



FloraPulse



LABFERRER

Sensor troubleshooting

February 5-6, 2024

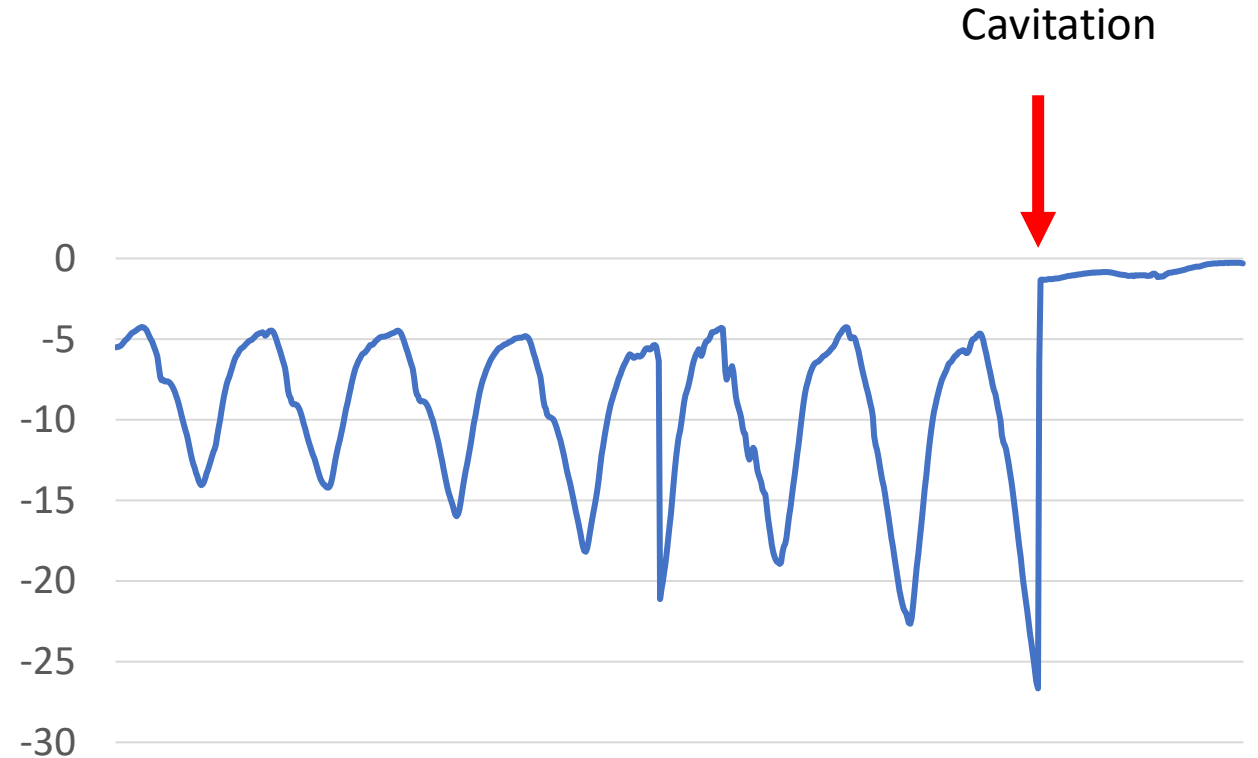
Outline

Here we'll discuss issues you may see, prevention tips, and possible solutions

- Cavitation
- Dry-out
- Shrinking of the signal
- Flooding of sensor
- Psychometric spikes
- Wetting of sensor from outside
- Wounding response pressing on sensor
- Random noise
- Sensor breaks
- Winter behavior
- Below zero temperatures
- Mechanical damage

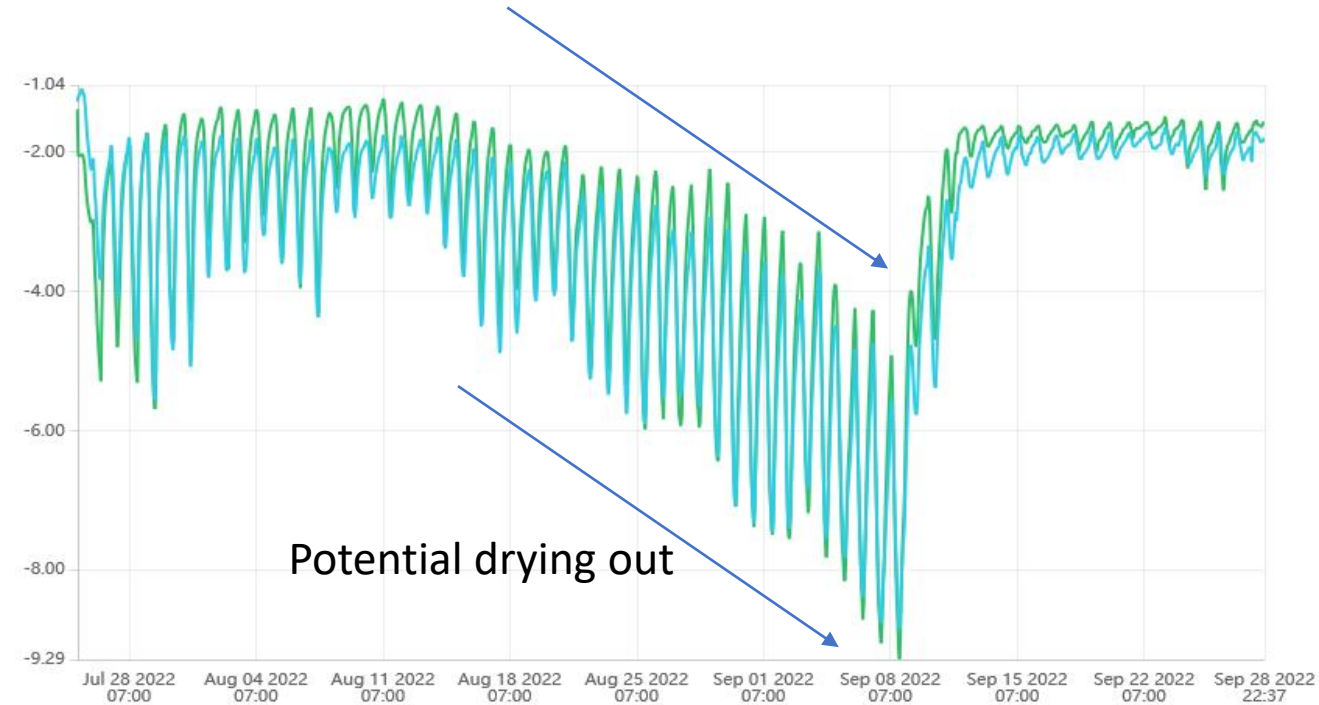
Cavitation

- Problem: sensor went to zero suddenly and isn't responding.
- Cause: sensor cavitated. Cavitation happens when the WP drops too low and the sensor membrane cannot hold the tension. The water inside the probe 'breaks' and the sensor will suddenly read zero.
- Or happens due to a defect in the membrane (the membrane broke).
- Shouldn't happen until the sensor goes below -35 bars.
- Solution: Refilling the sensor may bring it back to life. If plan to refill, keep sensor wet in the meantime.



Dry out

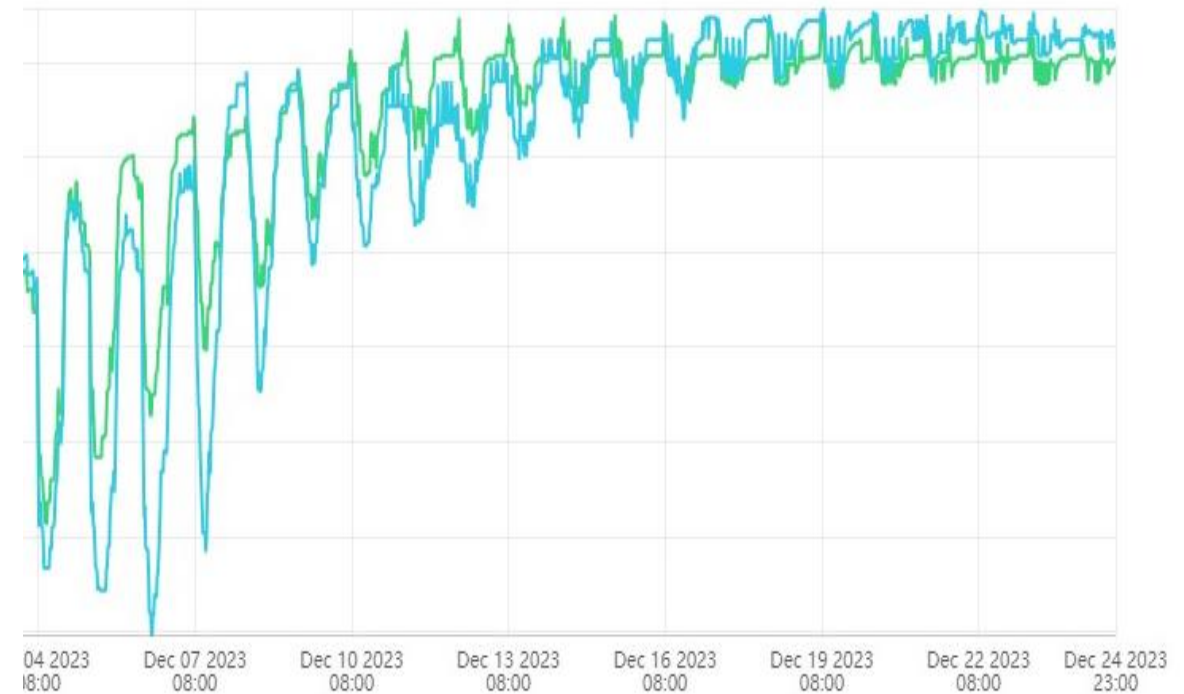
- Problem: sensor reads much lower SWP values than expected. Both predawn and midday SWP are too low.
- Cause: could be caused by a water leak from the sensor installation site, causing the sensor to dry out and read drier.
- Solution: try adding more grease around the sensor sleeve to block any leaks.



Sensor drying out looks like this, but the sensor keeps getting consistently drier without a good explanation.

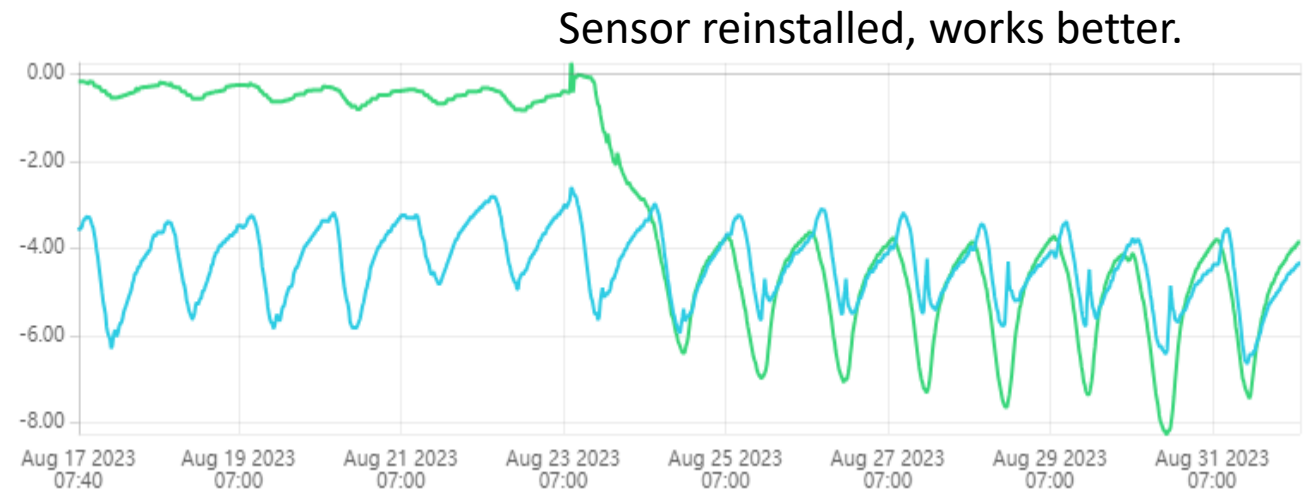
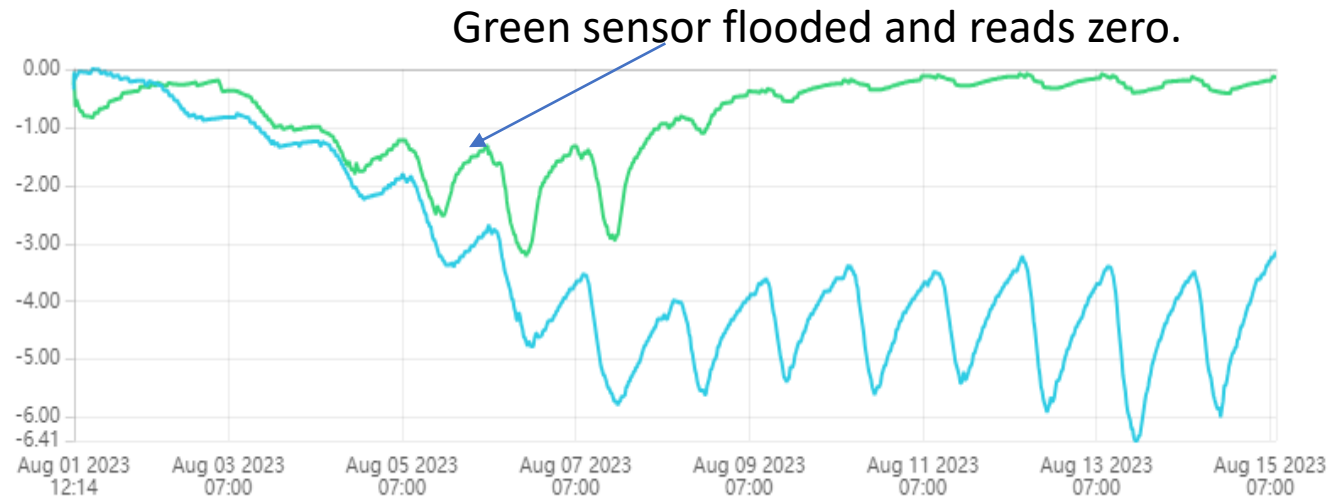
Shrinking of signal

- Problem: sensor readout shrinks so there is very small fluctuation in each daily cycle.
- Cause 1: poor connection with xylem due to wounding response.
- Cause 2: poor connection with xylem because wound closed over time.
- Solutions: this behavior may be due to the specific crop (i.e. walnut does this every time). Try re-installing and seeing if it happens again.
- Sensor may also be installed in 'dying' area of xylem. Reinstall in a different site.



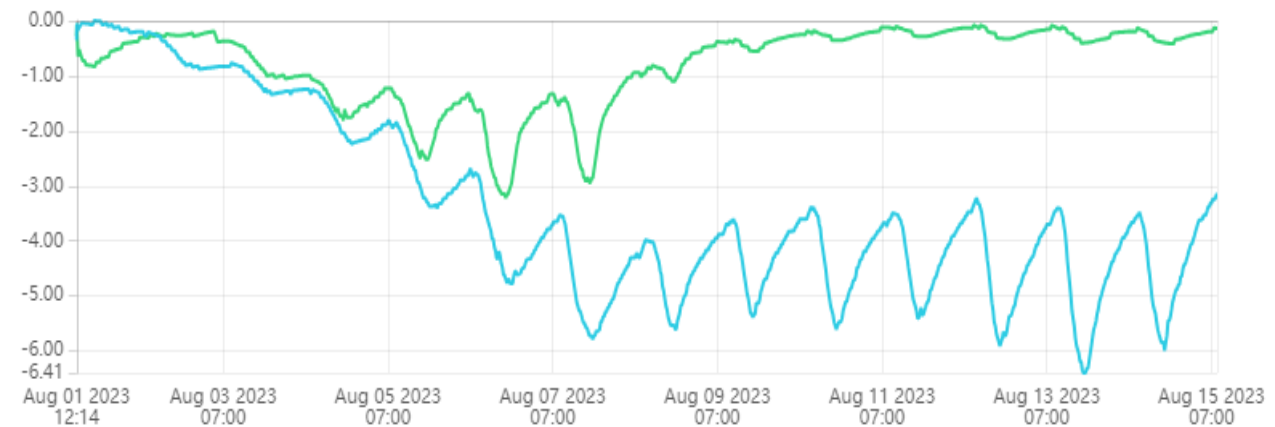
Flooding of sensor

- Problem: The sensor goes to zero and stays there.
- Cause: Likely wounding response is blocking sensor. Or installed in 'dead zone' of xylem.
- Solution: Try re-installing sensor.
- Some crops flood sensor immediately and cannot be measured for long: pecan, walnut and avocado.
- Some crops flood sensor randomly: pistachio, some citrus.



Wetting of sensor from outside

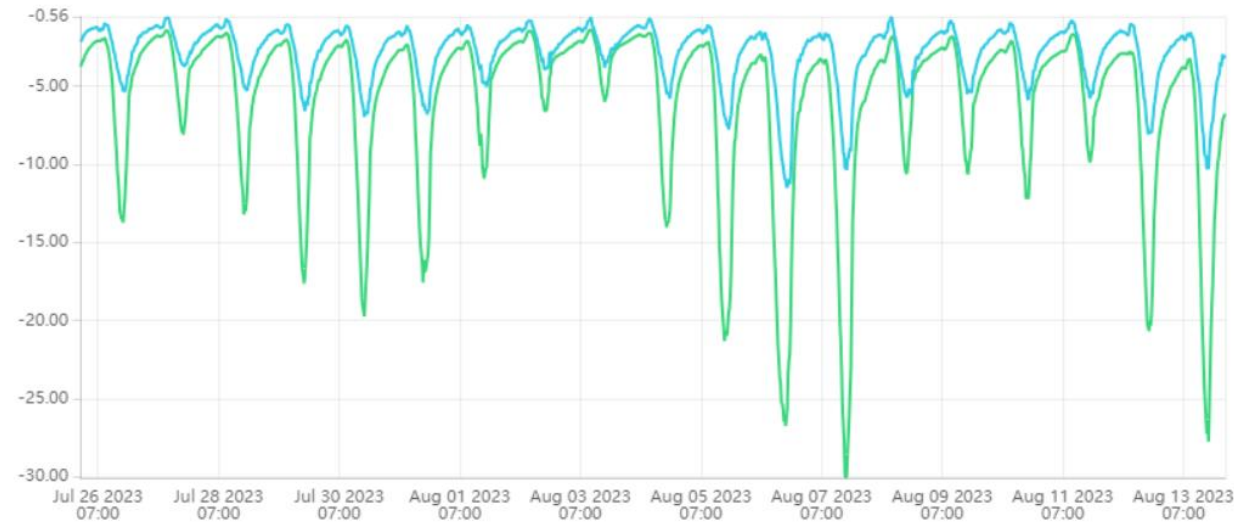
- Similar behavior to sensor flooding. The sensor goes to zero and stays there, but right after a rain/wetting event.
- Cause: water stuck inside the insulation is wetting the trunk for multiple days and getting to the sensor install site.
- Solution: the sensor bubble wrap insulation should be attached somewhat loosely so that excess moisture can evaporate. Especially important in wet climates.
- Might need to ignore SWP data right after a big rain storm, until excess water dries out.
- New small probe may be less affected by outside rain due to use of better sealant (still under testing).



Psychometric spikes

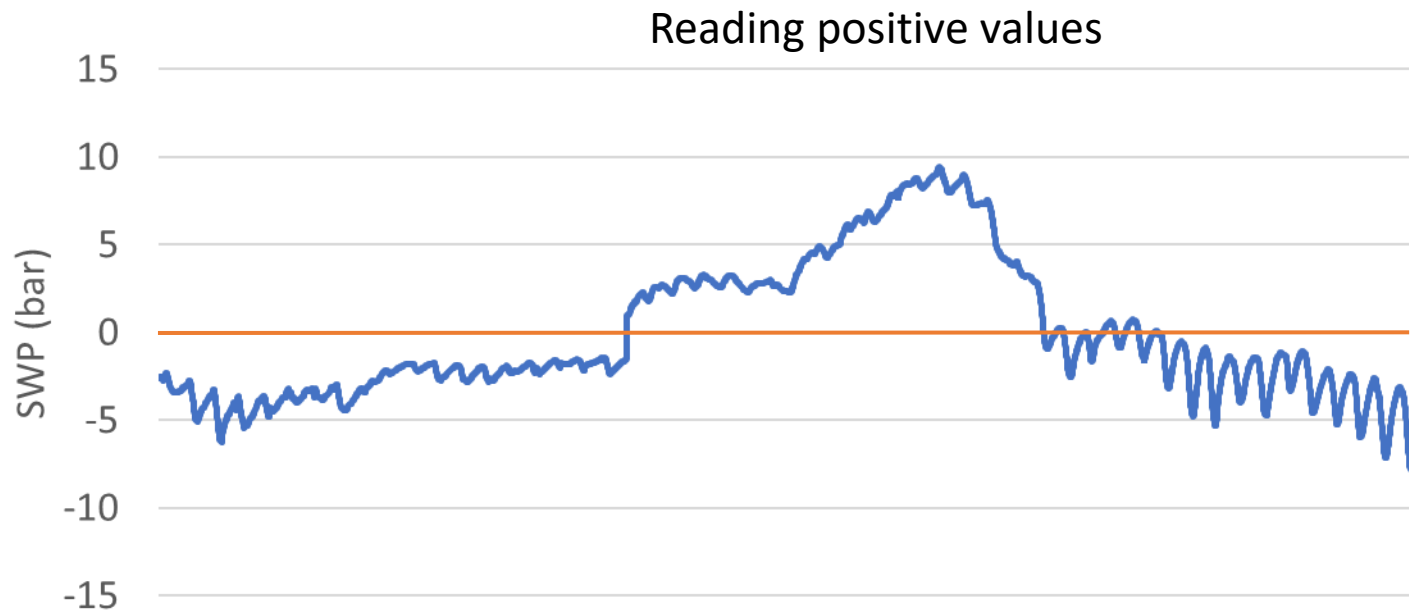
- Reading WP is extremely difficult because tiny temperature differences cause huge errors. Usually not a problem with FloraPulse, except when there's a gap between the sensor and xylem.
- In the field, this shows up as reasonable SWP values when temperature isn't changing much (at night), but very negative SWP measurements during the midday.
- Cause: bubbles in the mating clay, sensor disconnected because moved/hit, extremely hot days with poor insulation. More likely in very hot climates.
- Solution: recommend re-installing sensor.

Grape install. Green sensor reads unrealistically low SWP during HOT times.



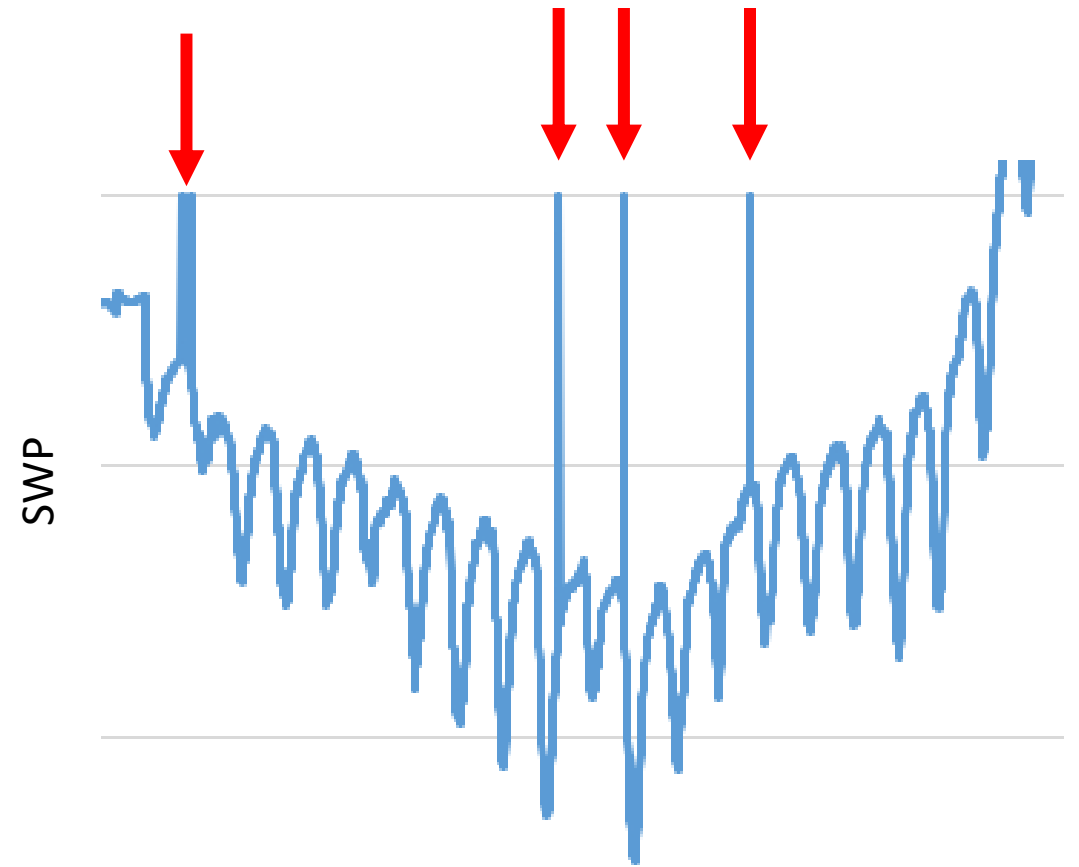
Wounding response spikes + positive values

- Pressure on the chip can cause it to read positive values temporarily. This often happens right after a rain event when the xylem expands with water and presses on the chip.
- Recommend ignoring the data if it is temporary. Otherwise remove, test and reinstall the sensor.



Random noise

- Sensors sometimes show random 'upward' spikes in the reading. It's unclear what causes this, but it may be due to the tree pressing on the sensor and stressing the chip.
- Recommend just ignoring them.
- The new smaller probe may be less susceptible because the probe sits completely inside the sleeve and isn't pressed on by the tree.

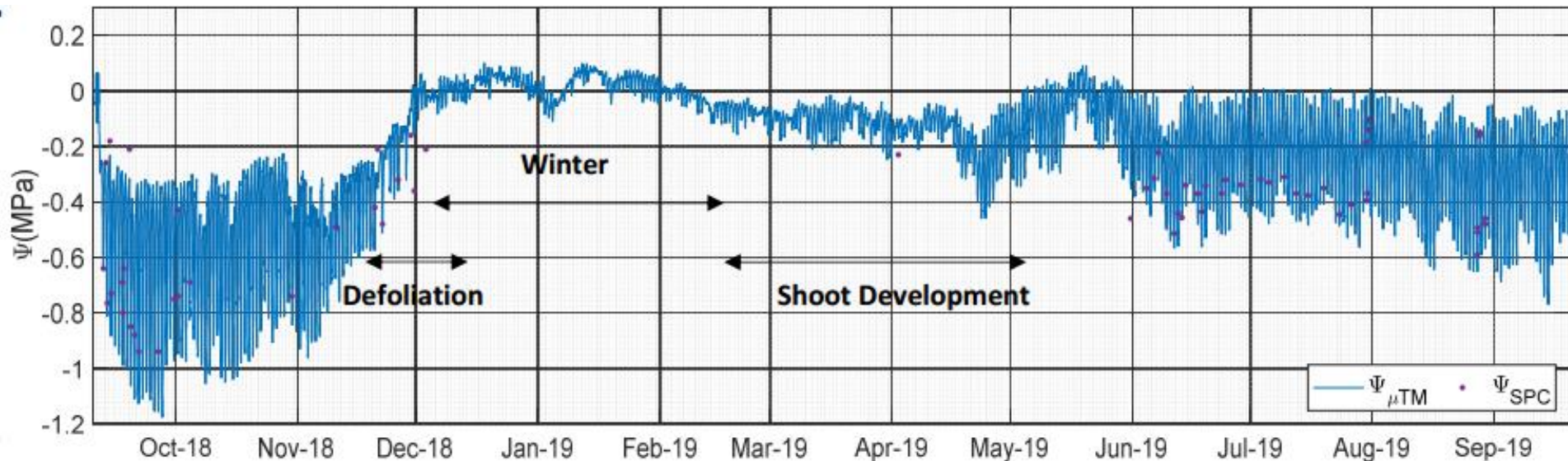


Sensor breaks

- It's usually very obvious when the sensor outright breaks. The data will have a huge jump in SWP and be noisy.
- This can happen due to excess pressure on the chip (say during installation, or due to a strong wound response).
- Unfortunately sensors cannot be repaired because the parts are so small.

Winter behavior

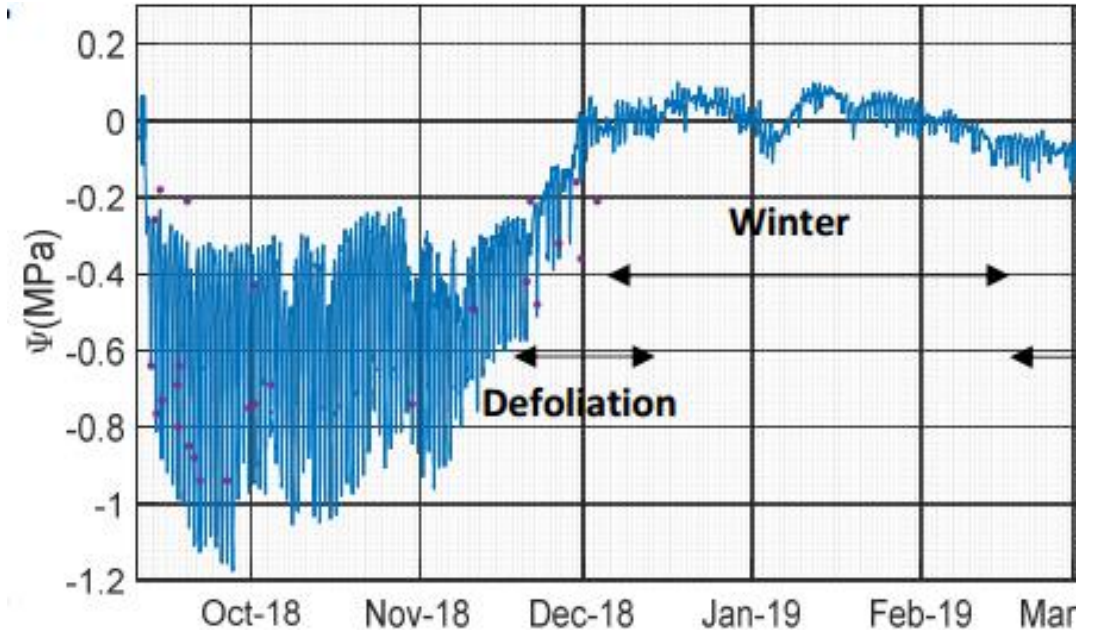
- Many crops go dormant during the winter and the measured water potential will go to zero, or show some 'noise' near zero.
- The measured water potential may go slightly above zero (+1 or +2 bars max). This is normal.
- Data during dormancy is not particularly useful and may be dominated by noise.
- Recommend sensor re-install after winter for best accuracy. Depending on the crop, sensors will read wetter values if left installed over the winter (due to wound closure).



1 year measurement in cabernet grapes

Slightly positive values

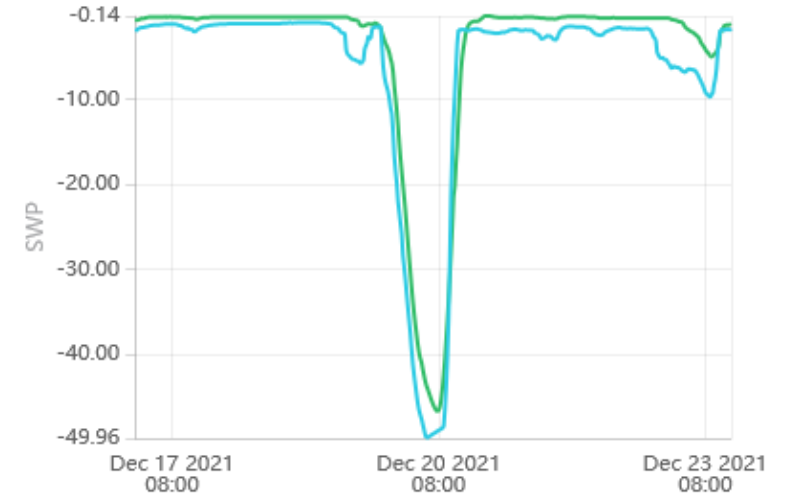
- Normal to have sensor sometimes read above zero, up to +1 or +2 bars.
- Cause 1: be due to electrical noise (sensor inaccuracy).
- Cause 2: In some crops, there is actually positive pressure in the xylem at times (i.e. grape during leaf out) and the sensor is reading this.
- Cause 3: The solutes from the tree xylem/elsewhere got into the sensor water and cause readings above zero due to osmotic pressure.
- If in doubt, you may remove the sensor and reinstall it. Or test it in the lab. The sensor should go back to zero in pure water.



Below zero temperatures

- Sensors will behave erratically when exposed to below freezing temperatures.
- If the exposure is brief, the sensor may work properly afterwards.
- Longer exposure or colder temperatures will eventually freeze the probe and break it.

p1, p2



Ambient temperature



Mechanical damage

Typical problems we see in the field:

- Rodent chews on sensor wires
- Machinery or tripping on wires

Data missing

- Usually happens because of SDI12 communication issue.
 - Check the wiring.
 - Interference between multiple SDI12 sensors connected to same port.