

Soil Moisture Monitoring & Irrigation Management

A Holistic Solution for Irrigation Management



Soil - plant - atmosphere monitoring



Data interpretation

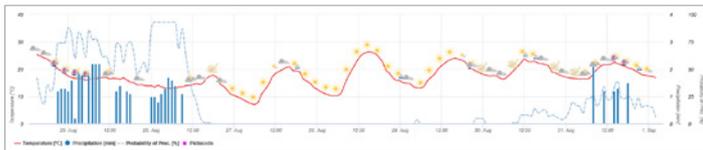


ACTION
When and how much to irrigate



Automation
(Interfaces with the major automation industry players such as Lindsay, Wiseconn, Spherag and Talgil)

Pessl Instruments offers a wide range of hardware and software solutions for efficient and cost effective soil moisture and irrigation management. Hardware devices monitor the soil (its moisture, temperature, salinity, presence of nutrients), the plant (dendrometric variations...), the atmosphere (all meteorological variables, from which you can estimate the evapotranspiration), and also the irrigation system (flow, water level, pressure, pH and electrical conductivity of fertilizer...).



The measured values can be combined with site specific weather forecasts and are accessible in near real-time on the FieldClimate platform. Weather forecast is updated on an hourly basis, available for a 3 to 7 day window and includes a number of variables - quantity and probability of precipitation, temperature, wind speed/direction, leaf wetness, relative humidity and evapotranspiration.

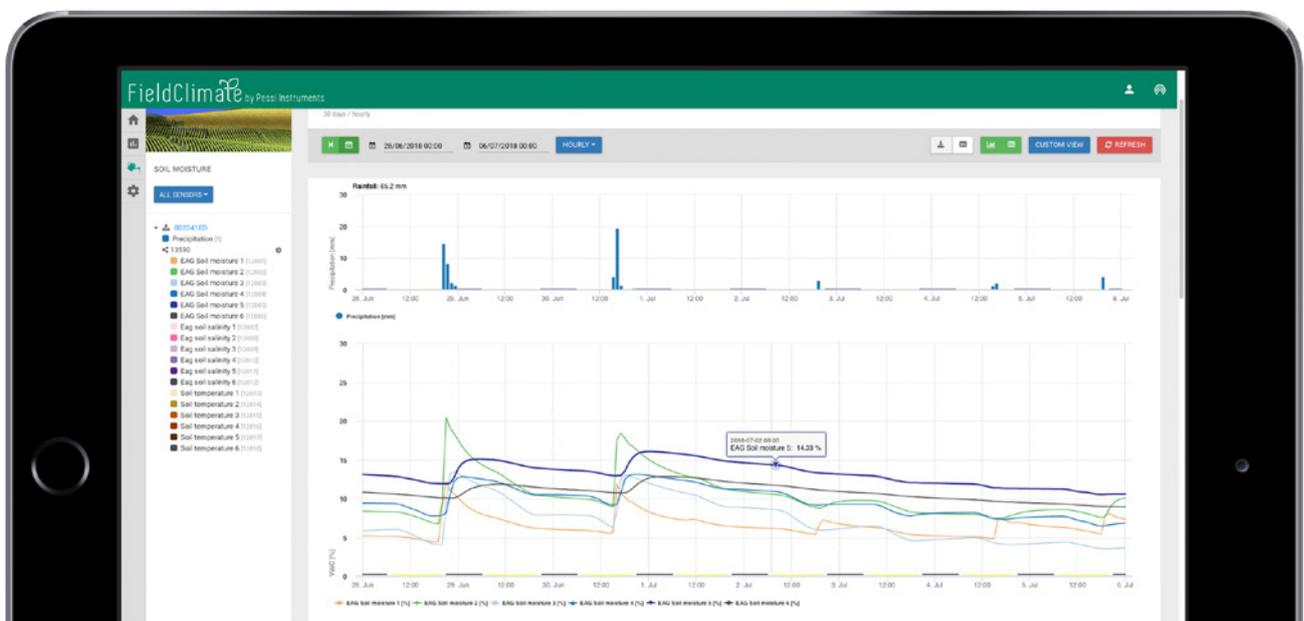
This enables the user to implement the best soil moisture-irrigation strategy for the fields. For example, understanding soil moisture values in a dynamic root zone allows the definition of a crop and soil specific growth season template, while near real-time field measurements, combined with forecasted evapotranspiration, provide an insight into future water use.

APPLICATIONS

- Irrigation and fertigation of numerous crops
- Targeting yields in irrigated and dryland crops
- Soilless crop irrigation
- Sports lawns and golf course management
- Management of urban green spaces
- Frost alert and frost automation systems
- Soil moisture analysis for flood monitoring
- Forest applications for fire risk and tree health

ADVANTAGES

- **Water Savings** – better timing and potential reduction of water use
- **Higher Yield** – safeguard and maximize genetic potential
- **Better Quality** – optimize quality based on crop health
- **Saving of Fertilizers** – reduce runoff or deep leaching of nutrients and optimize fertilizer use
- **Crop Health** – manage water for phytopathological adversities, stimulate root development and provide frost protection
- **Security** – real-time alerting on a number of parameters, including refill and saturated soil moisture levels, pump activation or failure and traceability of all events
- **Save Time** – rationalization of business operations
- **Lower Environmental Impact** – less water waste and ground water contamination



Data Interpretation with FieldClimate

All measured data from METOS® devices and sensors is stored and available in near real-time on FieldClimate and accessible through free iOS and Android apps. You can select any time period you want to view, including all historical data in both graph and table form.



WHICH INFORMATION CAN I OBTAIN FROM SOIL MOISTURE DATA?

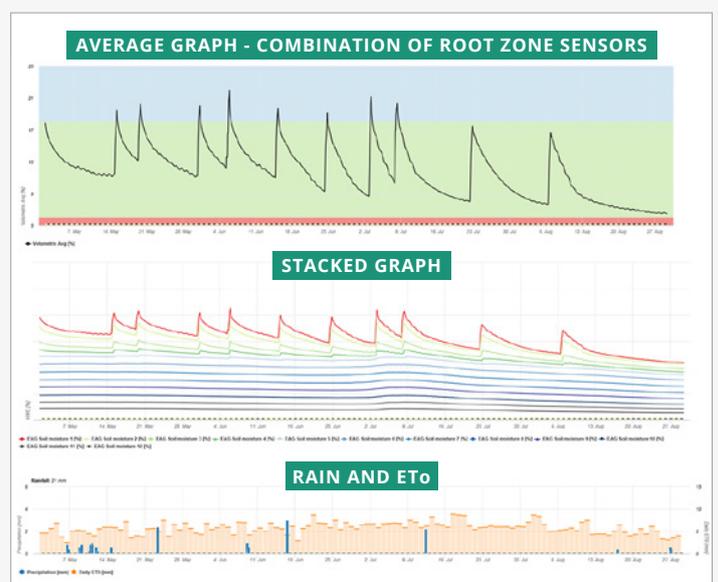
	Soil moisture measurement method	
	VWC	Tension
How does water move along the vertical soil profile?	👍👍	👍
Which root system portion is wet and in what time?	👍👍	👍
Does water leakage occur in deep percolation?	👍👍	👍
How does the root system develop?	👍👍	👍
What is the best irrigation scheduling (when and how much)?	👍👍	👍
How is water available for the plant?	👍	👍👍
How much force do the roots have to use to extract water from the ground?		👍👍

FieldClimate IRRIGATION MANAGEMENT SETTINGS:

- Calculation of an average root zone soil moisture graph defined by the user (the upper full amount known as full point or field capacity and the lower amount or refill point).
- Various sensor layers can be displayed in graphs in a number of formats, including standard, stacked or average.
- Full and refill point budget lines are color coded so users can clearly see the range of soil moisture for optimal management – red (deficit), green (comfort zone) and blue (excessive soil moisture).

OTHER PARAMETERS AND TOOLS FOR COMPREHENSIVE UNDERSTANDING OF WATER MANAGEMENT:

- Weather measurements and forecast, such as precipitation amounts and timing.
- Vapor pressure deficit.

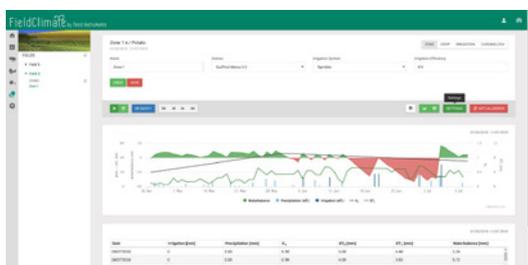


- Growing degree days (phenological stages).
- Current and forecasted evapotranspiration ETo.

WATER BALANCE MODULE

FieldClimate provides a module for the calculation of the water balance which enables the user to optimize water management and crop productivity by scheduling the irrigation so it will maintain the balance equilibrium. The reference evapotranspiration ETo is calculated according to Penman Monteith (FAO - 56 method) and requires measurements of temperature, humidity, solar

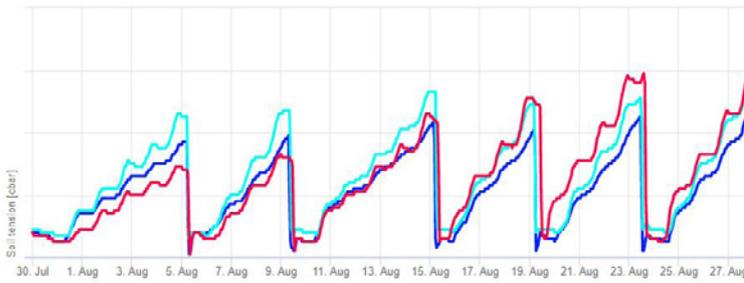
radiation and wind speed. The water balance model then permits the calculation of crop evapotranspiration ET_c , applying to the ETo the FAO crop coefficients K_c or other personalized coefficients for different phenological stages. The water balance is calculated in function of ET_c , rain and rain efficiency, type and efficiency of irrigation system and irrigation events. The application requires a station with sensors for ETo calculation and a rain gauge.



SMS WARNINGS

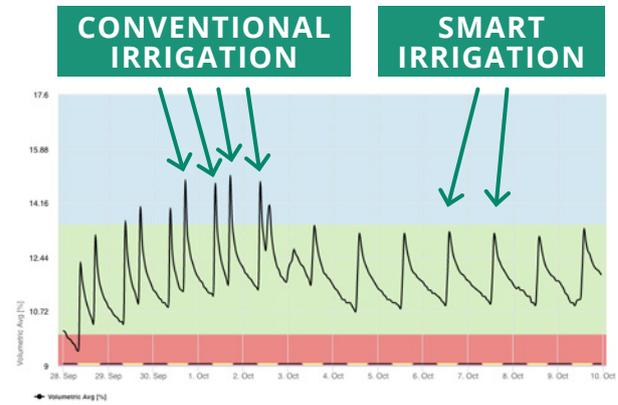
You can define critical threshold alerts for a number of sensors, including refill and field capacity soil moisture levels. SMS alerts can be sent to a number of users and issued in 5 minute intervals, which allows users to keep track of conditions in each field.

Action & Use Cases



CROP: Open-field tomato
IRRIGATION SYSTEM: drip
SOIL MOISTURE MEASUREMENTS: tension
DISPLAYED PERIOD: 20 days

The crop is irrigated every 4/5 days. Thanks to soil moisture monitoring with Watermark sensors, it is possible to act on the basis of the crop water requirement (in this case at a tension between 35 and 45 cbar), avoiding plant stress conditions and saving water.



CROP: Blueberry
IRRIGATION SYSTEM: drip
SOIL MOISTURE MEASUREMENTS: VWC
DISPLAYED PERIOD: 9 days

The crop shown in the graph is initially subject to two irrigation interventions on a daily basis. Thanks to probe monitoring of volumetric water content, it was observed that an acceptable soil moisture level for the crop could be maintained even with only one irrigation intake per day.

Result: Immediate 50 % water saving.

Agronomic Consulting

To help you with precise METOS® IoT data interpretation and get the most out of your crop by optimizing every drop of water and fertilizer, we can recommend local irrigation experts who can support you with on-site visits. Partners like Aquagri have a

local footprint, they are using our API and enrich the data with additional software services, field visits, on farm training and specialized know-how on crops.

Automation Solution

Once you have developed a good irrigation management strategy based on conscious interpretation of the data coming from your soil-plant-atmosphere monitoring solution, you are ready for the next step: **the automation**.

Pessl Instruments offers an open API (Application Programming Interface) which interfaces with the major automation industry players worldwide. We have developed seamless interfaces with several leaders in this field:

- **Lindsay Fieldnet** (<https://www.lindsay.com/usca/en/irrigation/brands/fieldnet/>)
- **Wisconn** (<https://wisconn.com/about-us/>)

- **Spherag** (<https://spherag.com/>)
- **Talgil** (<https://talgil.com/Home>) and many others

We are ready to provide support, so your irrigation installer will be able to integrate your METOS® device in your irrigation and fertigation controller solution. With this interface to the METOS® IoT line you will make your irrigation controller truly a smart one. It will feel the real needs of the plants and based on that automatically adjust the irrigation scheduling. This way you will have all the tools to maximize yield and quality and save time in the management of many fields.



Soil Moisture Sensors

For more information about other sensors & dataloggers go to: www.metos.at



Pessl Instruments offers a wide range of OEM sensors for measuring soil moisture and other parameters, such as profile probes or fork like sensors. These sensors can provide measurements of volumetric water content (VWC) or tensiometric readings, which are used to measure tension (or suction) of the soil.

monitoring solution based on the characteristics of your soil, crops, irrigation systems, arrangement of the terrain and field management. Specific solutions are available for potted plants and soil-less applications.

The possibility to choose different technologies and sensors and combine them, allows you to design the best soil moisture

Some of the soil moisture sensors can also measure soil temperature or bulk electrical conductivity (EC) or volumetric ion content (VIC), indications particularly useful for fertilization management.

SENTEK DRILL & DROP TRISCAN PROBE



- VWC
- Soil temperature
- Soil salinity (VIC)
- Length: 10, 30, 60, 90, 120 cm
- One sensor every 10 cm
- Rapid connector
- Cable protection

PI-PROFILE PROBE



- VWC
- Soil temperature
- Lengths: 60 cm, 90 cm
- One sensor every 10/15 cm

PESSL INSTRUMENTS PI54-D



- VWC
- Soil temperature

TENSIOMETER (IRROMETER)



- Soil water tension
- Shaft length 15 cm, 30 cm, 45 cm, 60 cm, 90 cm

WATERMARK (IRROMETER)



- Soil water tension

Other Sensors

RAIN GAUGE



PESSL INSTRUMENTS pH SENSOR



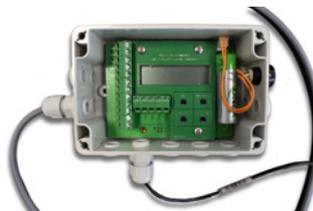
SOIL TEMPERATURE



PRESSURE SWITCH



EC & pH INTERFACE WITH DISPLAY



PIPE PRESSURE



PESSL INSTRUMENTS ELECTRICAL CONDUCTIVITY



WATER LEVEL



Hardware Technology



μMETOS
iMETOS 3.3
nMETOS



FieldClimate



Real time data access
and decision support

FieldClimate also provides APIs through which specific data, measured by our devices, can be exchanged automatically to support other platforms and work environments.

μMETOS FOR SOIL MOISTURE & RAINFALL MONITORING

Connectivity: NB-IoT NB1 / Cat-M1 / GPRS

μMETOS is a micro data-logger powered by a solar panel and rechargeable battery. It is designed to work in all environments and can be equipped with numerous sensor combinations, such as soil moisture, temperature, salinity, water level, air temperature, and precipitation.



iMETOS 3.3 FOR WEATHER MONITORING

Connectivity: 2G, 3G, 4G (LTE class 1, LTE class M)

iMETOS 3.3 is highly durable weather station, adaptable to all environmental conditions. Power is supplied by a solar-panel, rechargeable battery and is reliable thanks to an internal non-volatile memory. Based on configuration it can store up to a year of data.

nMETOS

Connectivity: NB-IoT NB1 / Cat-M1

nMETOS, an entry-level solution, is the latest generations of weather stations that operates on NB-IoT network. nMETOS can measure rainfall, air and soil temperature, relative humidity, leaf wetness, and soil moisture.



FieldClimate Web & Mobile Apps



A complete range of wireless, solar powered monitoring systems under the METOS® brand comes together on the FieldClimate platform.

MOBILE APP



fieldclimate.com



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