Current work on irrigation scheduling
- plant development and climatic water balance

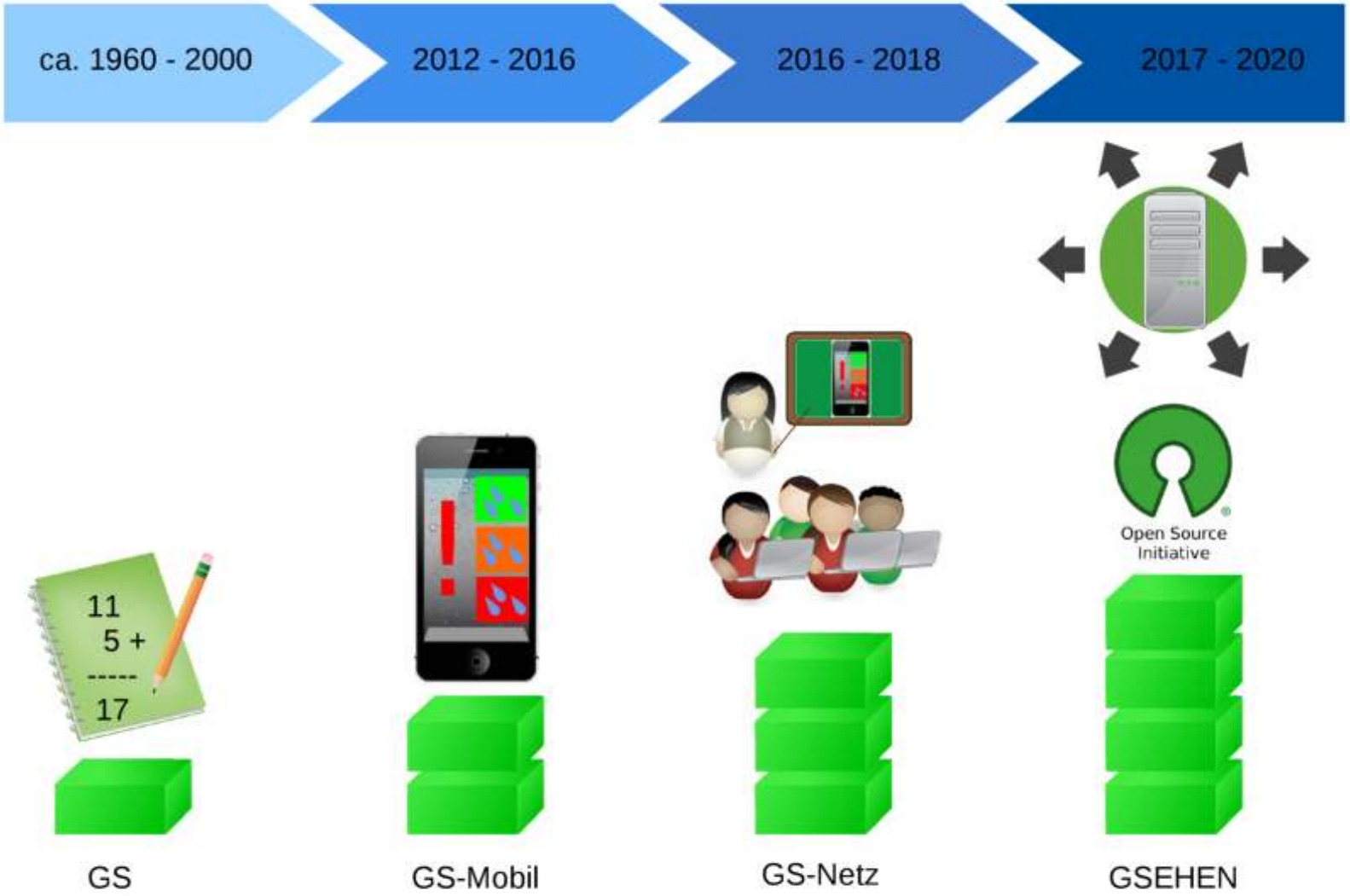
Session: MODELS AND DECISION SUPPORT SYSTEMS

Jana Zinkernagel

Department of Vegetable Crops

May 7, 2017

Geisenheim Irrigation Scheduling



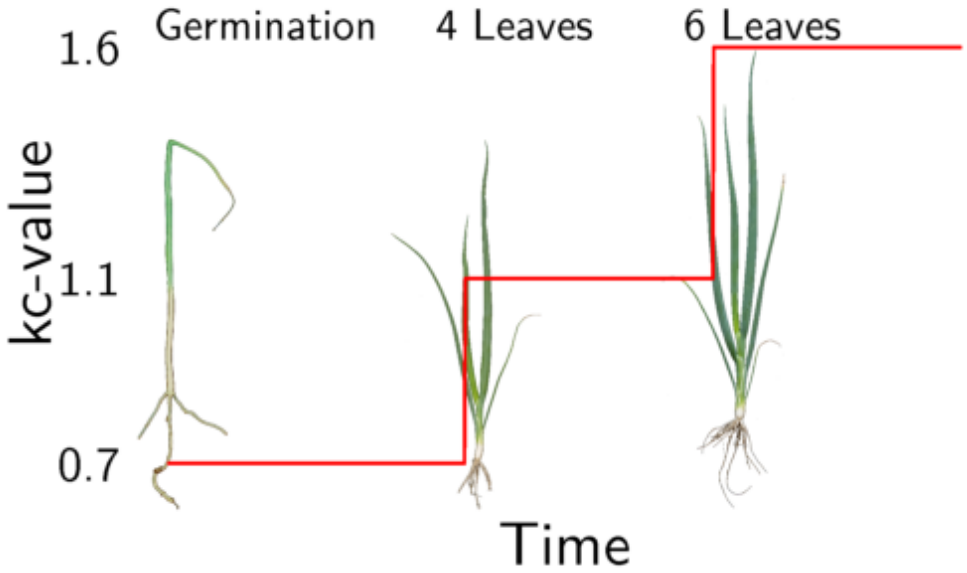
The evolution of the Geisenheim Irrigation Scheduling (GS)

Geisenheim Irrigation Scheduling (GS)

$$GS : CWB + kc(BBCH)$$

$$ET_c = ET_0 * kc$$

$$\text{GS} = \sum_{Start}^{End} irrigation + precipitation - ET_c$$

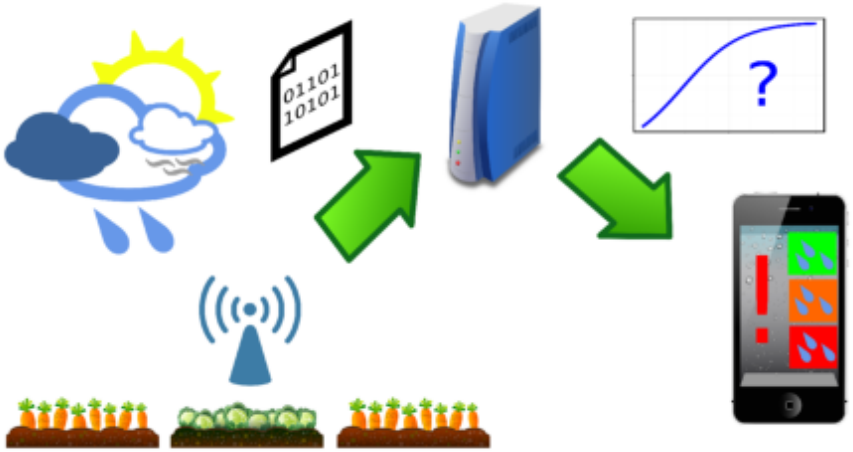


A decision support model for open field irrigation of vegetable crops.
Based on climatic water balance with FAO56-ET_0.
Used with sprinkle irrigation.
27 parametrized and evaluated vegetable crops.

GS is calculated by hand

GS-Mobil App

- Mobile GPS backed DSS featuring plot specific recommendations
- Plant development predicted by temperature sum model
- Available for lettuce
- In preparation: spinach, celery and onion



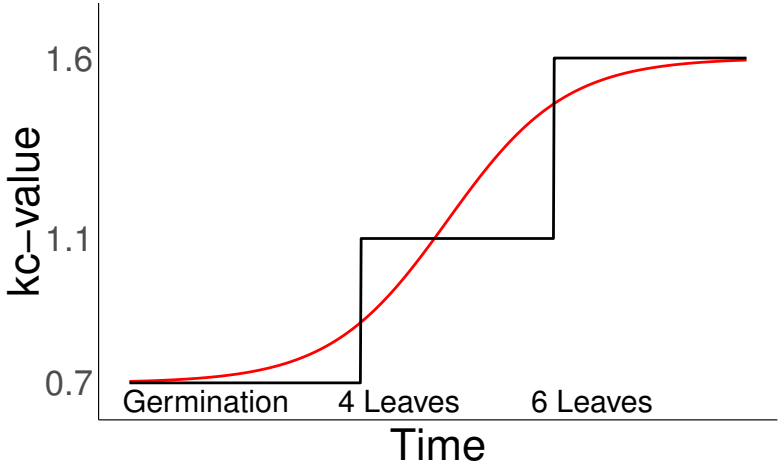
Project conducted in cooperation with Helm Software (Apple mobile devices only), German Weather Forecast

GS-Mobil

$$GS : CWB + kc(BBCH)$$

$$GS_{mobil} : CWB + kc(\sum Temperature)$$

$$kc_{Tempsum} = \frac{kc_{max} - kc_{min}}{1 + a * exp(-b * TempSum)} + kc_{min}$$



Temperature sum model in contrast to kc-stairs, observed $\rightarrow$ simulated kc
$kc = f(BBCH, Step) \rightarrow kc = f(TempSum)$

EIP Agri: GS-Netz (GS-network)

Advancement in GS-Mobil App in cooperation with the involved farmers.

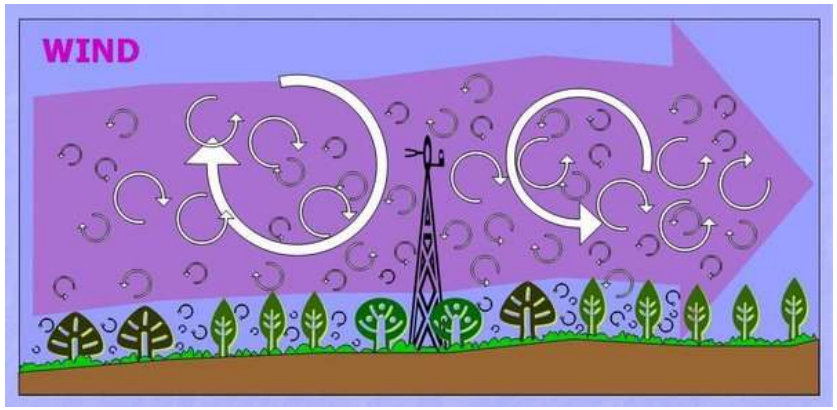
- Traffic light system:
  - *green* 0 => 8 mm *AWC in corresponding soil depth*
  - *yellow* 0 =< 8 mm *AWC in corresponding soil depth*
  - *red* *Number=output of the irrigation recommendation*
- Smaller and low frequency irrigation recommendations to promote not only the initial growth, but to ensure quality by prohibiting leaf burn.

GSEHEN

- GS as **free and open source software**
- Server-based data, accessible by clients
- User-interface independent of the operating system
- Distribution of GS and accessibility to all

GSEHEN Eddy-covariance

- **Measurement** of crop evapotranspiration
- Evaluation of kc-values
- Improving GS as Irrigation DSS

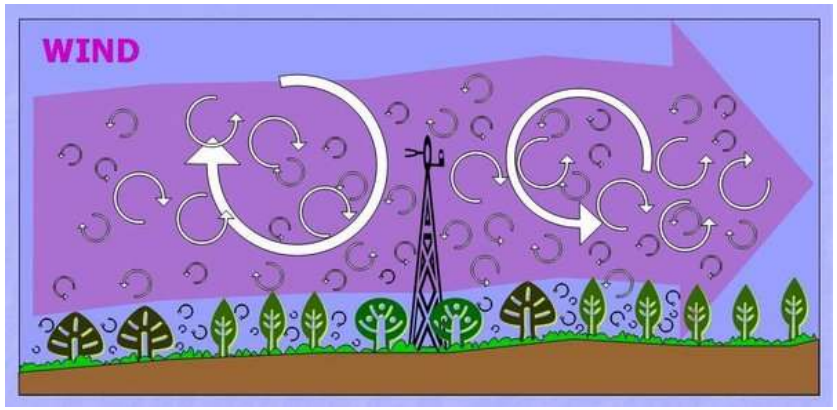


measuring vertical turbulent fluxes
source: Burba (2013)

Eddy-covariance weather station at research site with onion

GSEHEN Eddy-covariance

- **Measurement** of crop evapotranspiration
- Evaluation of kc-values
- Improving GS as Irrigation DSS



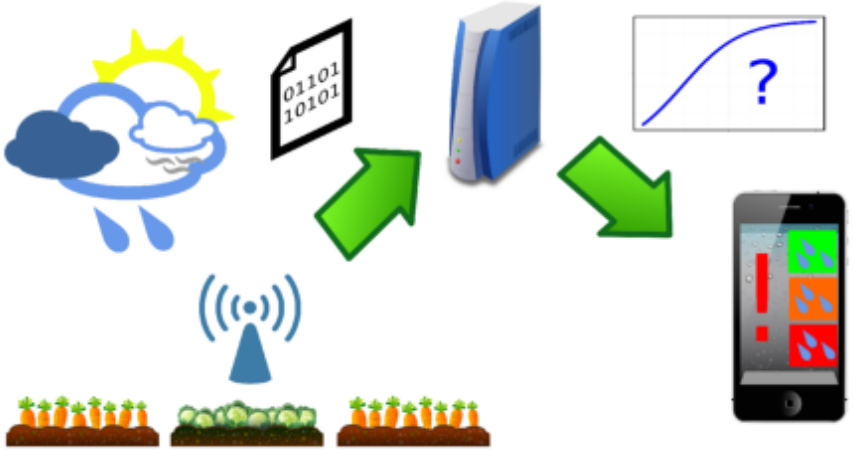
measuring vertical turbulent fluxes
source: Burba (2013)

Eddy-covariance weather station at research site with onion

⇒ Potential for further research questions

Relevant or interesting for you?

Please join us!



GS Evaluation

The kc-value is calculated by a daily water balance which includes the ratio between ET_0 and ET_a.

$$kc = \frac{ET_a}{ET_0}; \frac{\text{actual evapotranspiration}}{\text{reference evapotranspiration}}$$

$$ET_a = \Delta\text{weight} + \text{irrigation} + rain - drainage$$

Figure : Measurement of reference evapotranspiration, ET_0 (weather station) and water use, ET_a (lysimeters)