Using Sensors for Better Irrigation Management Decisions… and More….

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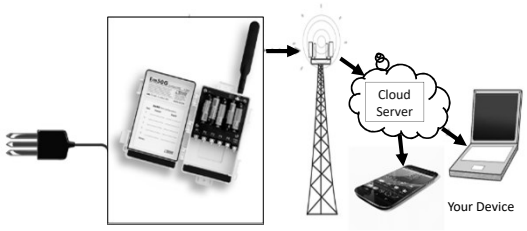
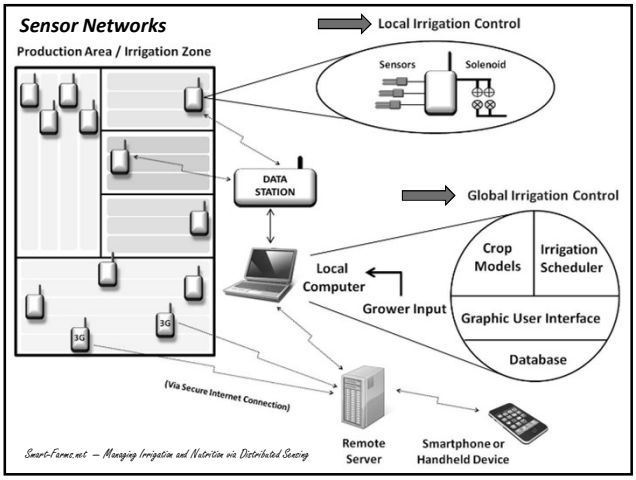
Smart Farms
SCRI-MINDS—Managing Irrigation and Nutrition via Distributed Sensing

USDA-NIFA-SCRI Award no. 2009-51181-05768

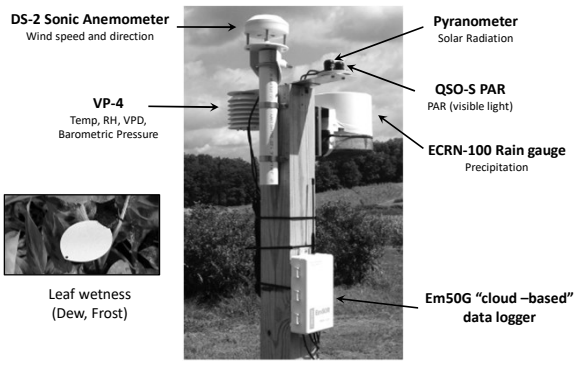
3G Radio Datalogger (Node)



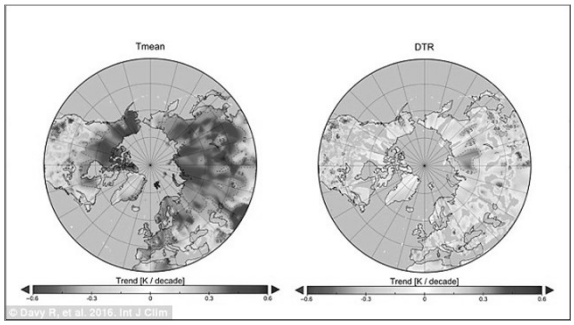
Sensor Networks



On-farm Weather Station



The Planetary Boundary Layer



Davey et al., 2016 Int. J. Clim.

The Planetary Boundary Layer

INTERNATIONAL JOURNAL OF CLIMATOLOGY

RESEARCH ARTICLE

Diurnal asymmetry to the observed global warming

Richard Davy, Igor Esau, Alexander Chernokulsky, Stephen Outten, Sergej Zilitinkevich

First published: 24 February 2016

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Cited by: 3 articles

ABSTRACT

The observed warming of the surface air temperature (SAT) over the last 50 years has not been homogenous. There are strong differences in the temperature changes both geographically and on different time frames. Here, we review the observed diurnal asymmetry in the global warming trend: the night-time temperatures have increased more rapidly than day-time temperatures. Several explanations for this asymmetric warming have been offered in the literature. These generally relate differences in the temperature trends to regionalized feedback effects, such as changes to cloud cover, precipitation or soil moisture. Here, we discuss a complementary mechanism through which the planetary boundary layer (PBL) modulates the SAT response to changes in the surface energy balance. This reciprocal relationship between

The Planetary Boundary Layer

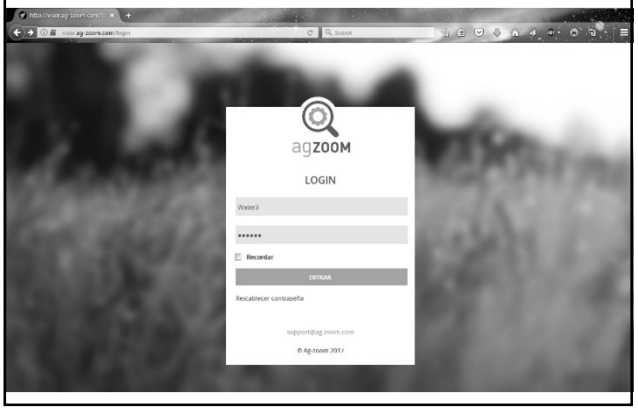
PLANETARY BOUNDARY LAYER	
According to climatologists, the reason for the rapid increase is a band of air close the ground, called the planetary boundary layer (PBL).	The researchers explain that as more carbon dioxide has been added to the atmosphere from man-made activities, such as burning fossil fuels, this has meant less heat escapes from the atmosphere at night, and the warmer atmosphere heats the thin PBL below.
This thin layer of the Earth's atmosphere is distinct from the upper layers and changes in thickness over the course of the day-night cycle. At night the solar radiation absorbed by the surface over the course of the day is released into space.	Because the layer is so thin at night, the warming effect is much more pronounced, adding extra energy to the climate system

Agricultural Implications of Increased Night Temperatures

1. Increased respiration rates
   - Decrease in yield
   - Decrease in food quality
2. Disruptions in pollination, fruit set
3. Increase in soil temperatures, microbial respiration rates, decrease in organic matter content
4. Increase in relative humidity, fungal disease
5. Increased weed pressure
6. Increased number of pest life cycles

Wolfe et al., 2018 Climatic Change 146: 231-245

Cloud Software Capabilities: AgZoom

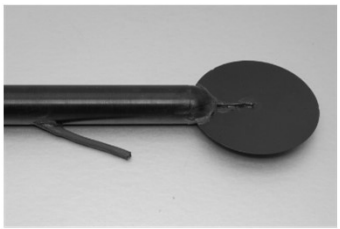


Geolocation of Cloud Dataloggers

Dashboard – Single Node Data

Frost Monitoring

- → Current frost prediction tool - Sky-Bit (Satellite data)
- → Air temperature is not a reliable predictor of frost events
- → Canopy temperature should be measured
- → Radiative frost: CT << AT on clear and calm nights



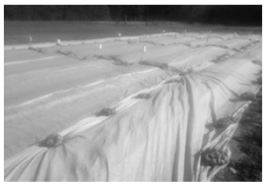
- 2 precision thermistors
- Mimic plant leaf and flower bud
- Measurement Range: -50 to 70 °C
- Accuracy: ± 0.1 to ± 0.4 °C

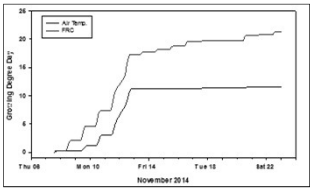
Apogee SF-110 Radiation Frost Sensor

Radiative Frost Sensor

Flower bud and leaf thermistors (indicated with red arrows) on the SF-110 radiation frost sensor deployed within the plant canopy at Shlagel Farms

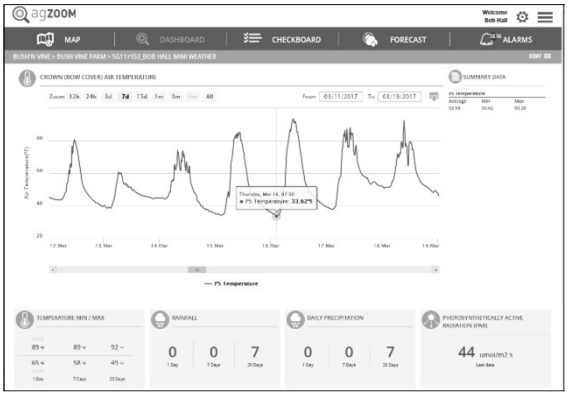
Floating Row Cover Use



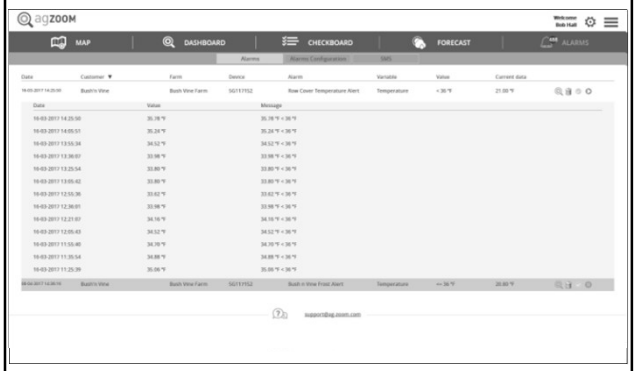


Growing degree day (GDD) units recorded below and above floating row cover

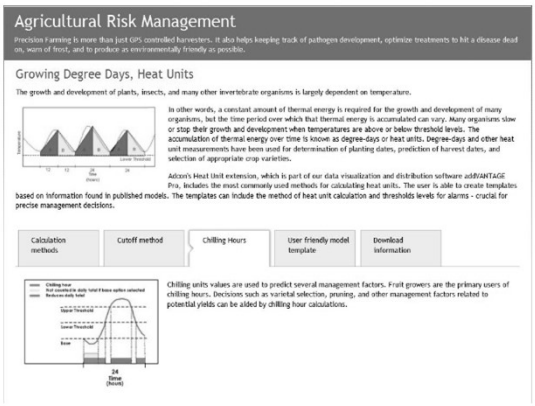
Frost Events South Carolina – March 14-16, 2017



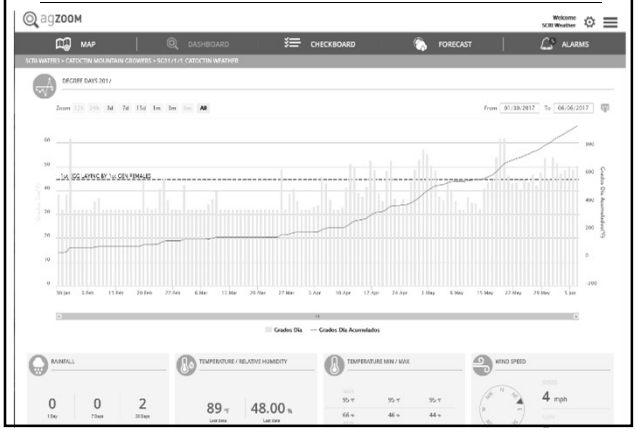
Alert Capabilities



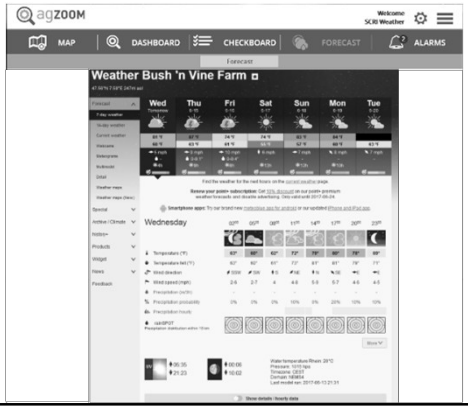
Predictive Tools for IPM, Disease Management



Dashboard – Single Node Data



Geolocated 7-Day Weather Forecast



Monitoring System Considerations

1. **Prioritize your issues:** Irrigation, water quality, pests, disease
2. **Monitor with Intent:** Develop a site- / crop-specific strategy
3. **Purchasing:** Make sure any system you buy has all the components you need. *Demand quality, Don't buy cheap*
4. **Support:** Consider the time *YOU* have to invest in any system.
5. **Investment:** Start small, get comfortable, grow at your own pace.

Project Information at http://smart-farms.net