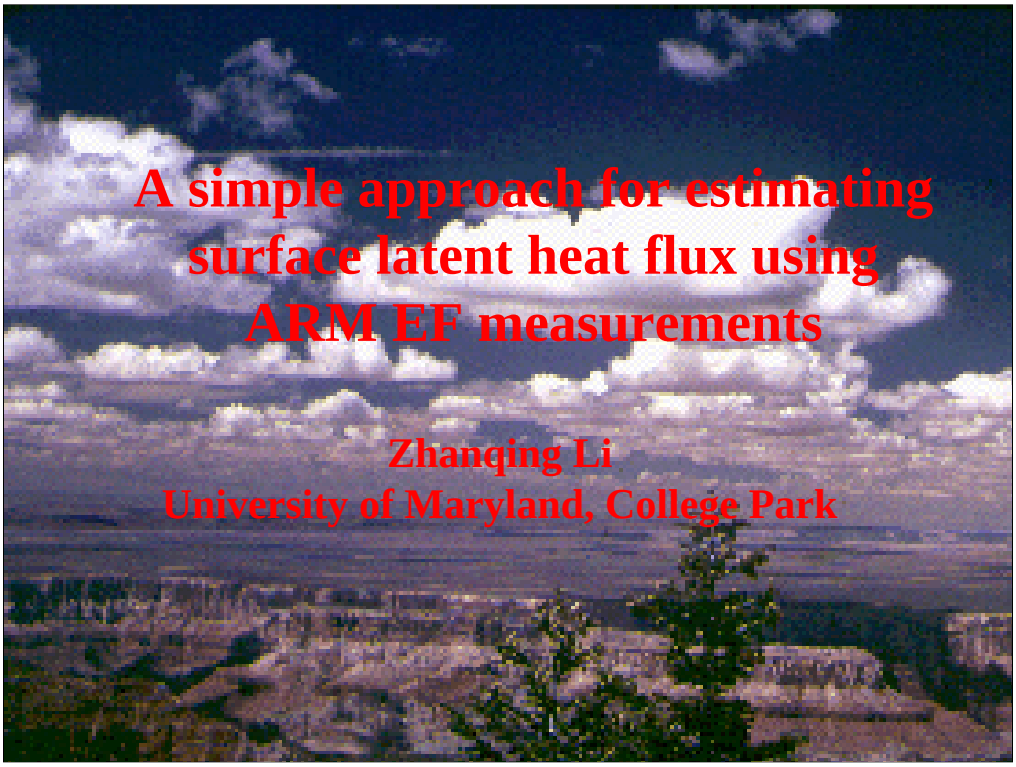

A simple approach for estimating surface latent heat flux using ARM EF measurements

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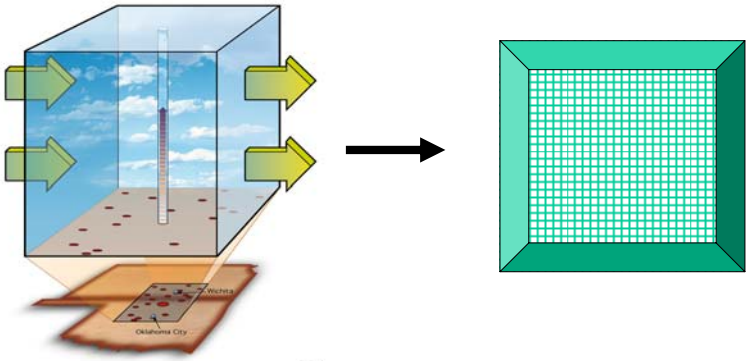
University of Maryland, College Park

A Popular Paradigm in Testing GCM Parameterization

- Use CSRM to simulate cloud and surface fluxes fields.
- Feed GCMs with simulated atmospheric fields to compute surface fluxes with a set of parameterization schemes imbedded in GCMs.
- Compare GCM computed fluxes against CSRM computed fluxes.

200 km
(SCM)



Why high-resolution flux data ?

1. Modelers need surface heat fluxes to
   1) initiate and keep feeding (forcing) to the model
   2) validate model results

2. The spatial resolution of the current surface heat flux measurements are not be dense enough for cloud-resolving models

High-resolution products that can be generated from satellites

Surface:

- Radiation budget (SW, LW, and NET)
- Albedos (narrow- and broadband)
- Heat fluxes (latent and sensible)

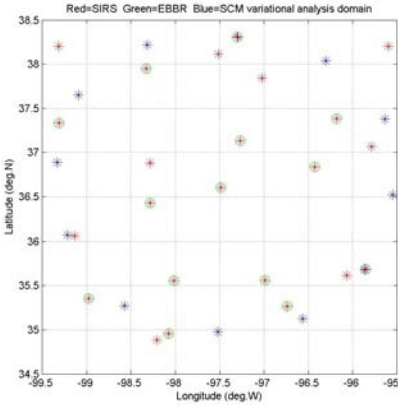
Cloud:

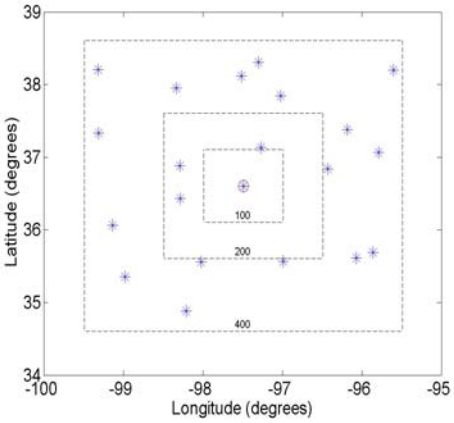
- Cloud cover
- Cloud vertical structure
- Cloud particle size
- Liquid water path

Aerosol:

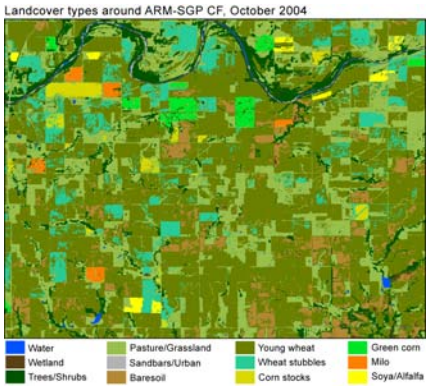
- Aerosol optical depth

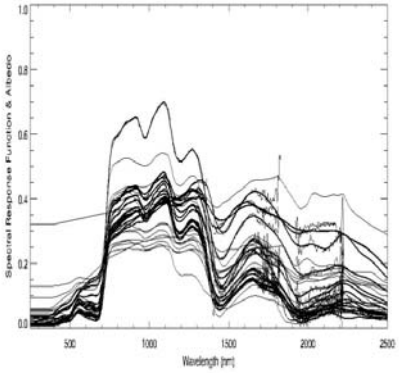
Radiation and boundary-lay Observation Facilities over the SGP



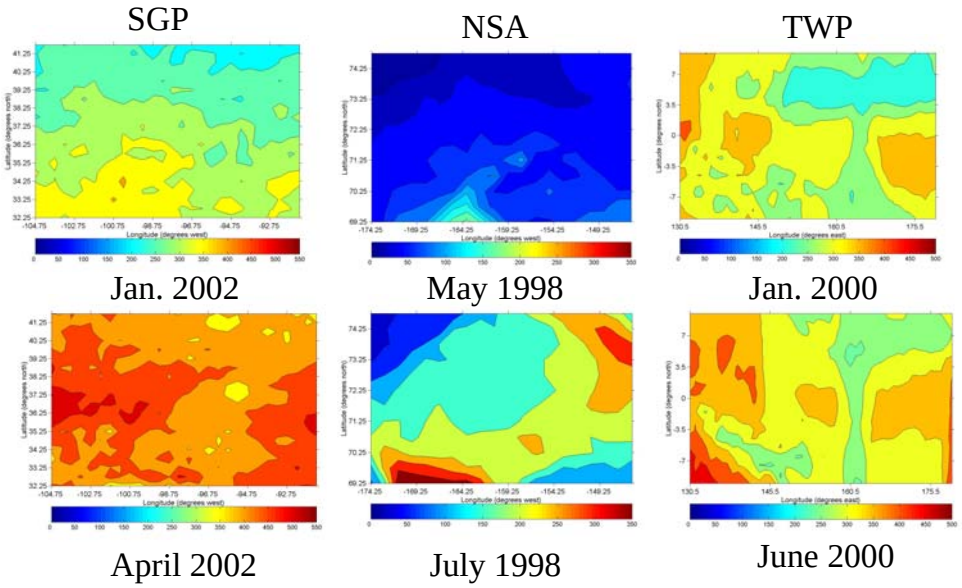


Land Cover Classification and Albedo Spectrum



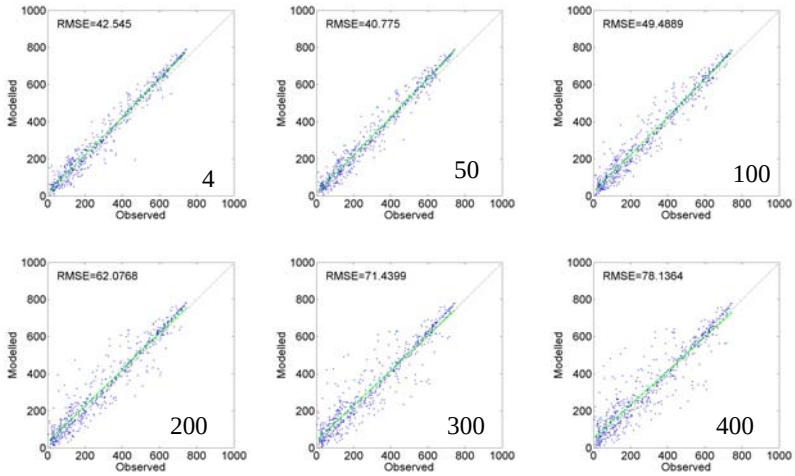


Monthly Mean Surface Insolation Estimated from Satellite



Surface observations versus satellite retrievals at varying scales

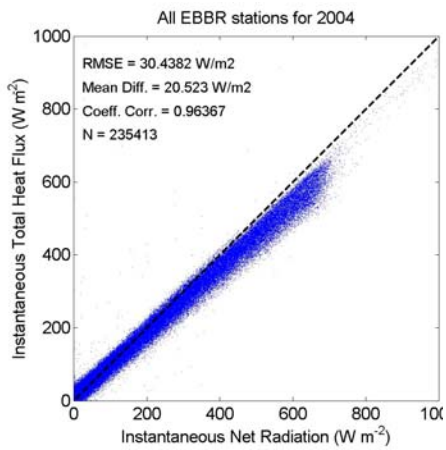
March 2000

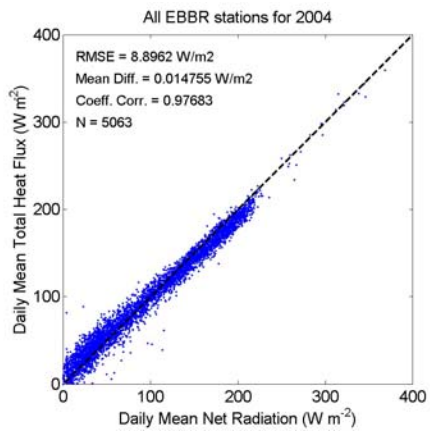


Modelled surface net radiation (averaged over an hour) as a function of observed surface net radiation at the Central Facility (averaged over an hour) for different domain sizes (top row,l-r: 4-km, 50-km, 100-km; bottom row,l-r: 200-km, 300-km, 400-km). The green line is the "best-fit" line through the data. Data shown is for the month of March 2000. Units are in W m^{-2}.

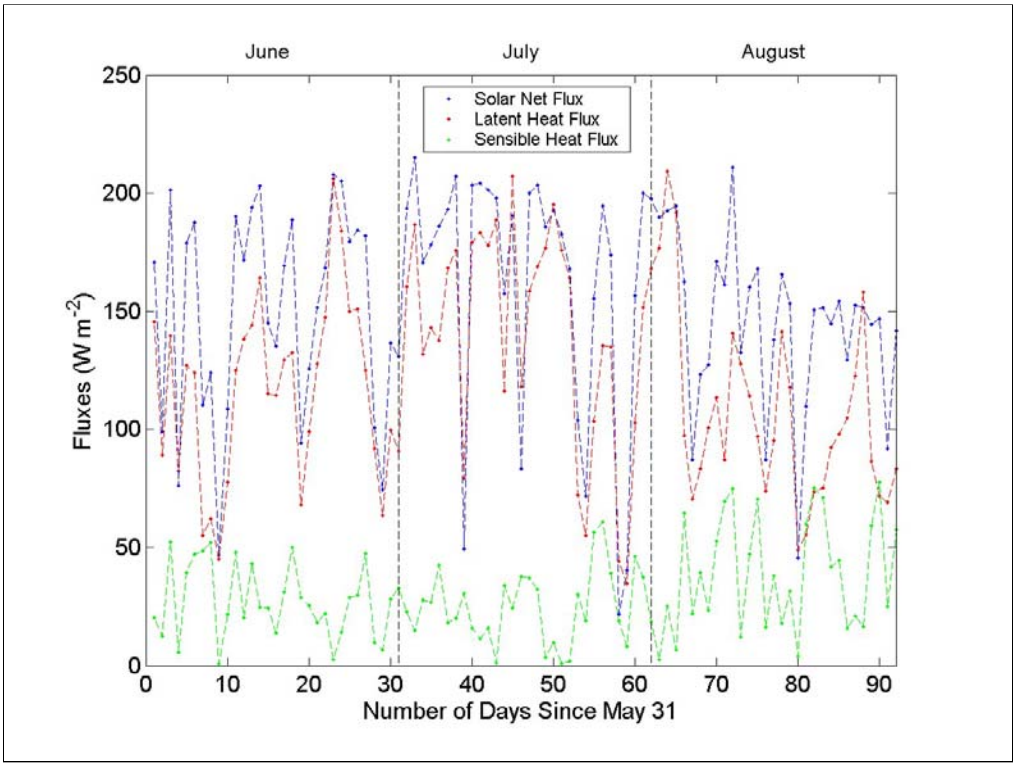
Li et al. (2005, JGR)

Comparison of instantaneous and daily mean radiation and heat fluxes



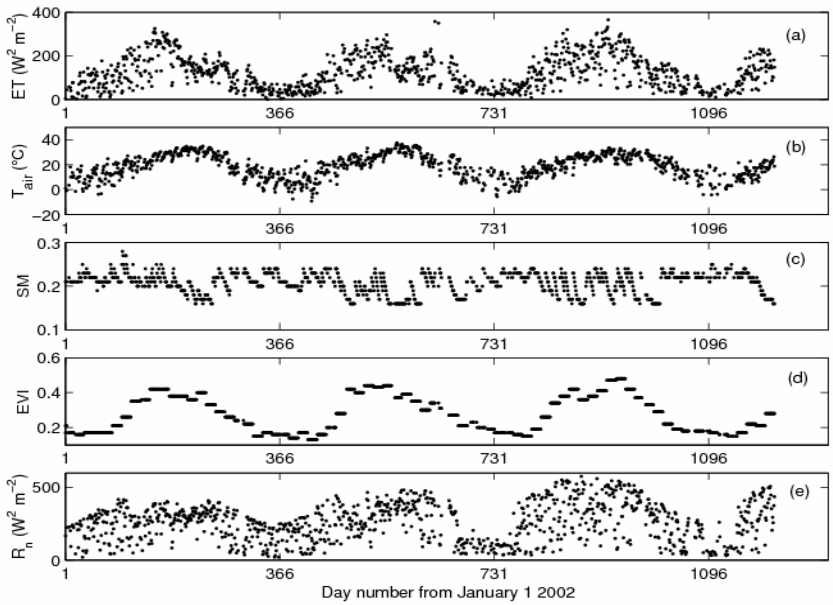


Instantaneous total heat flux (magnitudes of latent heat + sensible heat) as a function of instantaneous net radiation (using EBBR measurements made at all 14 stations for the year 2004).

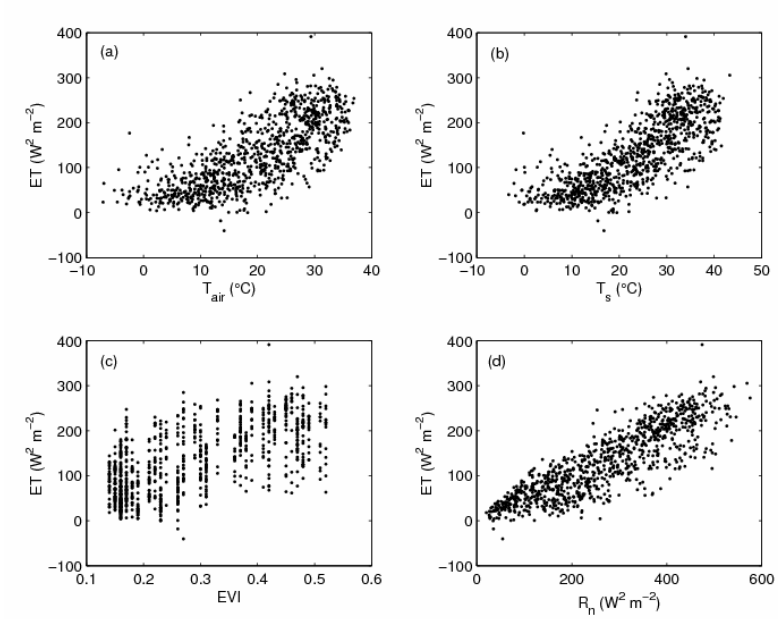


Time series of the 24-hour-averaged solar net radiation (in blue), sensible heat fluxes (in green), and latent heat fluxes (in red) for June-August 2004 at the Central Facility.

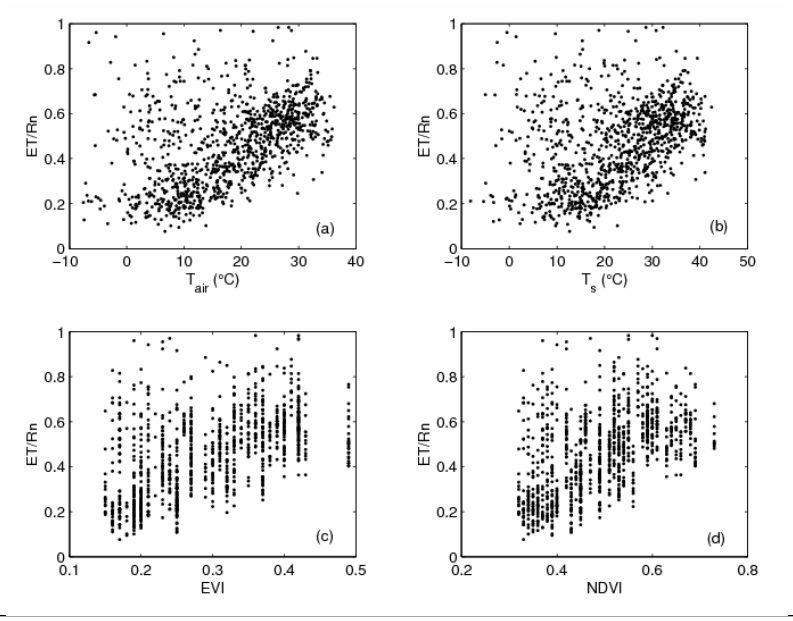
Day-to-day variations of ET and related variables



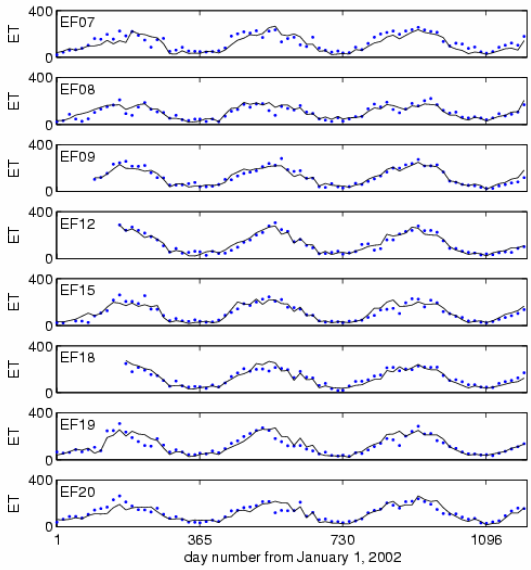
Relationship between ET & other variables



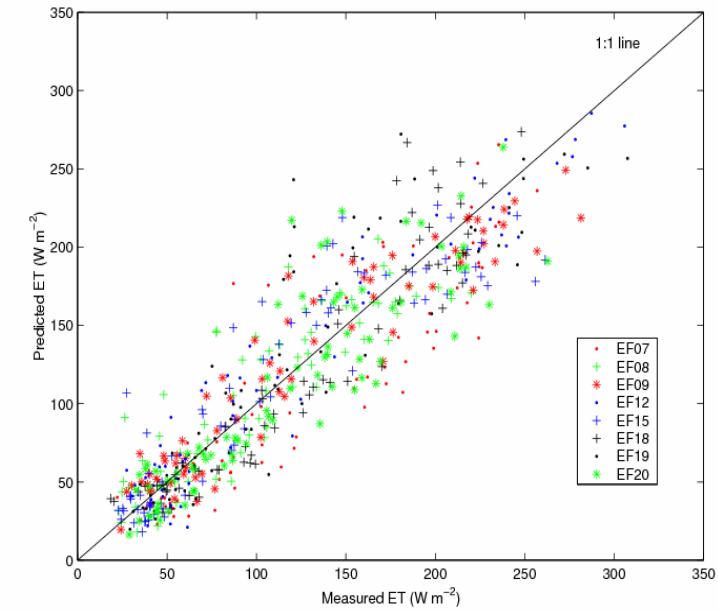
Relationship between ET & other variables



Comparison between estimated and observed ET



Comparison between estimated and observed ET



Statistics of the estimation uncertainties

	EF07	EF08	EF09	EF12	EF15	EF18	EF19	EF20
Correlation coefficient	0.88	0.88	0.95	0.96	0.91	0.94	0.90	0.88
Bias (relative)	-16.08 (-12.4%)	4.50 (4.5%)	-0.66 (-0.5%)	1.05 (0.8%)	2.46 (2.3%)	-5.00 (-3.9%)	4.08 (3.4%)	-5.48 (-4.6%)
RMSERSME (relative)	33.08 (25.6%)	25.57 (25.3%)	23.98 (19.0%)	22.54 (17.8%)	29.80 (27.4%)	25.82 (20.1%)	34.18 (28.5%)	30.47 (25.6%)

References

- Wang, K., Li, Z., Cribb, M. 2006a. Estimation of evaporative fraction from a combination of day and night land surface temperature and NDVI: A new method to determine the Priestley–Taylor parameter. *Remote Sensing of Environment*, 102, 293-305.

- Wang, K., P. Wang, Z. Li, M. Cribb, 2006b, K. A simple method to estimate evapotranspiration from a combination of vegetation index and temperature, *Remote Sensing of Environment*, revised.