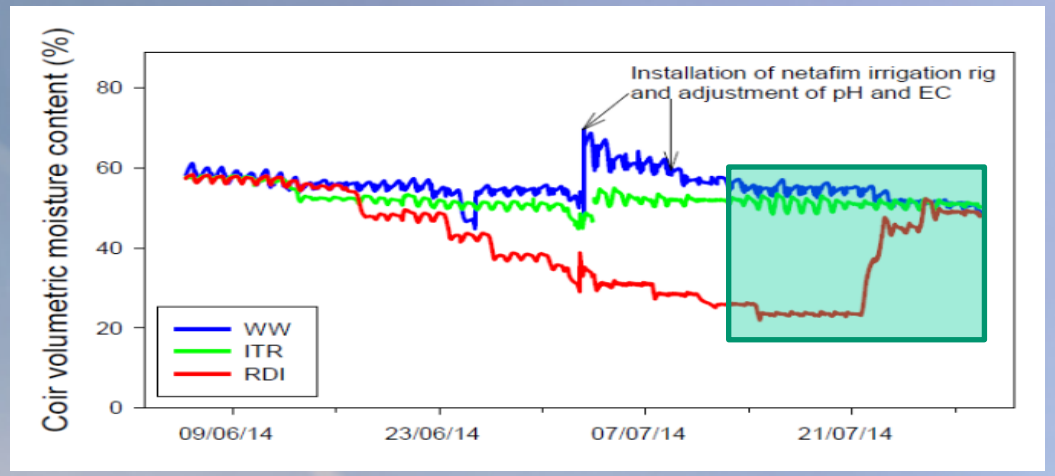
Hillier Nursery Irrigation DEFRA WaterLINK project /HDC (HNS122)

Delta-T Devices

Deriving irrigation set points for substrate strawberry varieties

Part of an IUK 101623 with Dr Mark Else at East Malling Research

- Precision control of coir water content:
  - GP2-based PID irrigation control via Netafim irrigation rig,
  - Temperature correction of substrate moisture measurement
- Maintain, reduce or eliminate ‘run-off’
- Impose controlled coir drying treatment
- Identify coir VMC which trigger plant physiological responses
- Monitor soil/substrate EC use flushing cycle when required



Innovate UK
Technology Strategy Board

Delta-T Devices

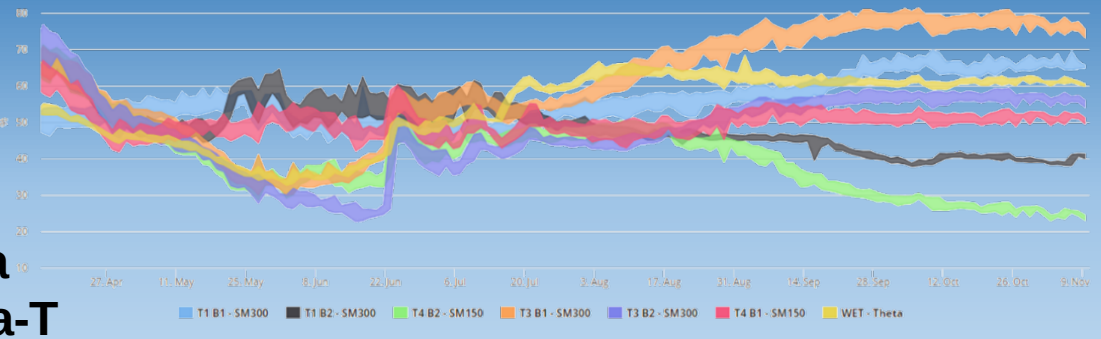
Sharing Sensor Data

Delta-T Devices

DeltaLINK-Cloud

www.deltalink-cloud.com

Sharing Sensor Data



DeltaLINK-Cloud is a free online data viewing and sharing service for Delta-T Devices data loggers.

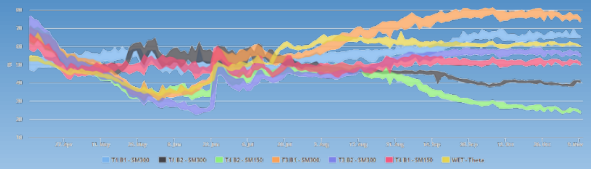
Connect, upload, then monitor, manage and share your sensor data with ease.

- **FREE service**
- **Remote data monitoring**
- **Share data and collaborate**
- **Automatic upload**
- **Mobile, tablet and PC compatible**
- **Flexible charting and reporting**
- **Smart SIM card provided**
- **Secure and encrypted**
- **Multi-language (Fr, De, Es, 中文)**

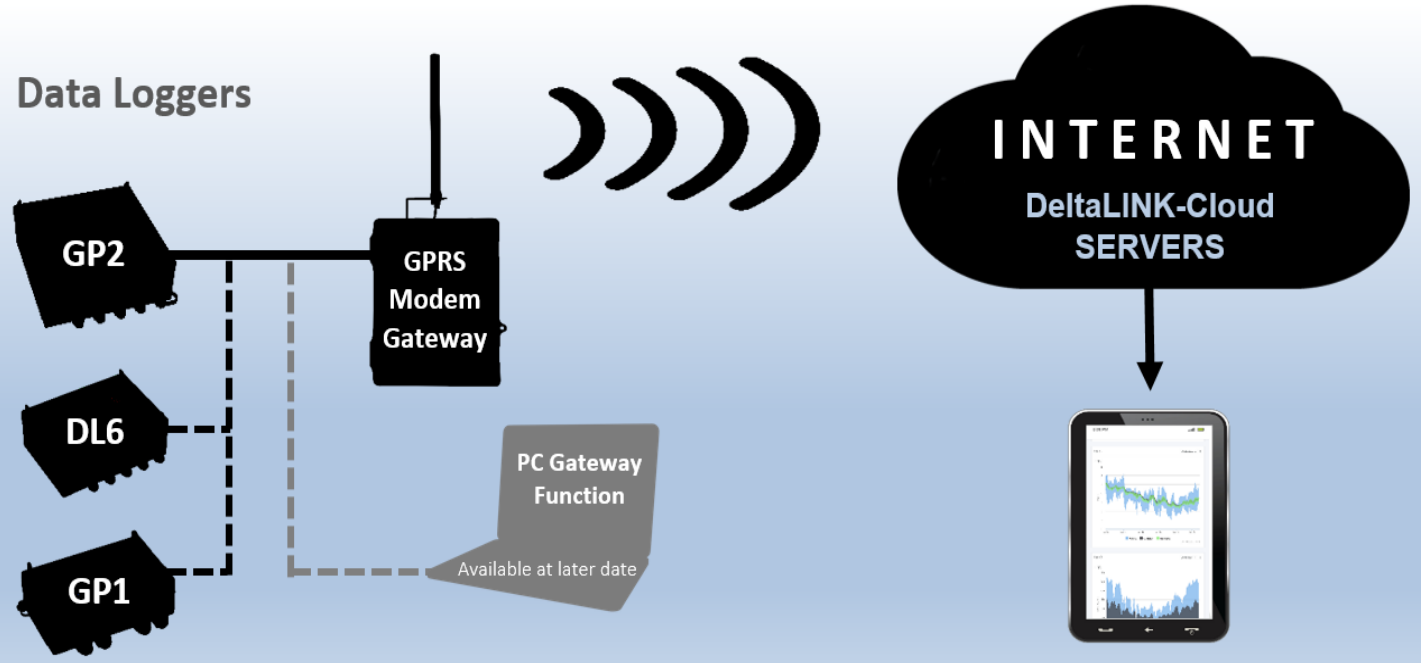
DeltaLINK-Cloud

www.deltalink-cloud.com

Sharing Sensor Data

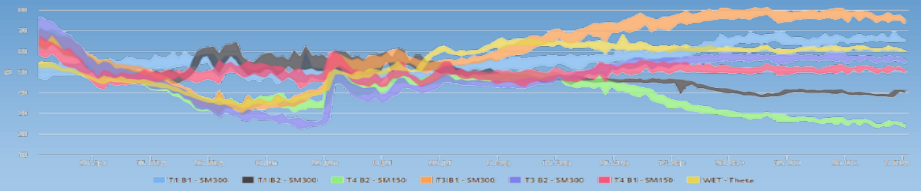


The DeltaLINK-Cloud Solution



DeltaLINK-Cloud
www.deltalink-cloud.com

Sharing Sensor Data



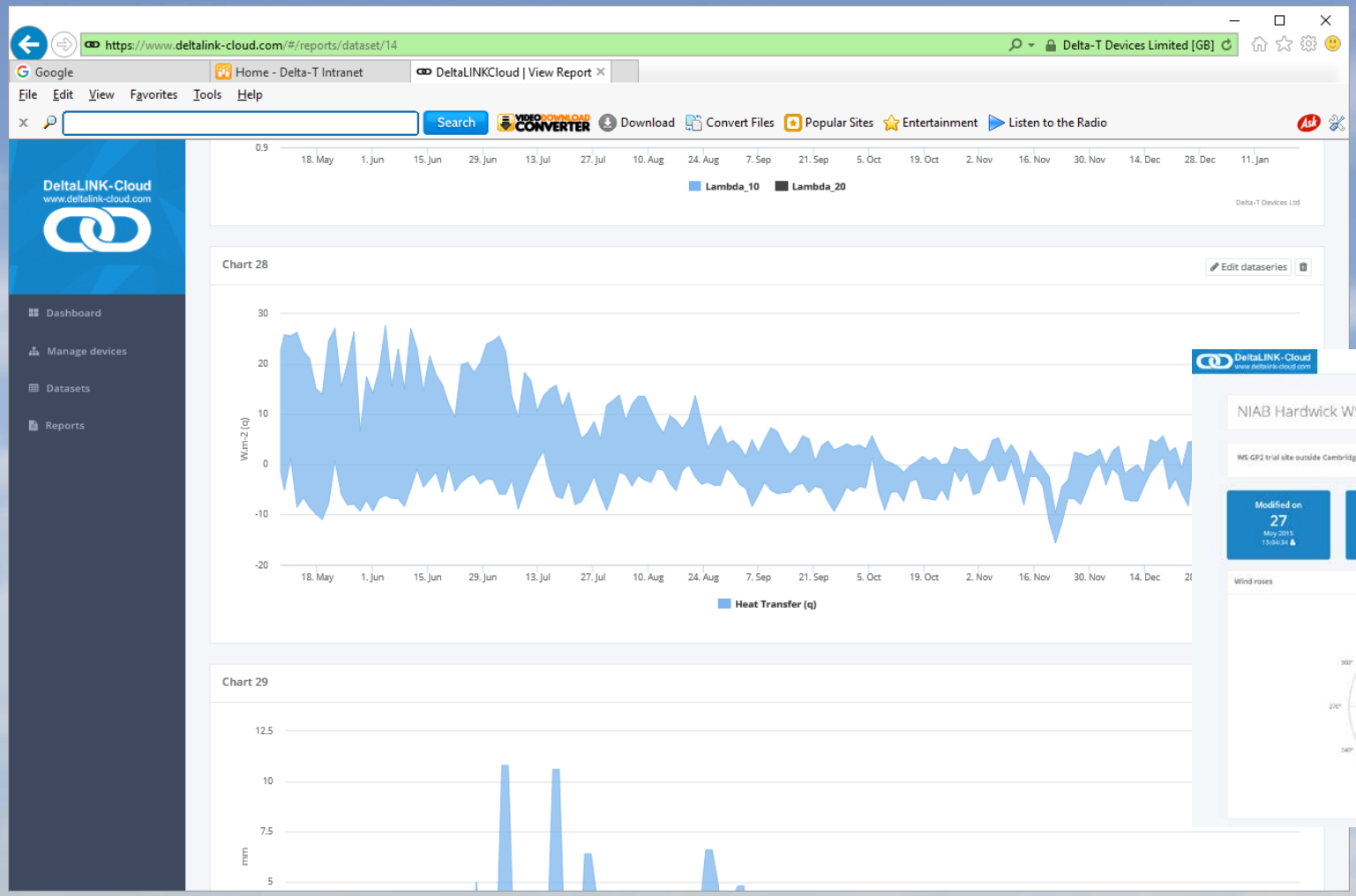
Report creation and sharing – Users can add and remove charts, and create custom reports for their data (single or multiple datasets). These can be saved and easily shared with colleagues.

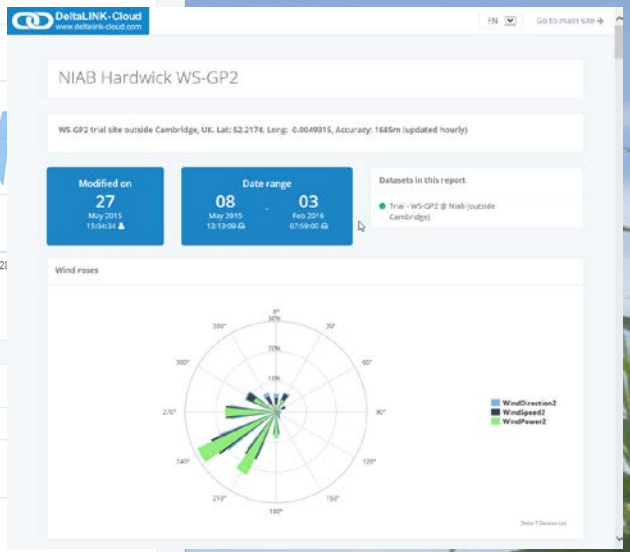
SIM card provided by Delta-T Devices – This makes the cost of the SIM card lower, and enables easier set-up. Our SIM cards will also be able to connect to multiple providers - increasing the reliability and availability of connections.

Secure and encrypted – The latest best practices for security have been employed in the creation of DeltaLINK-Cloud and the website is only accessible through an SSL (encrypted) connection.

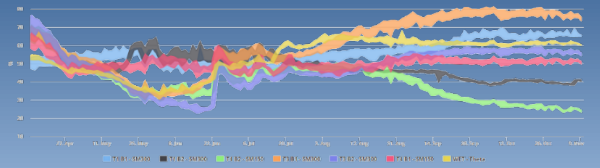
DeltaLINK-Cloud
www.deltalink-cloud.com

DeltaLINK Cloud Dataset



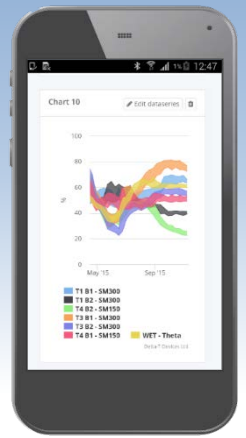


Sharing Sensor Data



Shared reports to live trial sites

Use QR code to view



NIAB Heat transfer

WS-GP2 trial site outside Cambridge

WS-GP2 Trial

NIAB Hardwick trial site outside Cambridge

WS-GP1 trial

Delta-T (Cambridge UK)

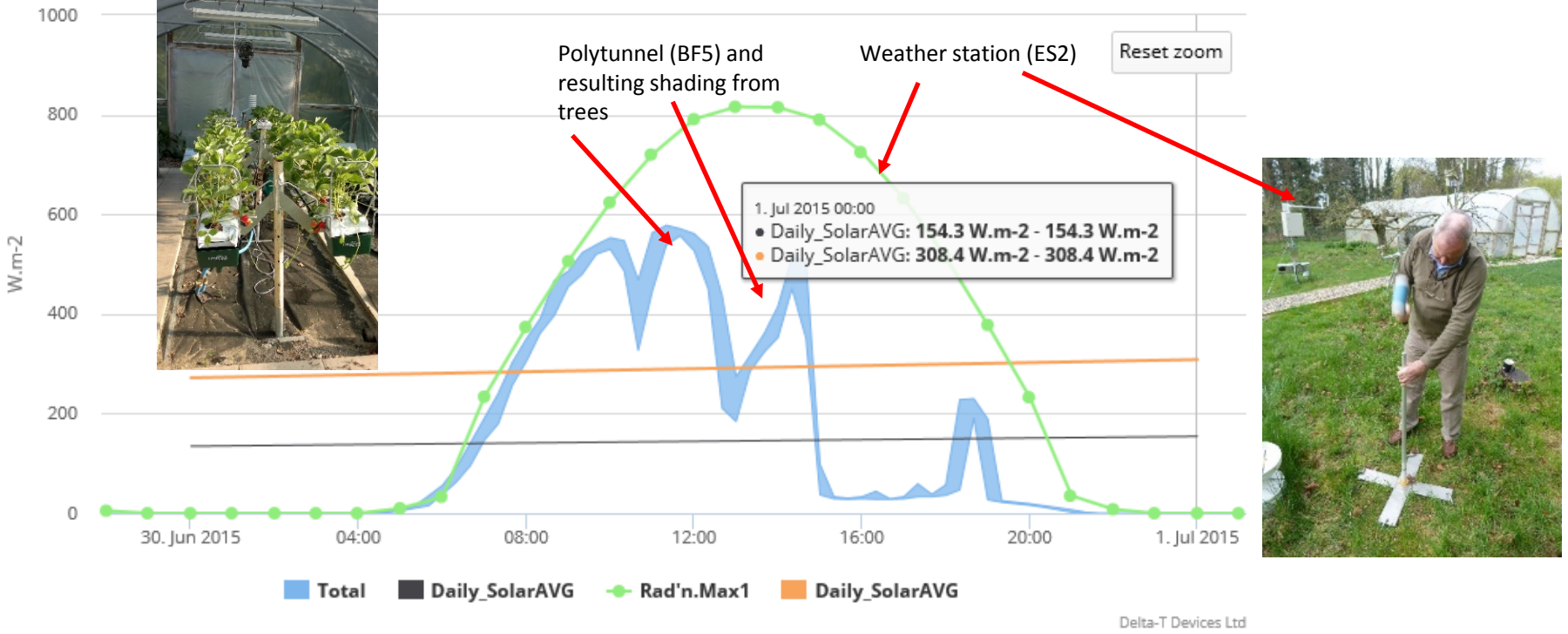
DeltaLINK-Cloud
www.deltalink-cloud.com

DeltaLINK Cloud Platforms

- **Free** service
- Data sharing
- Easy set-up
- Secure data
- Report creation
- Flexible charting
- Display data on:
  - Mob Phone
  - Tablet
  - Or PC

DeltaLINK-Cloud
www.deltalink-cloud.com

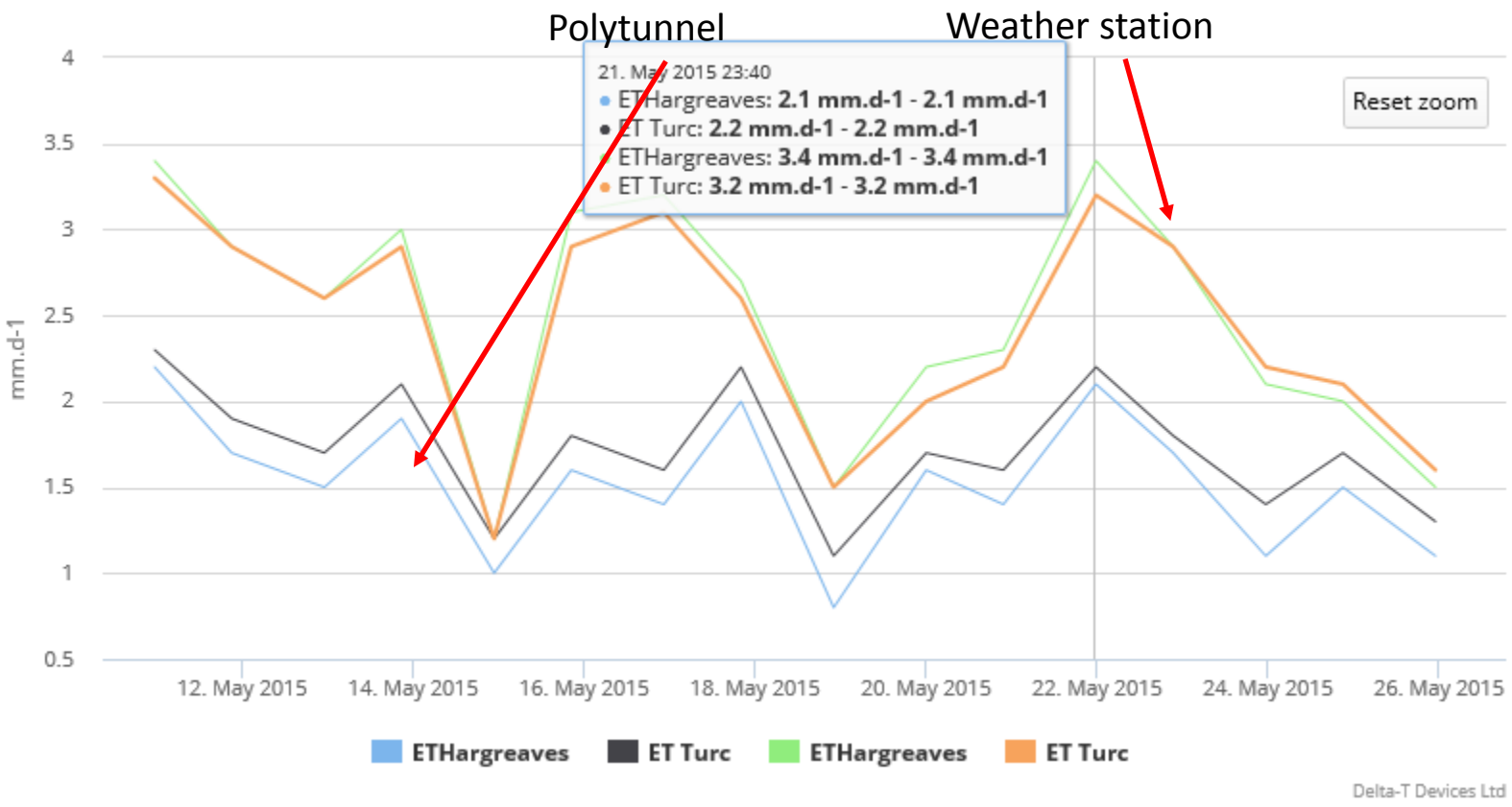
DeltaLINK Cloud – combining datasets
Solar radiation



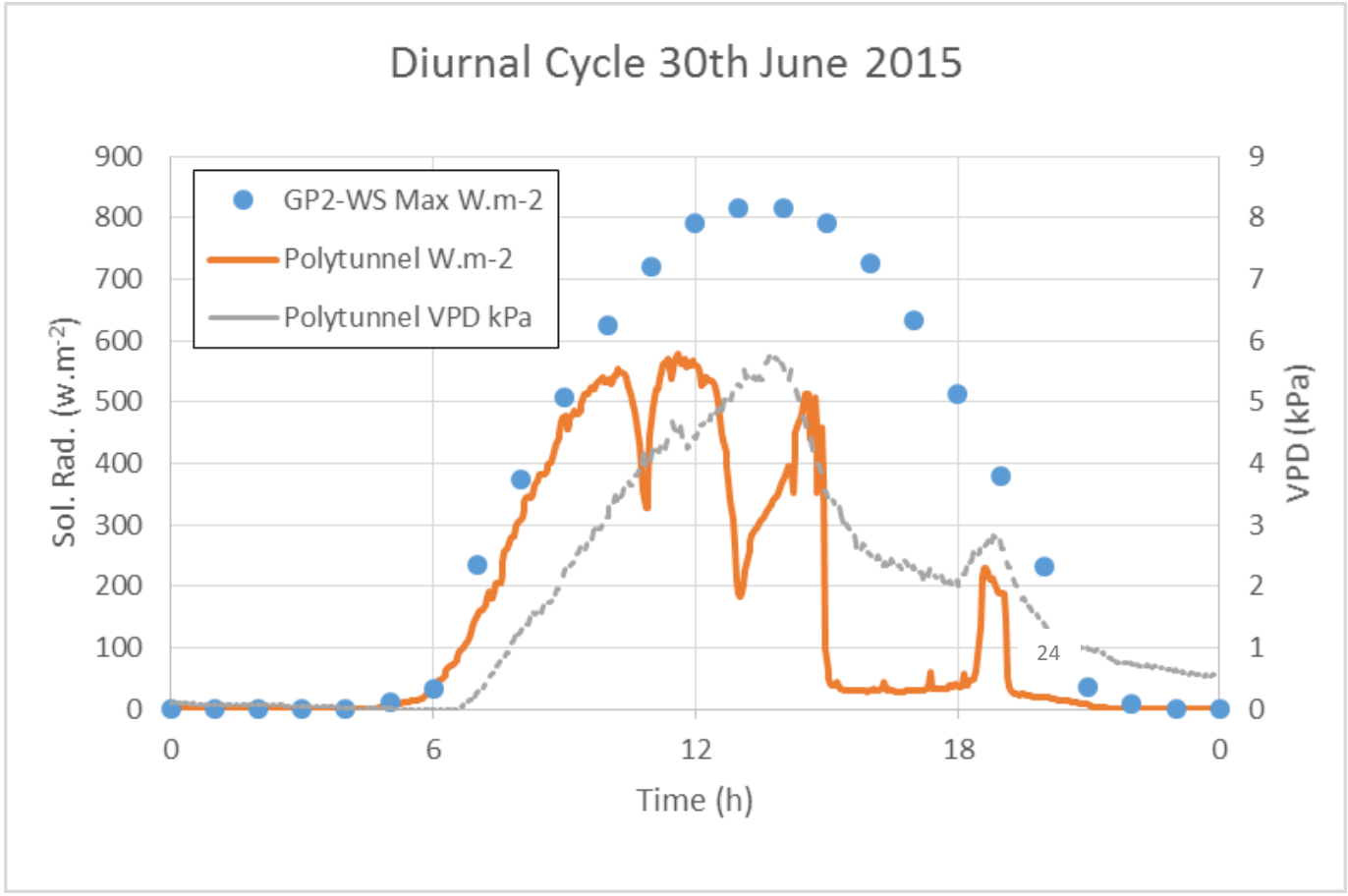
DeltaLINK Cloud reports:

- Presenting data from multiple data logger sources
- Updates live – synchronised to data updates from data loggers

DeltaLINK Cloud – combining datasets
Daily Evapotranspiration



Solar radiation and VPD



GP2 Precision Controlled Irrigation

- Applies water to growing plants only when they most need it
- Can be used with:
  - Soil Moisture Sensors
  - ET calculations
  - Vapour Pressure Deficit (VPD)
  - Combinations of any of the above or other parameters
- Responds quickly to differing growing conditions
- Used with DeltaLINK cloud saves both time and water!


Thank you for listening
Any Questions?