COMPARISON BETWEEN FORECASTS OF REFERENCE EVAPOTRANSPIRATION AND ET$_o$ VALUES CALCULATED USING DATA FROM DIFFERENT CLIMATIC CONDITIONS

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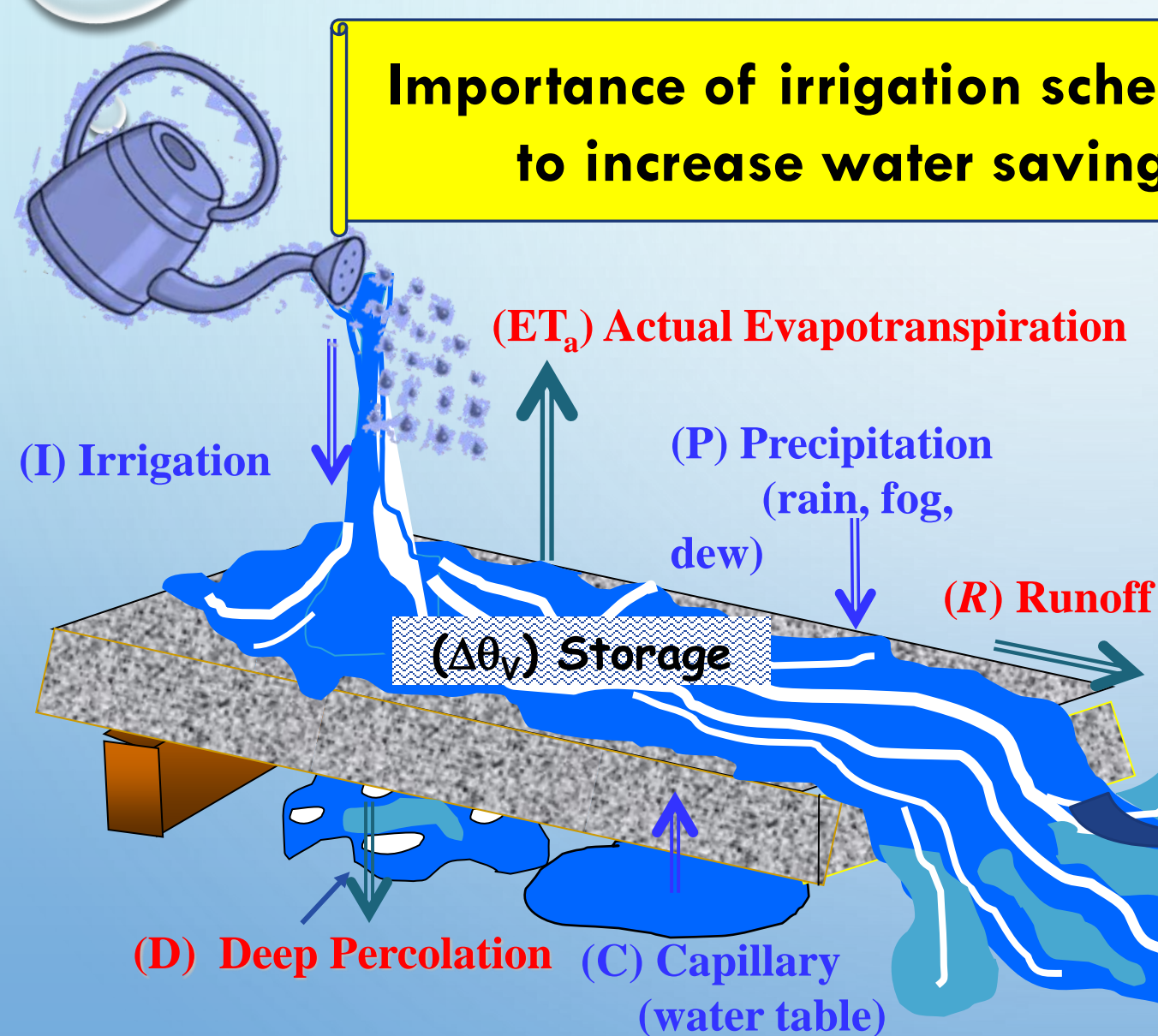
Water balance method allows irrigation scheduling based on weather data of the **previous** week: Why not calculate the irrigation needs based on the weather **forecast for the next week**?

ETo forecasts offer irrigators the ability to develop irrigation strategies to better match irrigation depths to soil water depletions.

EVAPOTRANSPIRATION AND WATER BALANCE

Importance of irrigation scheduling to increase water savings

(ET$_a$) Actual Evapotranspiration

(I) Irrigation

(P) Precipitation (rain, fog, dew)

(R) Runoff

(Δθ$_V$) Storage

(D) Deep Percolation

(C) Capillary (water table)

$$\Delta\theta_V = I+P+C-R-D-ET_a$$

$$ET_o = \frac{0.408\Delta\left(R_n-G\right)+\gamma\left(\dfrac{900}{T+273}\right)u_2\left(e_s-e\right)}{\Delta+\gamma\left(1+0.34u_2\right)}$$

EWRI-ASCE Committee on Evapotranspiration

CIMIS
California Irrigation Management Information System

- Automated ETo network
- Database of ETo and weather
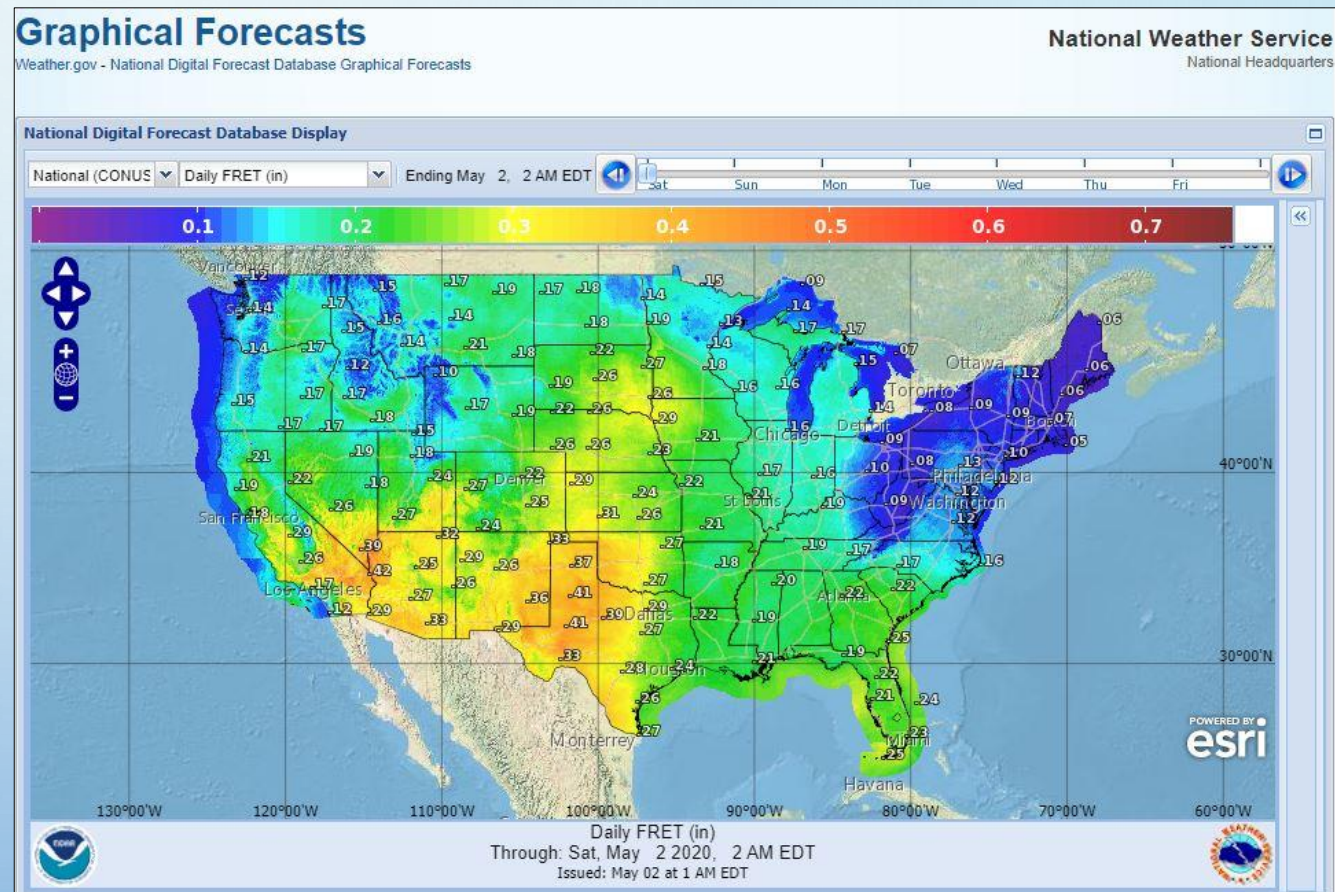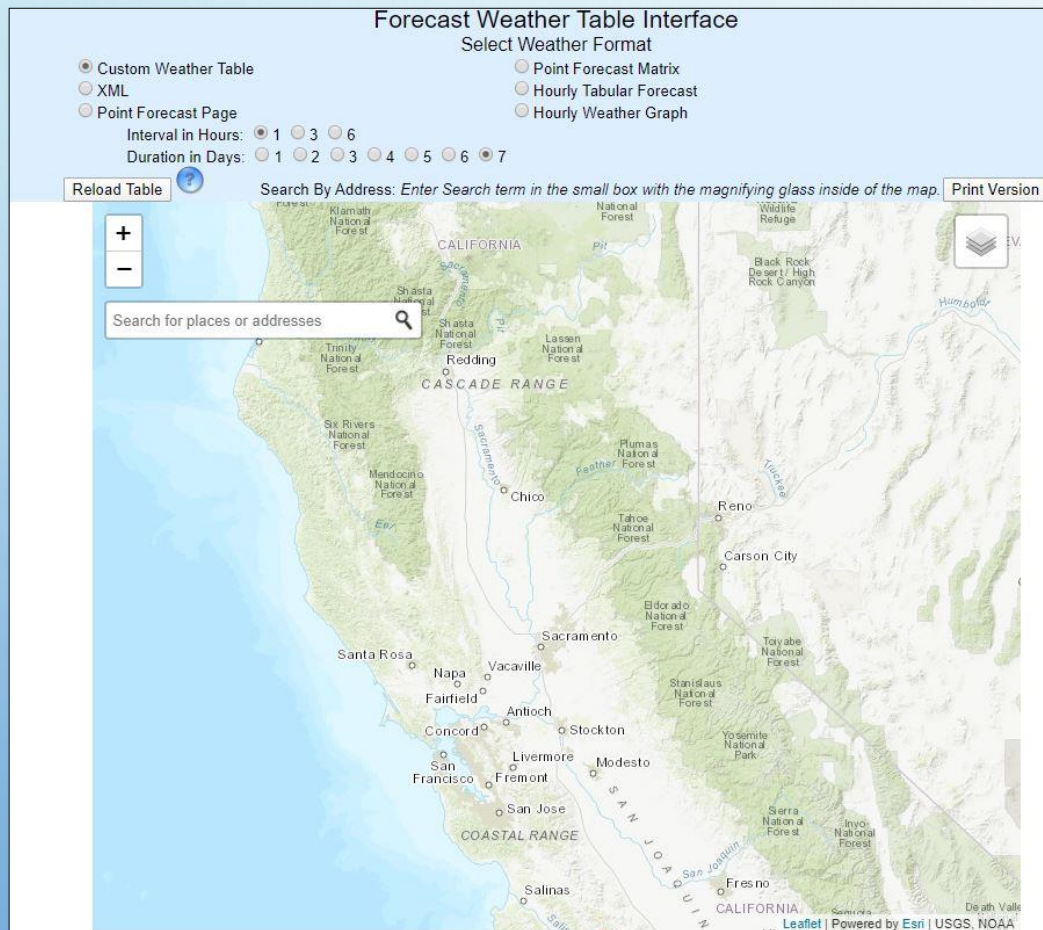- Encourages ET-based irrigation scheduling

Approximately 150 ± stations

INACTIVE STATIONS (61)
ACTIVE STATIONS (122)
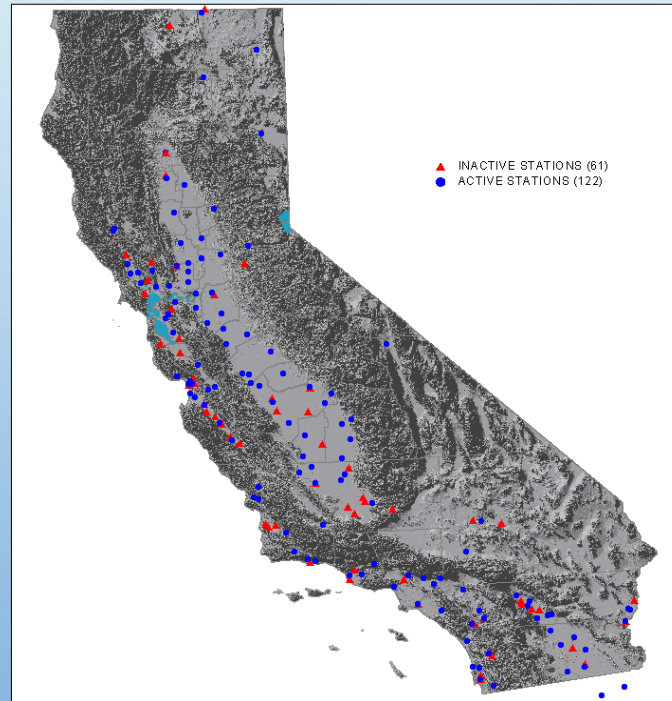
ETo data spatialized all over CA, using a combination of data from satellites and data interpolated from CIMIS stations.

>> ETo estimate at a 2 km resolution.
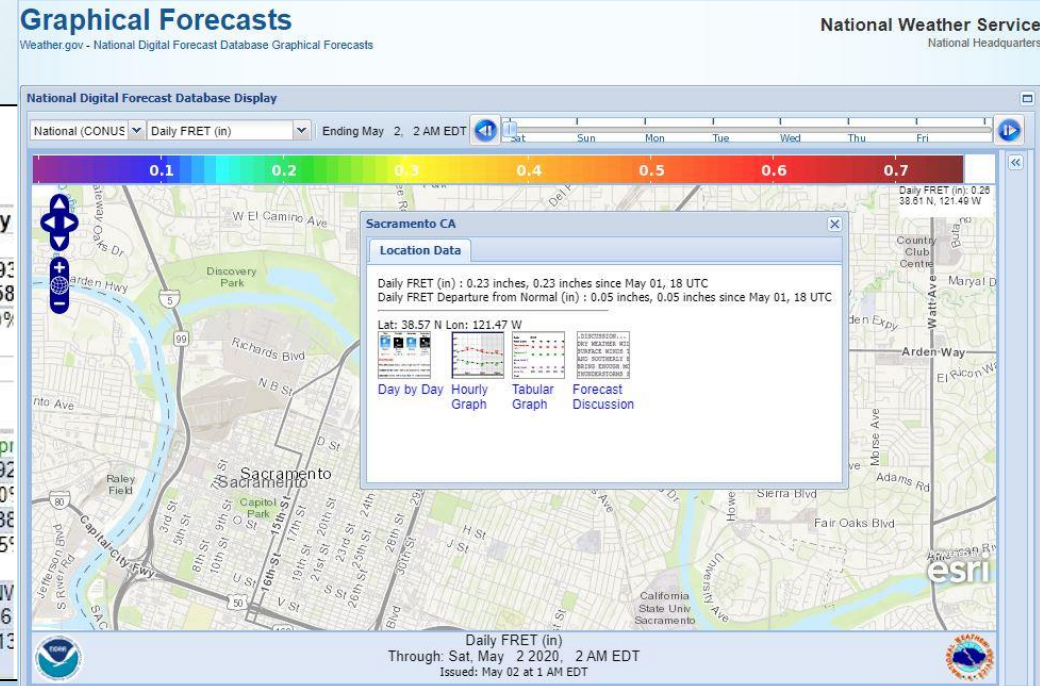
FORECAST REFERENCE EVAPOTRANSPIRATION *(FRET)*

https://www.wrh.noaa.gov/forecast/wxtables/index.php?wfo=sto

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FRET analysis program uses forecast daily T_{max} and T_{min}, forecast RH_{max} and RH_{min}, daily mean wind speed, and a slightly modified daily standardized reference ETo equation to provide the seven-day forecast ETo.
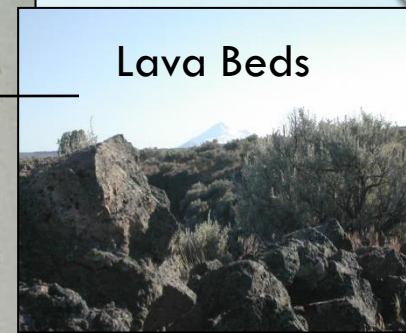
The National Weather Service (NWS) does not forecast solar radiation R_s, but it does forecast cloud cover C_C to estimate R_s as:

$$\frac{n}{N} = -0.0083 \cdot C_c + 0.9659 \quad \longrightarrow \quad R_s = \left(0.25 + 0.5 \cdot \frac{n}{N}\right) \cdot R_a$$
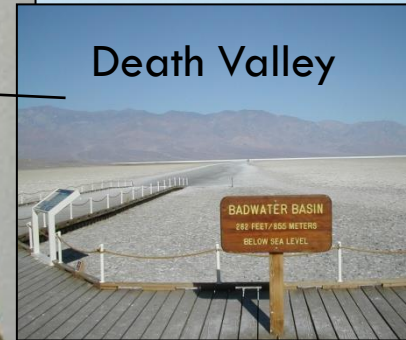
Validation period is 67 days
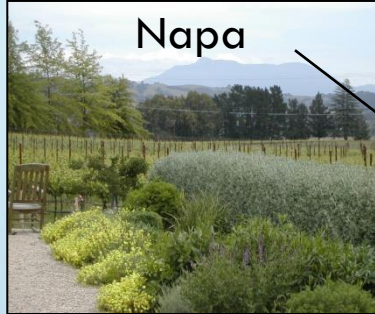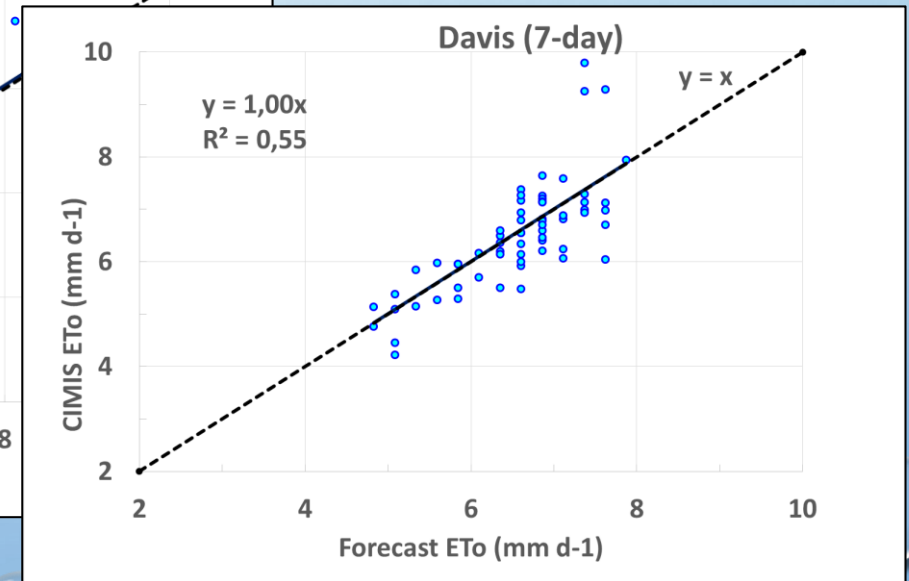
Method validation in 15 stations

Different climates

Napa

Lava Beds

Tahoe

Death Valley

SFO

Davis

SD

Torrey Pines

Meloland

EТo

Station name	RMSE			
	1d ETo (mm)	3d ETo (mm)	5d ETo (mm)	7d ETo (mm)
Davis	0.54	0.67	0.70	0.77
Meloland	1.52	1.48	1.66	1.45
Torrey Pines	0.89	1.02	0.94	0.83
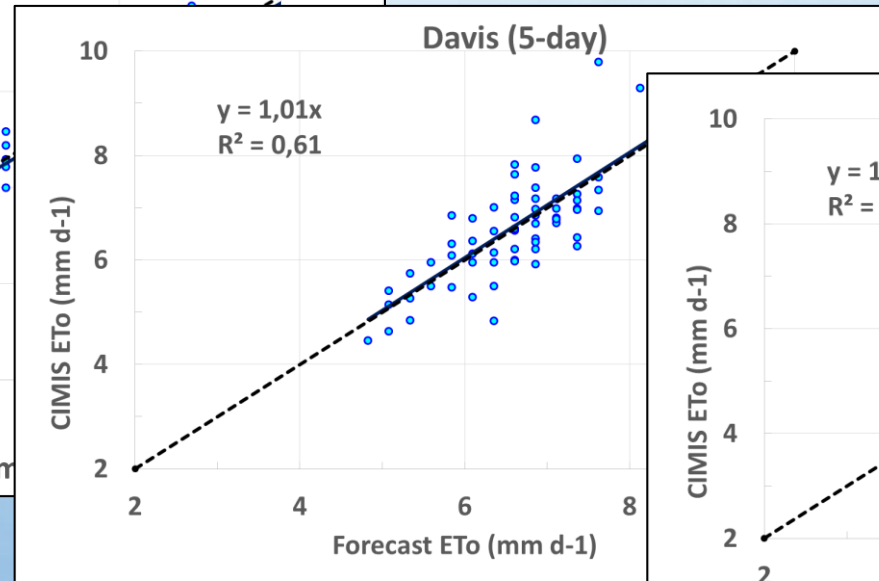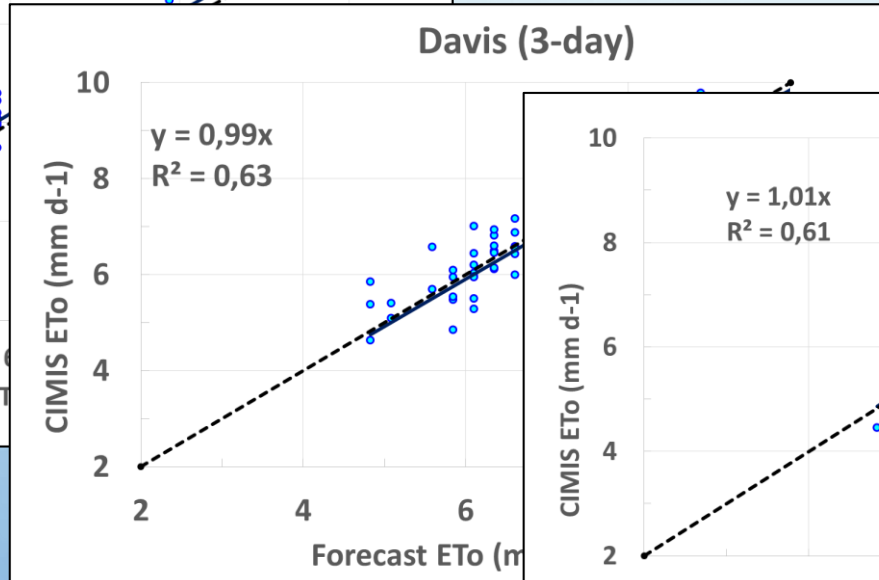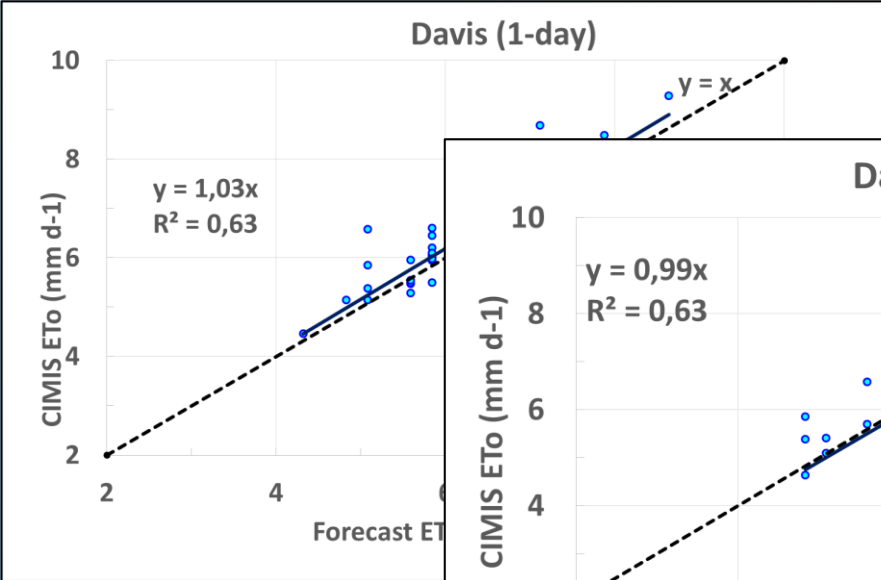
Good correlation for ETo, air temperatur and relative humidity

Station name	RMSE			
	1d WS (m/s)	3d WS (m/s)	5d WS (m/s)	7d WS (m/s)
Davis	1.13	1.17	0.86	0.79
Meloland	1.41	1.32	1.54	1.65
Torrey Pines	1.64	0.91	0.89	1.05

Wind Speed

Meloland (1-day)

y = 0,89x
R² = -0,84

RMSE=1.41

Meloland (3-day)

y = 0,83x
R² = -0,42

RMSE=1.32

Meloland (5-day)

y = 1,24x
R² = -0,69

RMSE=1.54

Meloland (7-day)

y = 1,15x
R² = -1,16

RMSE=1.65
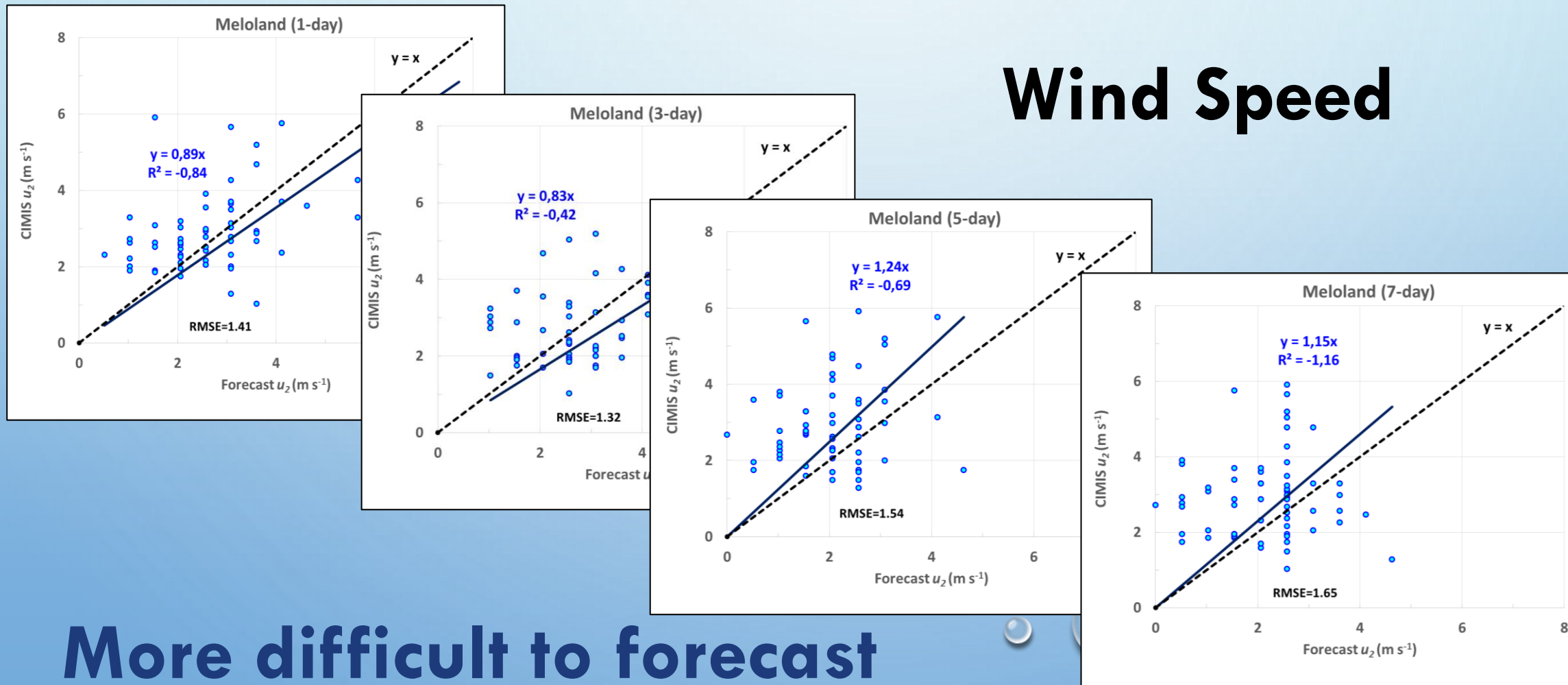
More difficult to forecast

CONCLUSIONS

- Validation results depend on the climate of the station selected.

- FRET offers to farmers the possibility to schedule up to one week in advance the irrigation water and labor needs.

- A properly designed and operated network of weather stations is needed to validate FRET accuracy especially in climates where it has not been tested.

- FRET is especially useful where good weather stations' sites are scarce and in countries where funding for setting stations is limited.

THANK YOU