

Evaluation of ET modules in Versatile Soil Moisture Budget: West Nose Creek Study

John Jackson, Ligang Xu, Masaki Hayashi
Dept. of Geology and Geophysics, Univ. of Calgary

Technical Assistance

**Ralph Wright, Rui Chen, Mike Toews, Jaclyn Schmidt,
Karen Miller, Nathan Green, Greg Langston**

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Groundwater Recharge Estimation for Sustainable Water Resources Management

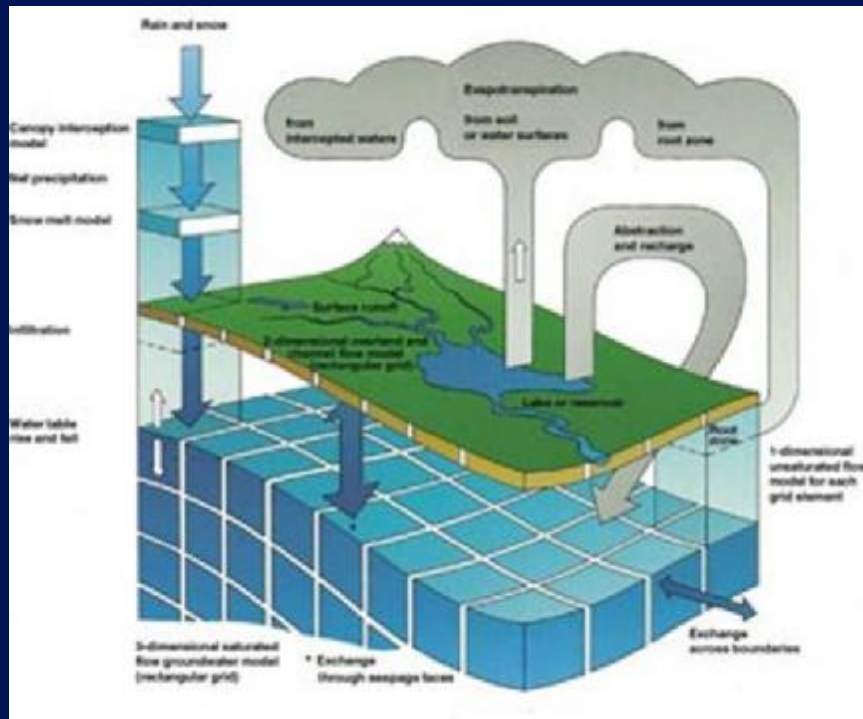
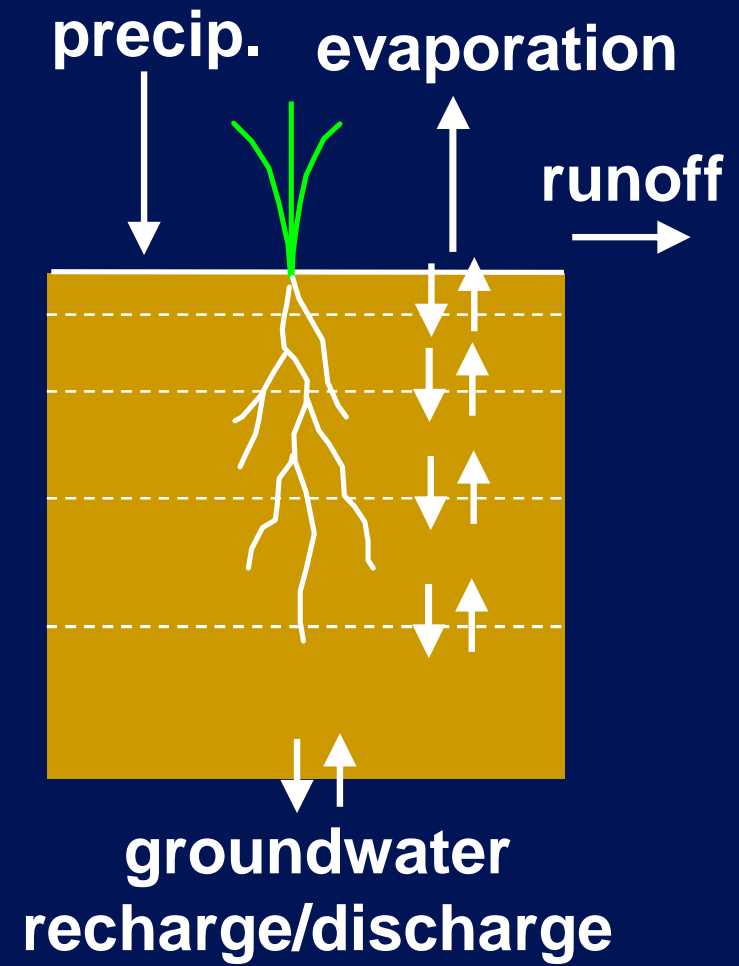


Figure from: www.dhisoftware.com

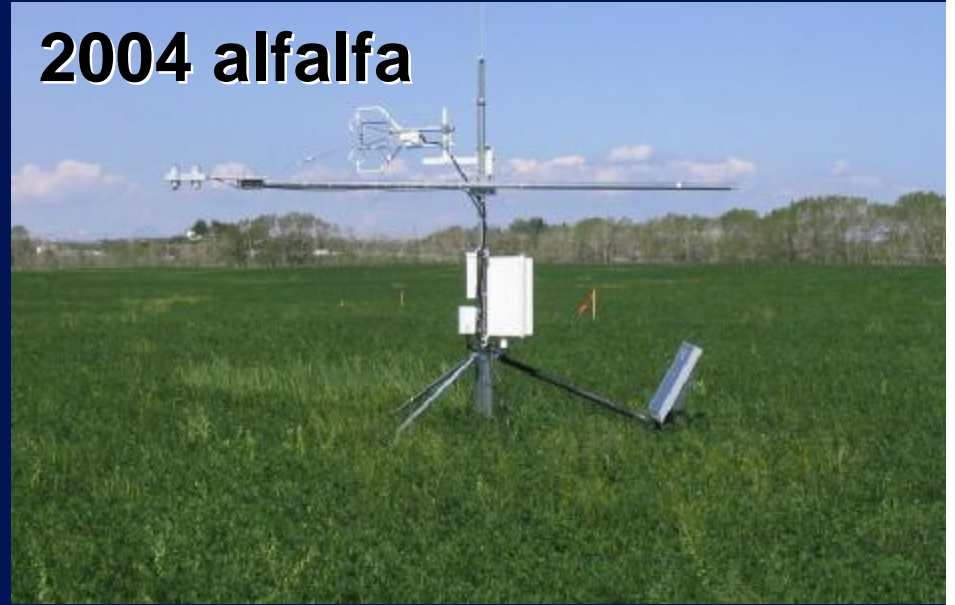


West Nose Creek Watershed

Located directly north of
Calgary

Primarily agricultural,
some residential

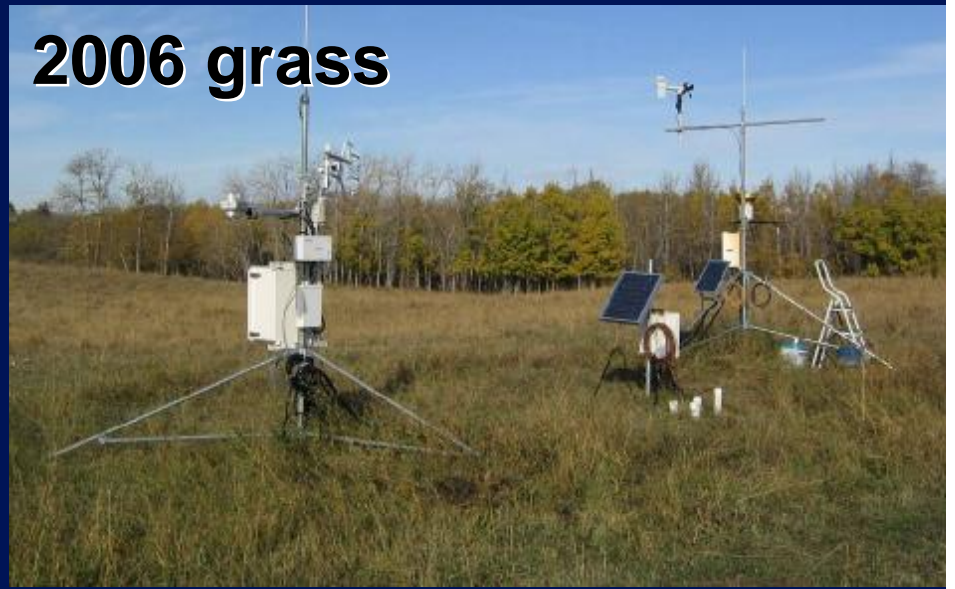
2004 alfalfa



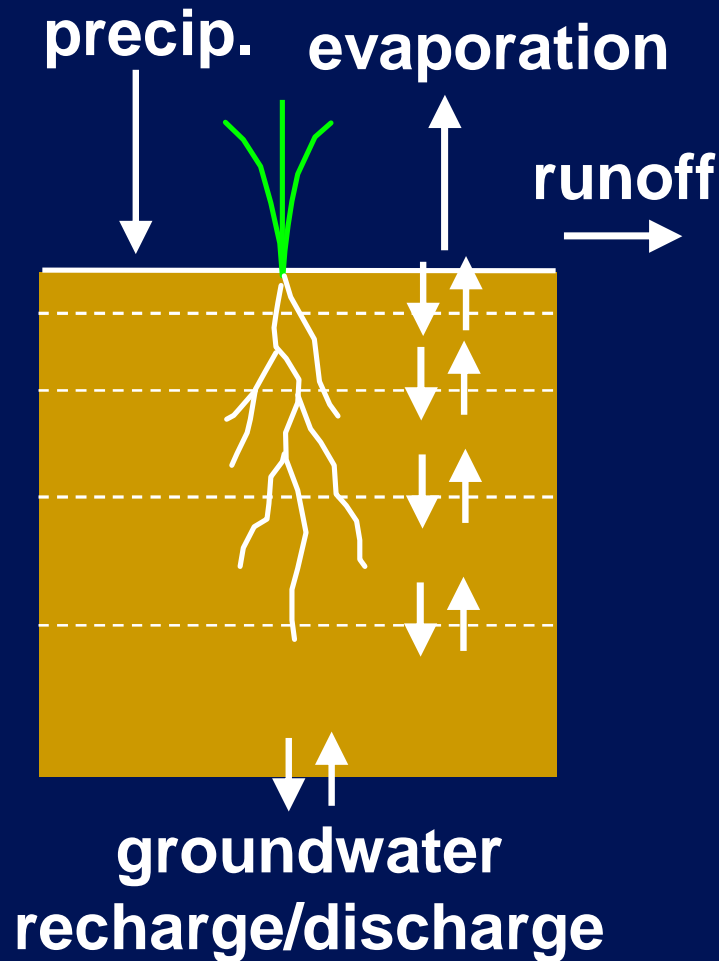
2005 barley



2006 grass



Versatile Soil Moisture Budget (VSMB)



Baier and Robertson (1966)

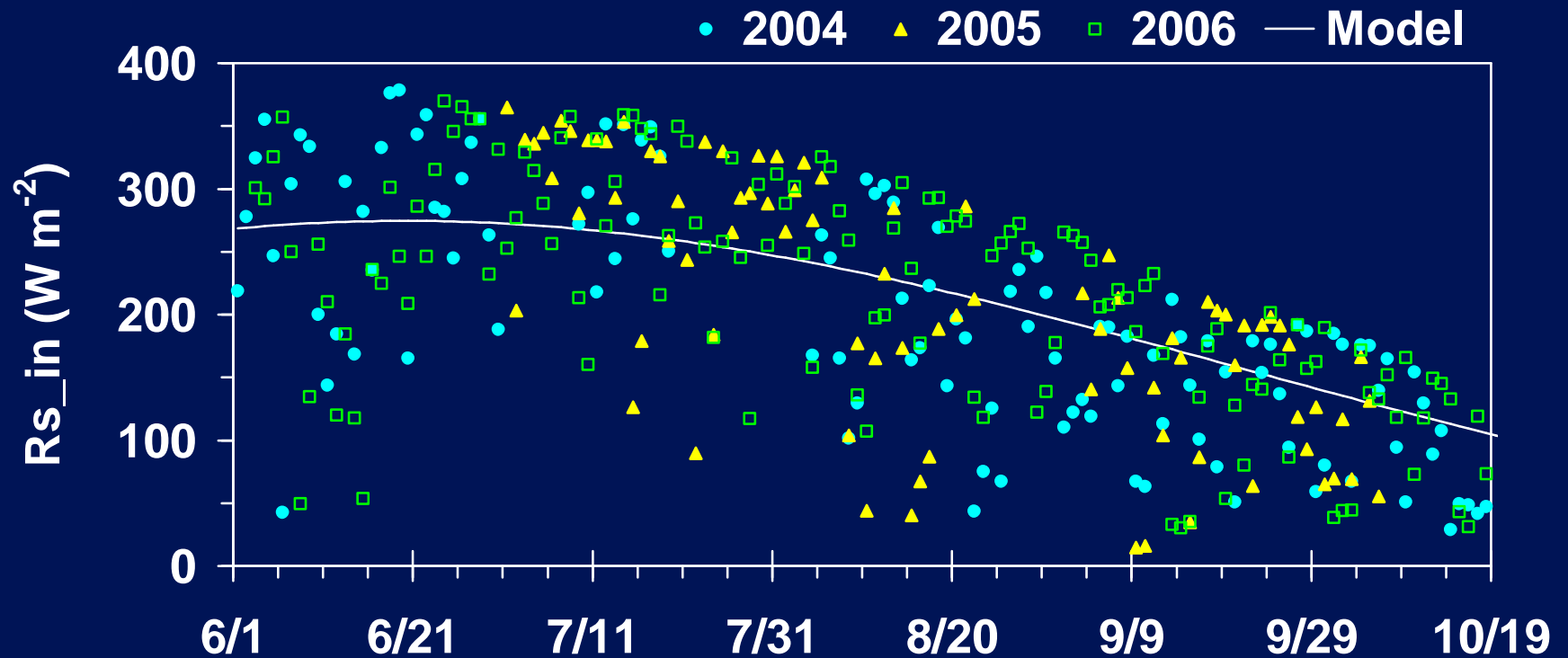
- temperature index PET
- $AET = PET \times \text{drying function}$
 $S f_{\lambda}(\text{crop stage, soil moisture})$
- bio-meteorological time for crop stages (degree day)
- gravity drainage of soil water to field capacity

Akinremi et al. (1996)

- Priestley-Taylor PET ($a = 1.28$)
- runoff by the Curve Number method

Radiation Module in VSMB

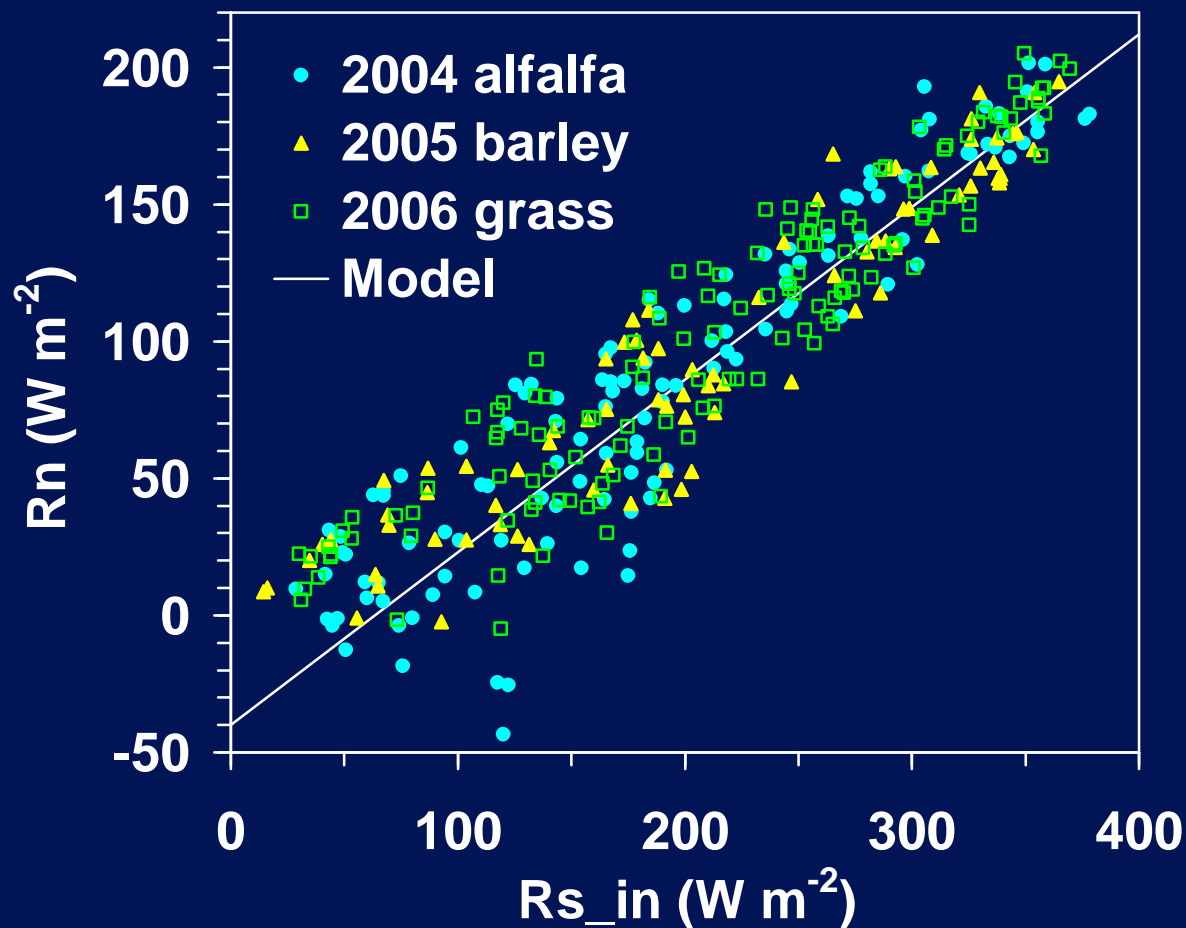
1. Compute SW incoming radiation (R_{s_in}) from latitude and Julian day.



2. Compute net radiation (Rn) from Rs_in

$$R_n = 0.63R_{s_in} - 40 \text{ W m}^{-2}$$

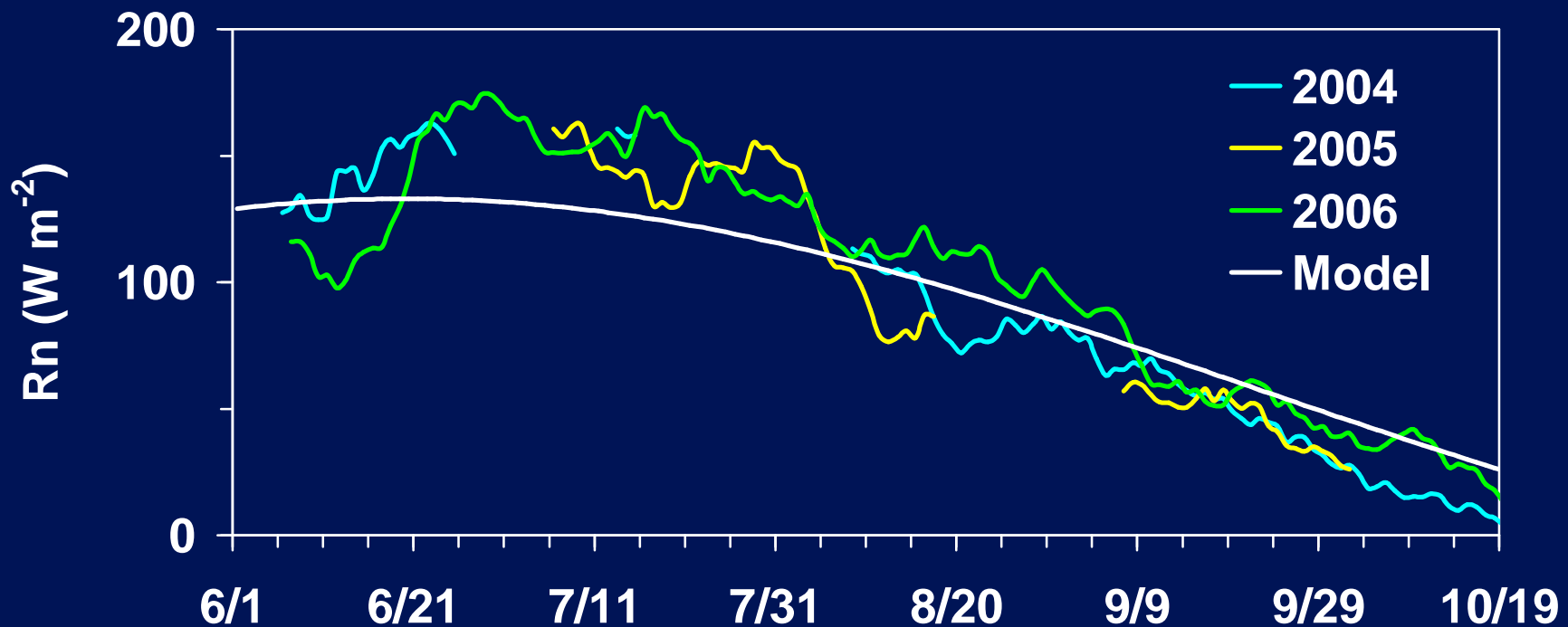
(Linacre, 1993. Agric. Forest Meteorol., 64: 237)



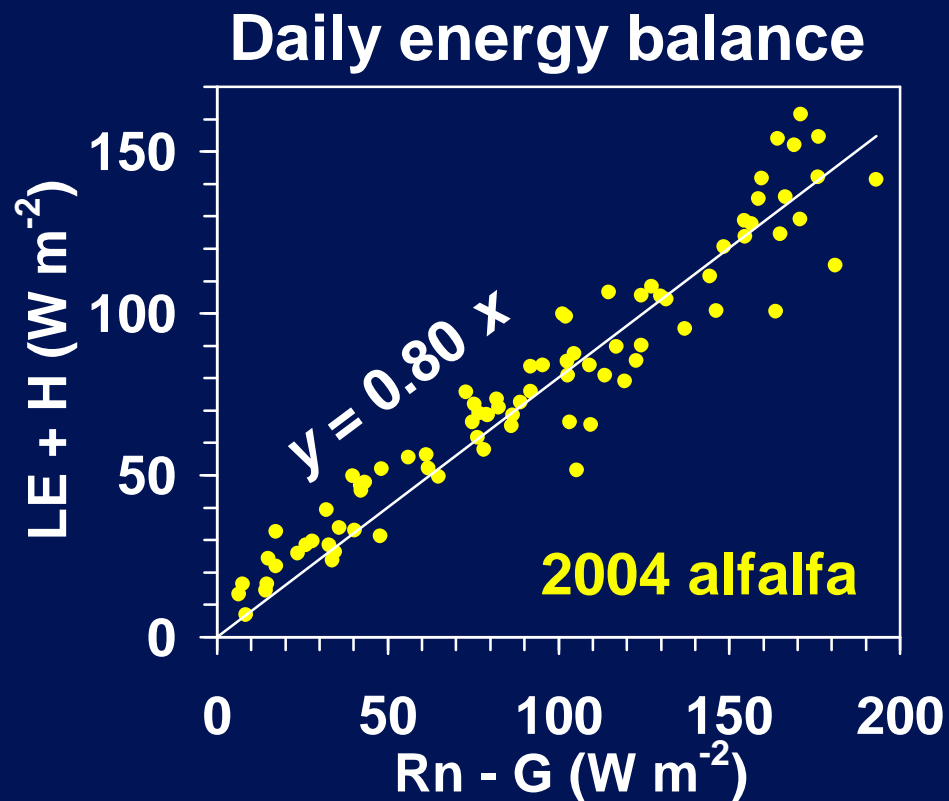
10-day Moving Average Net Radiation

VSMB has a tendency to underestimate Rn in June - July [®] underestimation of PET.

Feeding measured Rs_in will improve VSMB.



Turbulent Flux Measurements



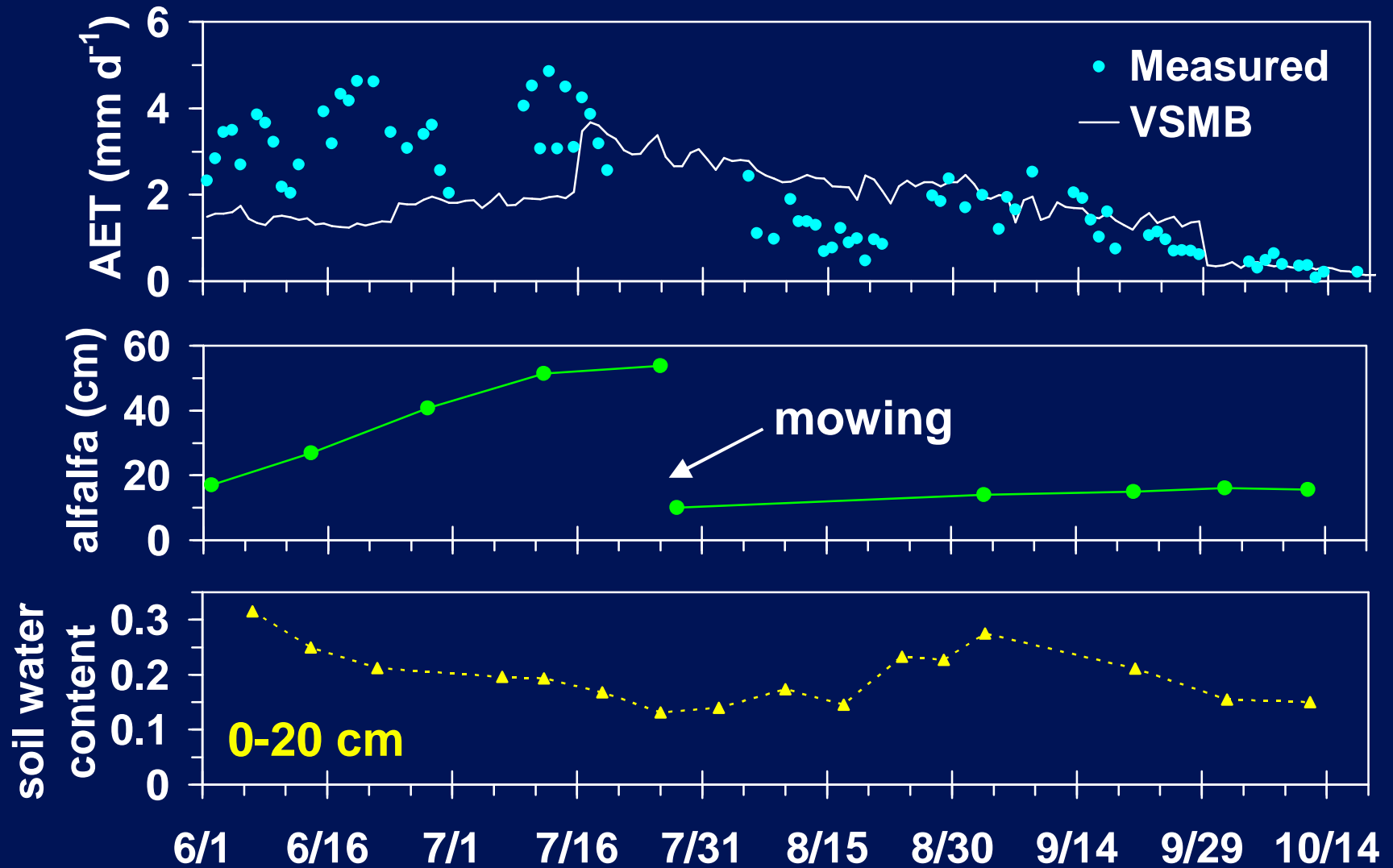
Turbulent flux ($LE + H$) < Radiation – Gnd. heat ($Rn - G$)

Evaporation is estimated from $Rn - G$ and the day-time average Bowen ratio ($= H / LE$).

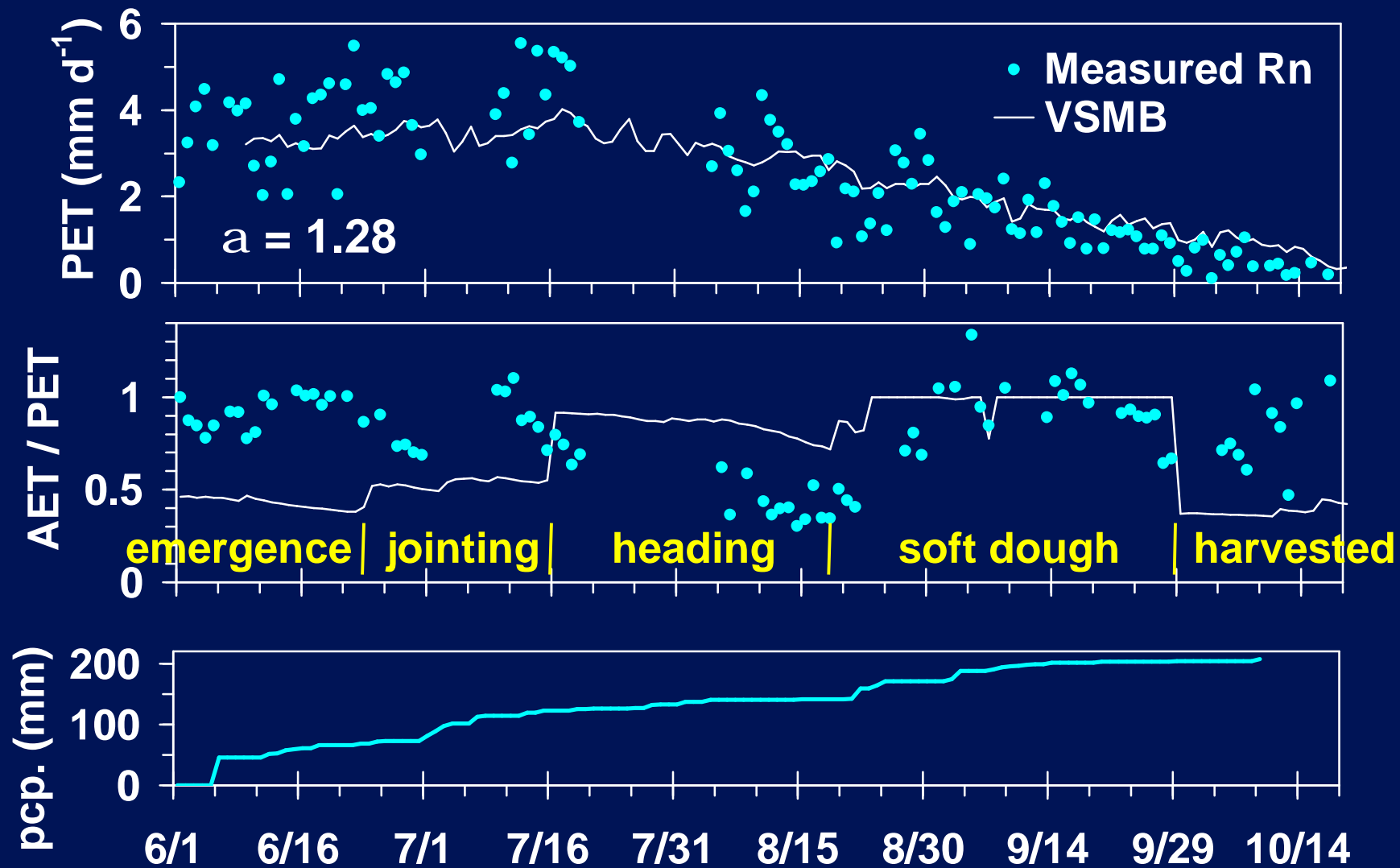
(Twine et al, 2000. Agric. Forest Meteorol., 103: 279-300.)

Alfalfa Field 2004

VSMB running with 'wheat' seeded on May 15

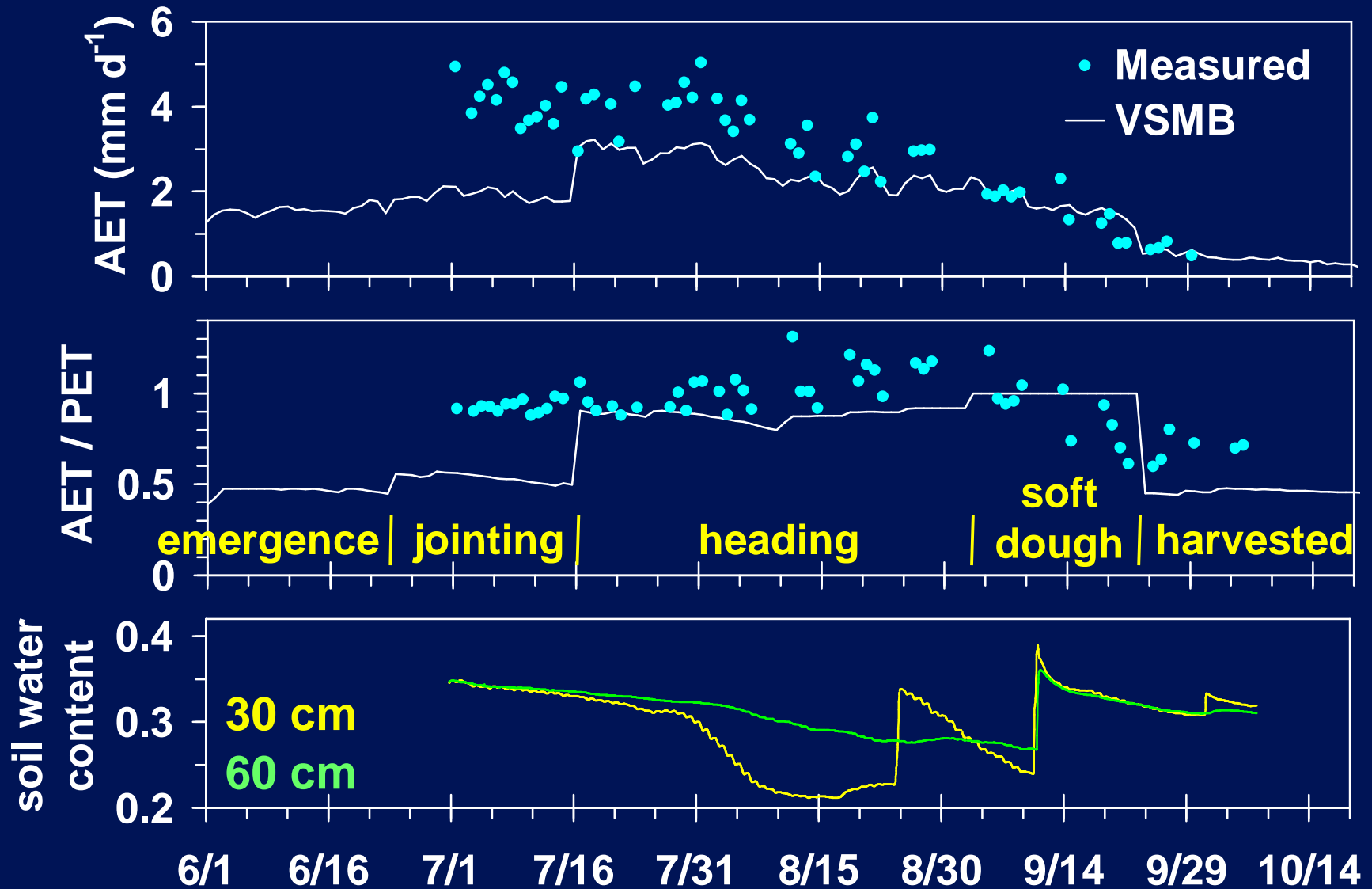


Priestley-Taylor PET, Actual ET, VSMB Crop Stage for Wheat, Cumulative Precip.



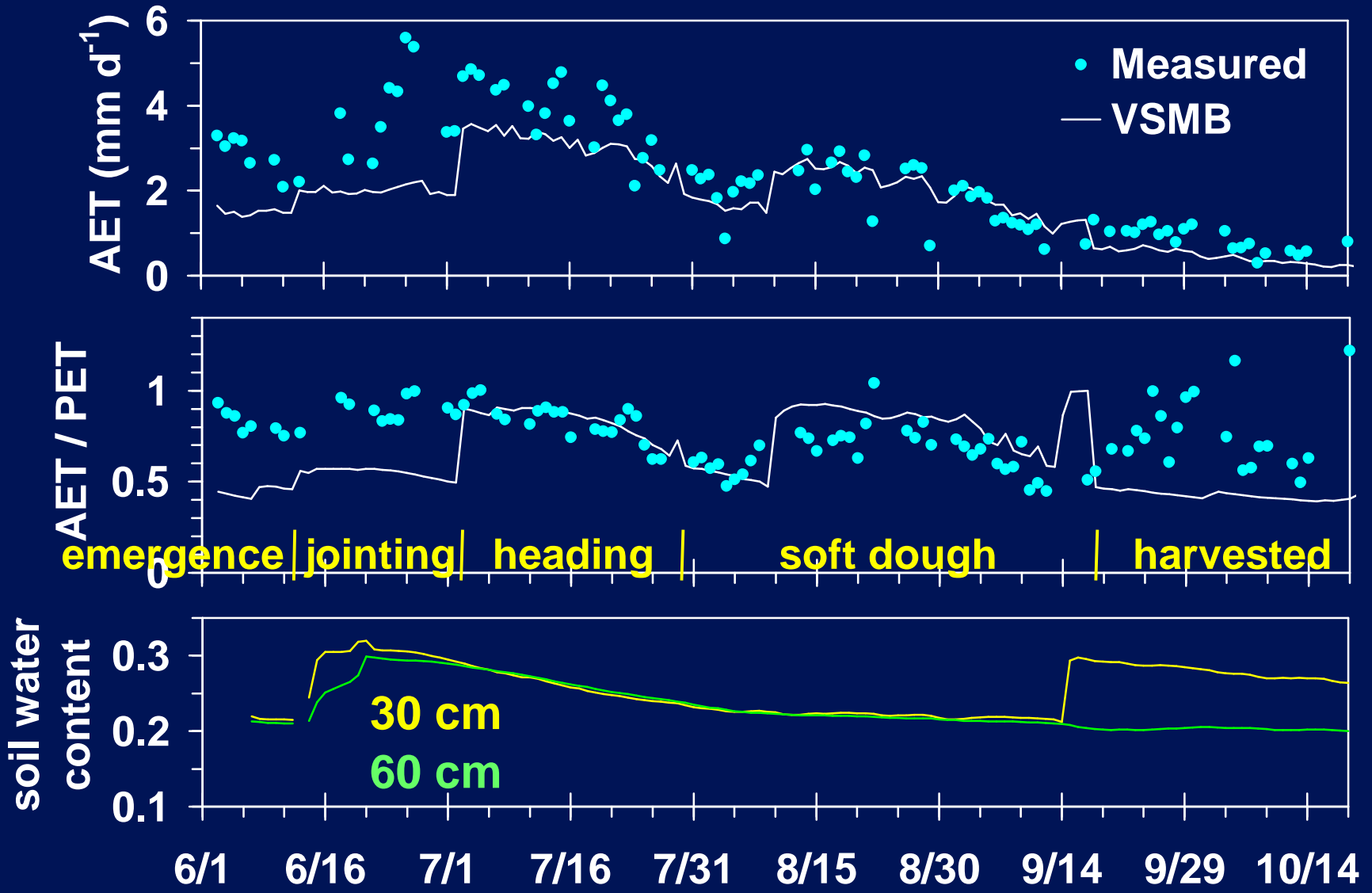
Barley Field 2005

VSMB running with 'wheat' seeded on May 15

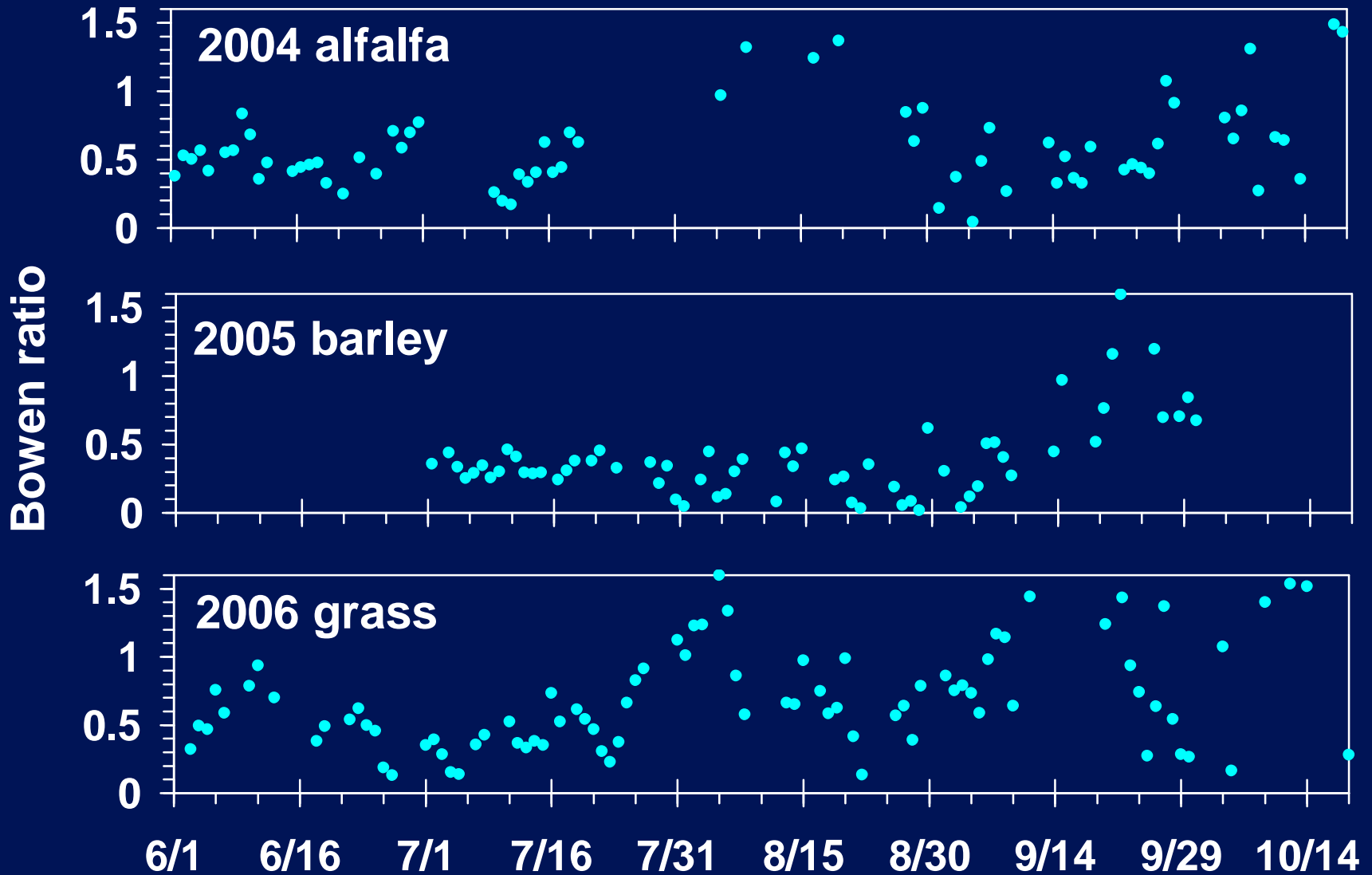


Grass Pasture 2006

VSMB running with 'wheat' seeded on May 15



Bowen Ratio (= H / LE)



Challenges and Opportunities

- Phenology is not properly represented in VSMB
® need for improved algorithm.
- Root uptake - depth function may require re-evaluation.
- Measured solar radiation should be used to drive the model ® new installation by Alberta Ag.
- Opportunity for model comparison using the field data.