Combining Scintillometry and Eddy Covariance to Evaluate and Validate Remotely Sensed Evapotranspiration Rate at Various Spatial Scales

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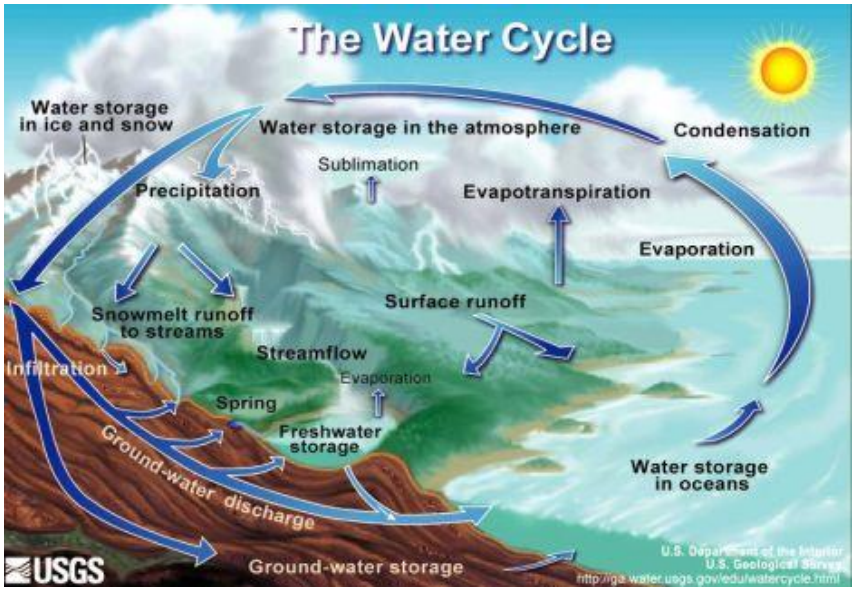
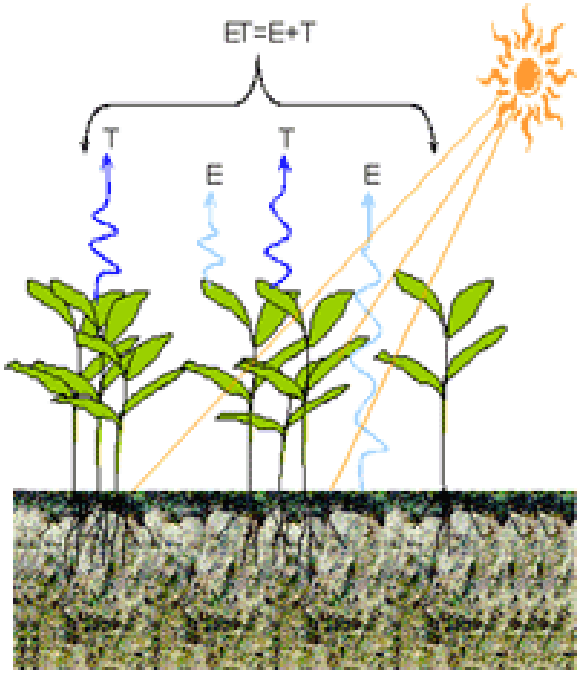
Water Cycle and Evapotranspiration



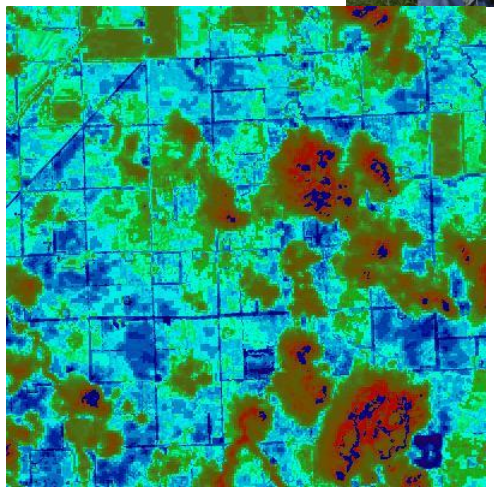


Why Evapotranspiration?

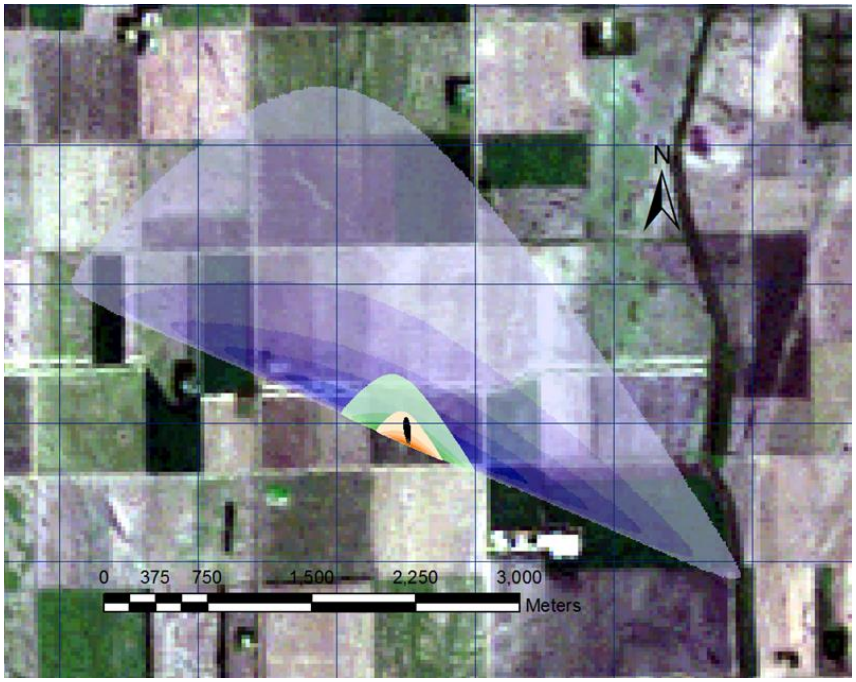
- Energy driven
  - Net radiation = Latent heat (or ET) + Sensible heat
- Least known component in water cycle
  - Precipitation = Evapotranspiration + Runoff + Soil Moisture + Infiltration to ground water
  - Difficult to measure

Measurement of ET

- Point
  - Direct: Eddy covariance
  - Mass balance: Lysimeter
- Areal average by remote sensing imagery
  - Energy balance: ET = Net radiation – Sensible heat – Soil heat flux



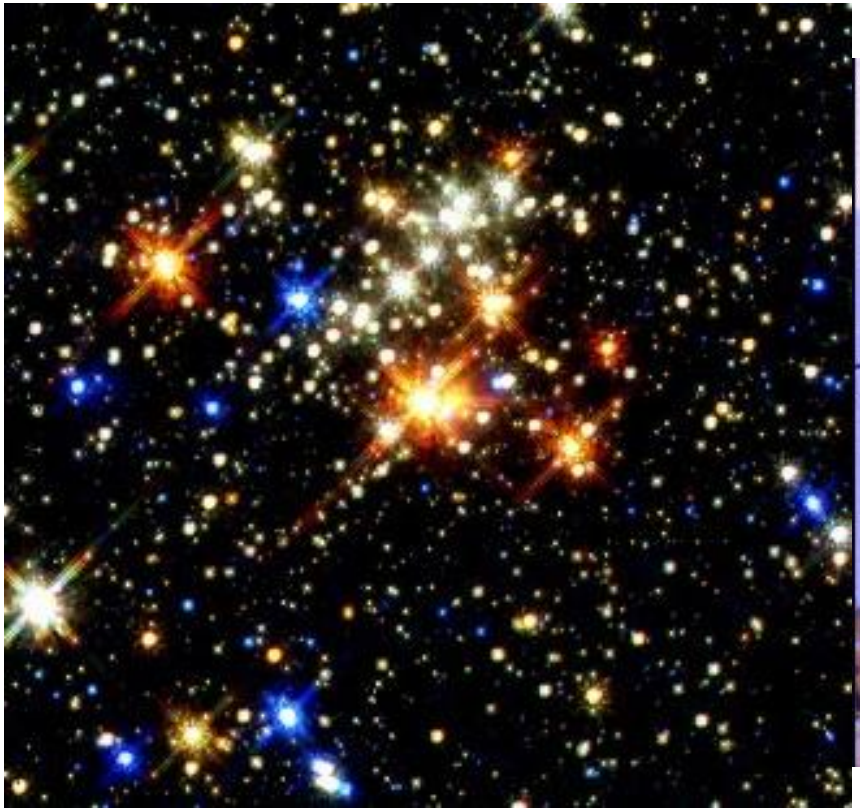
Scale issues with RS-derived ET



- Model calibrated based on point-based measurements
  - Point perfection but regional presumption
- RS-ET does not match with the scales of study
  - Up or down-scale across heterogeneity

MEASURING ET AT DIFFERENT SCALES - SCINTILLOMETRY

Twinkle twinkle little star

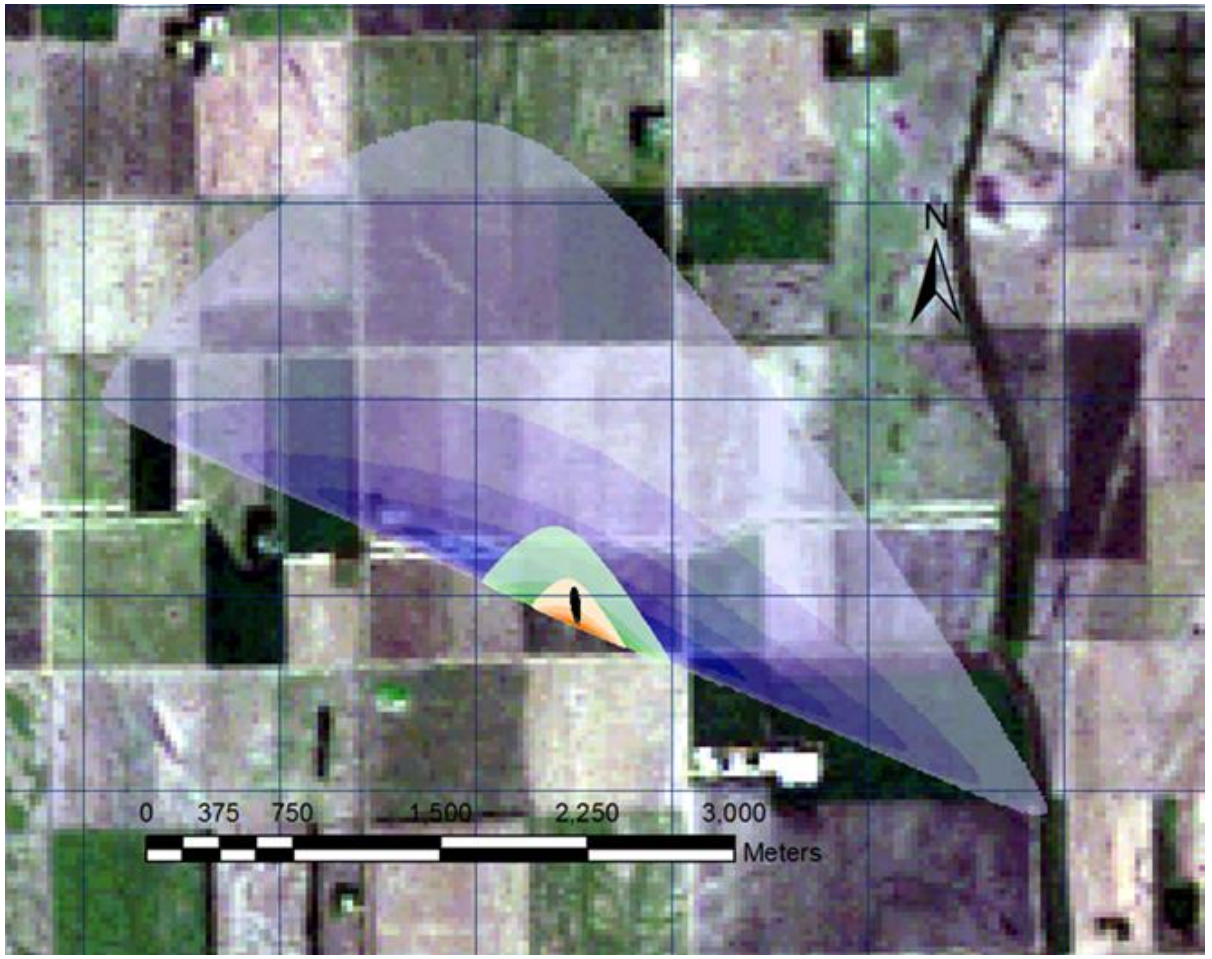


Scintillometer

880 nm, 5 – 125 Hz

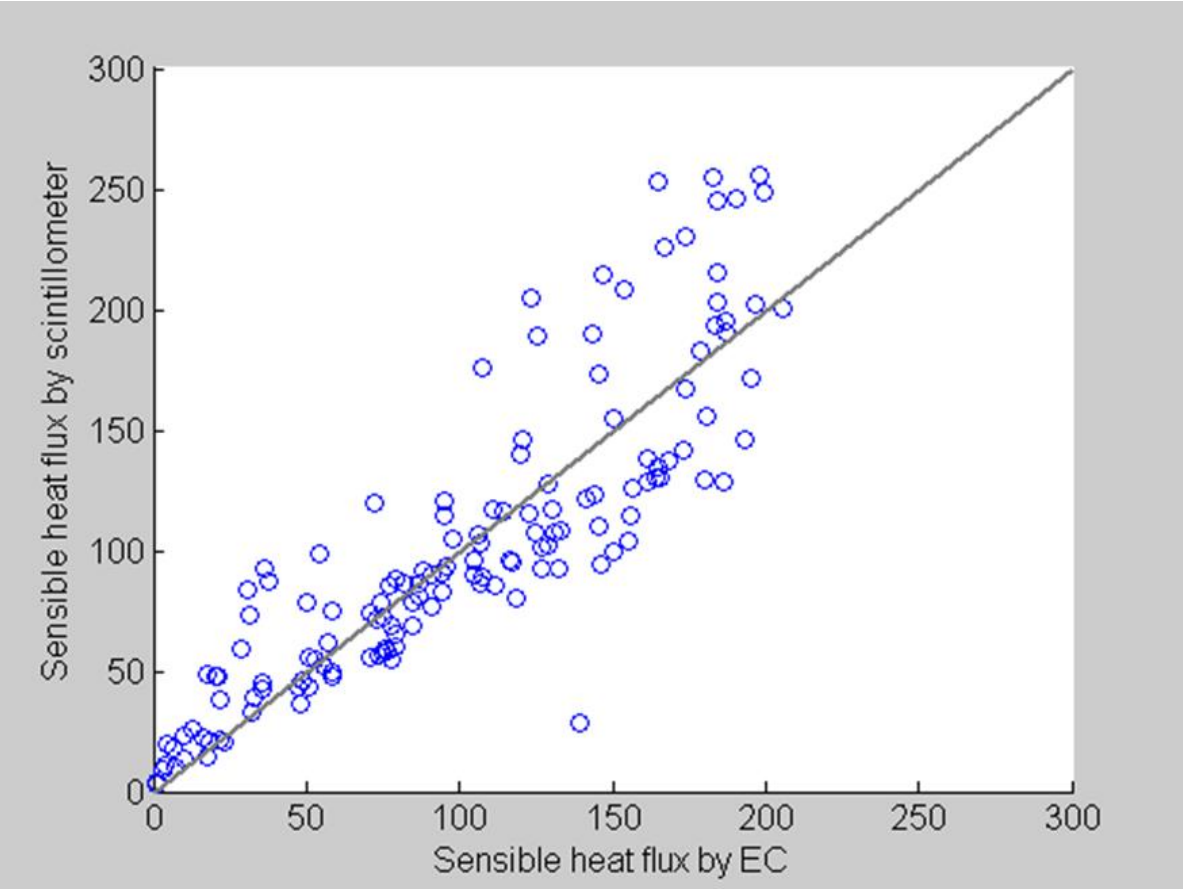
Variance of radiation is due to the changes in humidity and temperature in the air

Adjustable footprint allows ET to be measured at different spatial scales



Instrument and results

- Through other grants
  - BLS 900 Large Aperture Scintillometer (500 m – 10 km)
  - SLS20 Small Aperture Laser Scintillometer (50 – 500 m)
  - Eddy covariance system
- ND NASA EPSCoR
  - Optical Energy Balance Measurement System (OEMBMS1)



1. Field experiments in a farm field Fairmount ND during growing seasons of 2008, 2009 and 2010
2. Start soon in a field by NDSU
3. A proposal submitted to NASA Energy and Water Study project on March 21, 2011 with collaboration with NDSU and Univ. of Montana.

Zhang et al (2010) Agricultural and Forest Meteorology