

Enhance Drought Monitoring via Assimilating NPP/JPSS/GCOM-W/GOES-R Observations into Noah LSM

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OUTLINE

- ❖ *Motivation*
- ❖ *Current Drought Monitoring Methods*
- ❖ *Comprehensive Drought Monitoring Concept*
- ❖ *Preliminary Results*
- ❖ *Next Steps*

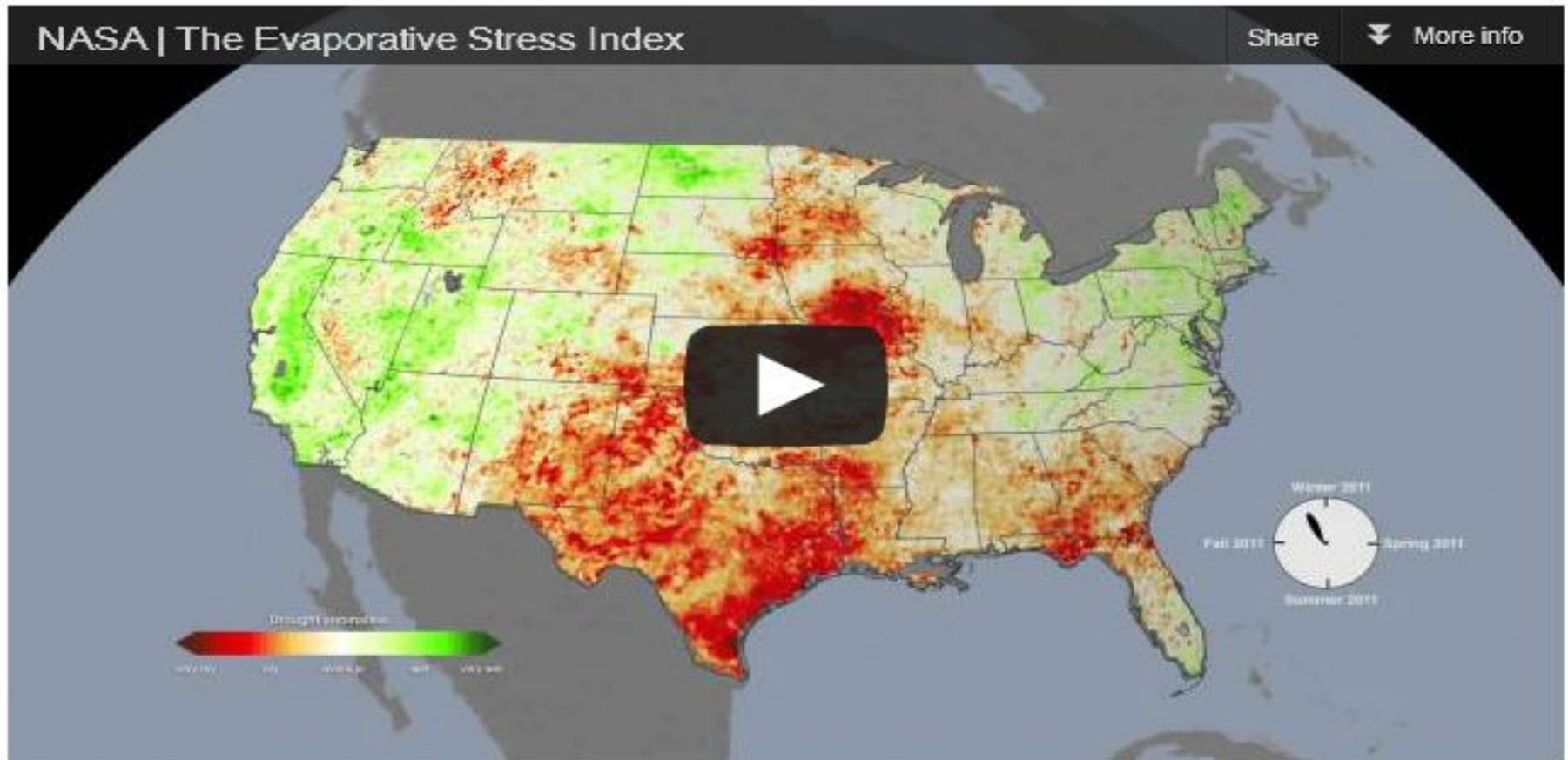
2012 US drought is the 2nd largest in size since Dust Bowl (*Washington Post*, 12/25/12)



New York Times, 12/07/12

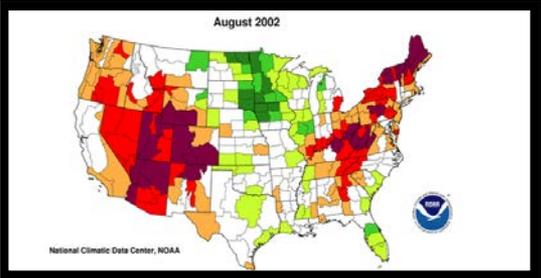
On Our Radar: A Plant Stress Index

By THE NEW YORK TIMES

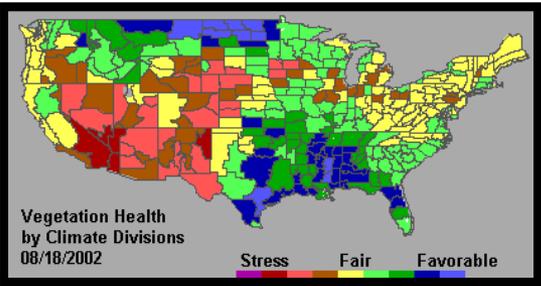


Government satellites' measurements of "plant stress" anticipated the arrival of this year's severe drought in the United States a month before the nation's drought monitor did. [The Atlantic]

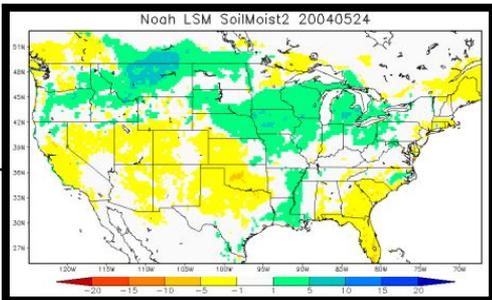
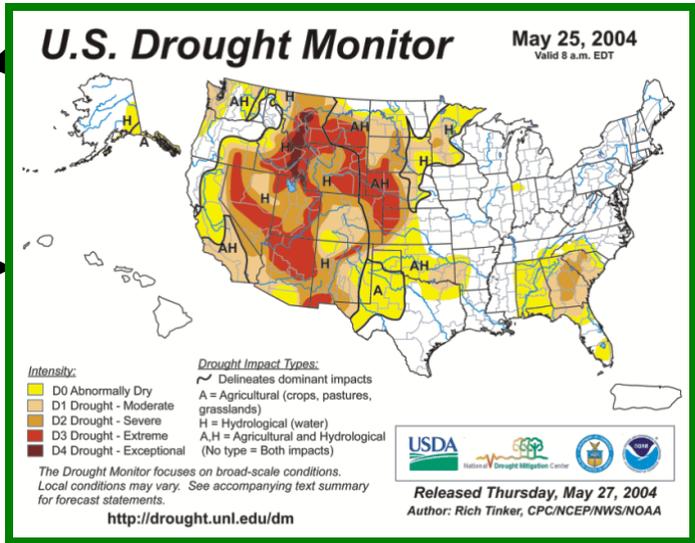
Current Drought Monitoring Methods:



Palmer Drought Index

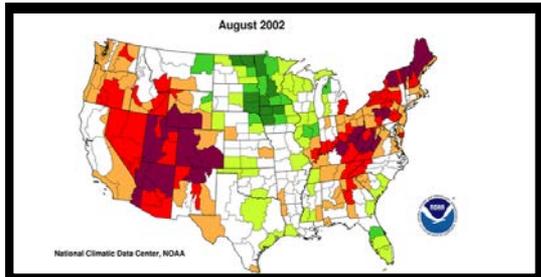


Vegetation Health Index

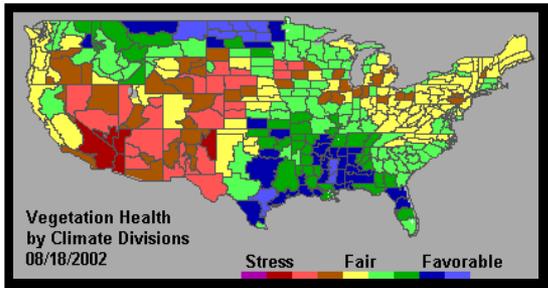


LSM SM Output

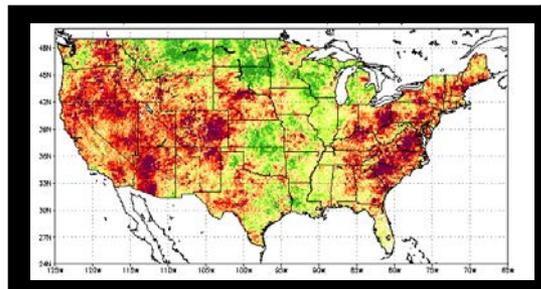
Comprehensive Drought Monitoring Concept:



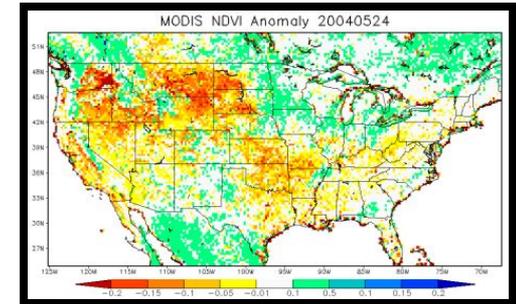
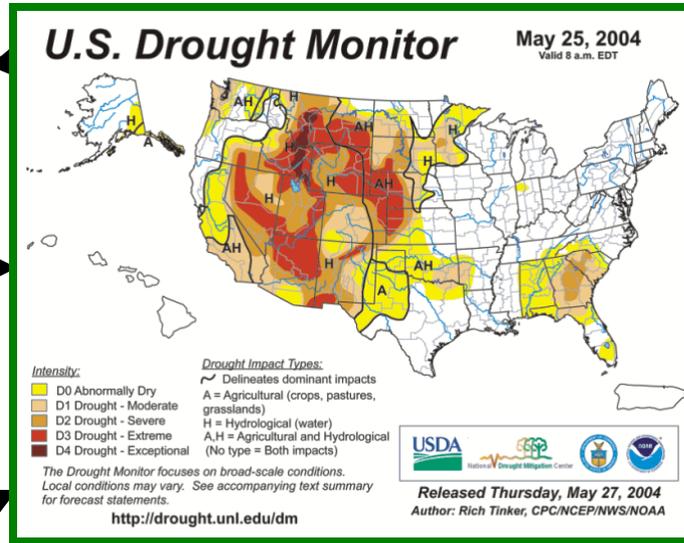
Palmer Drought Index



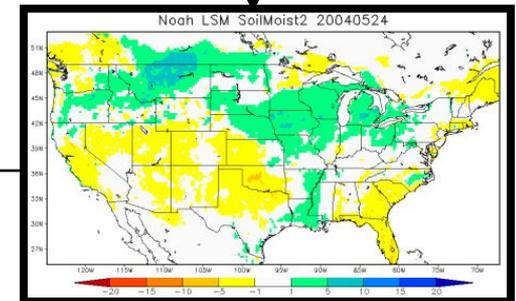
Vegetation Health Index



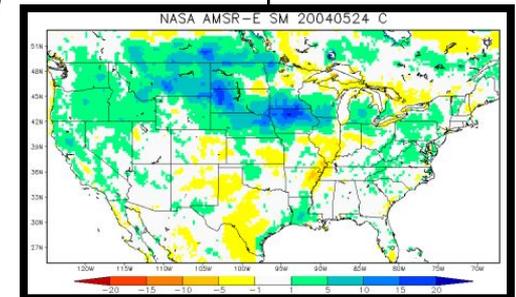
Evaporative Stress Index



Optical VI Remote Sens.

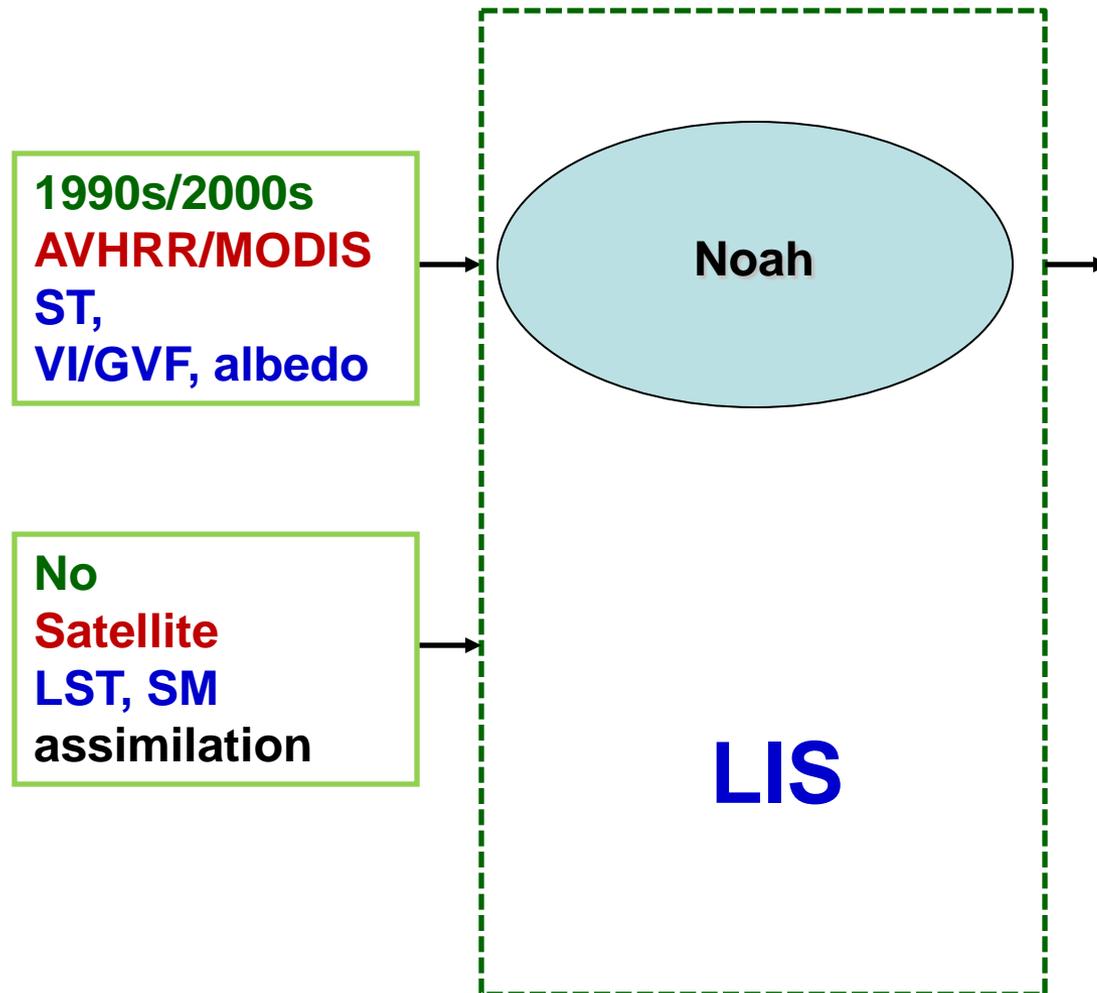


LSM SM Output

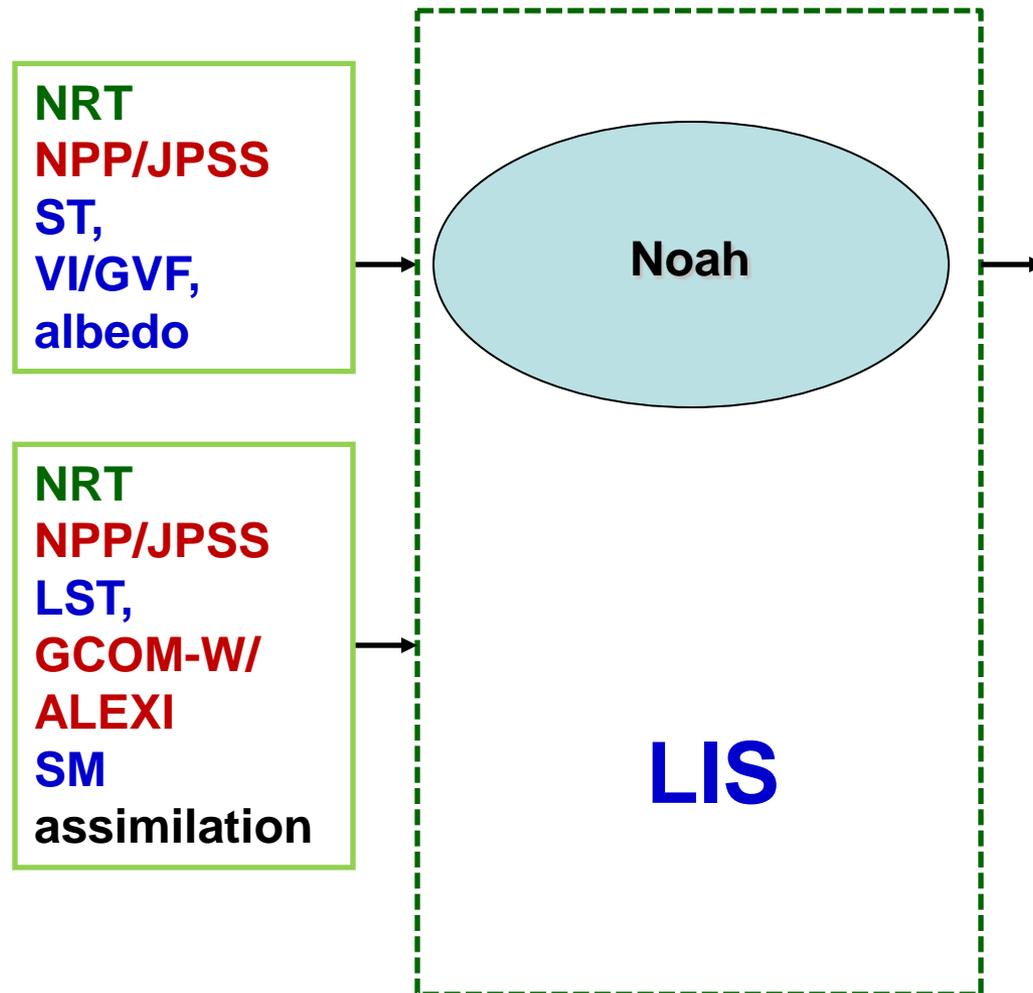


MW SM Remote Sens.

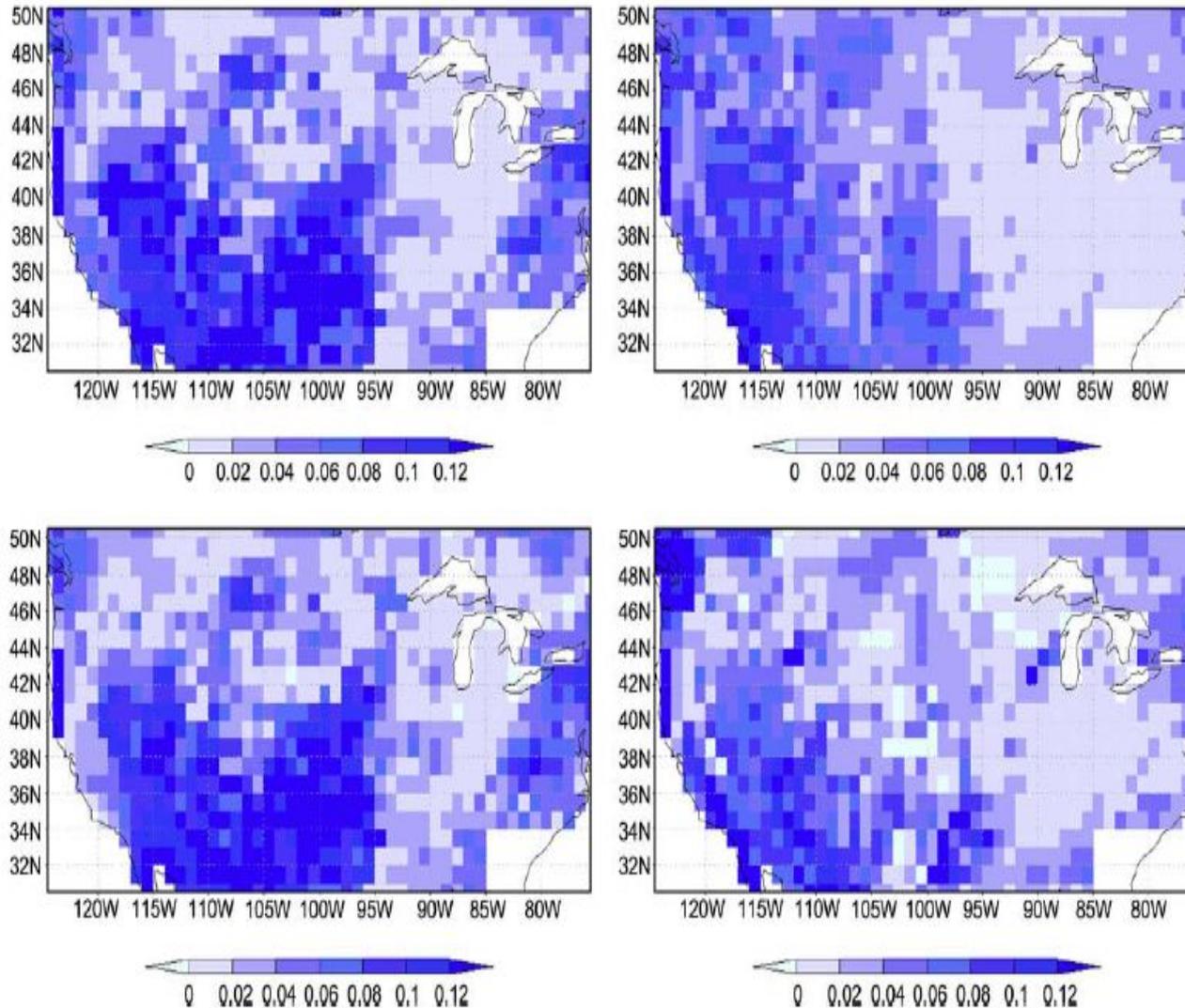
Current Noah LSM Simulations w/out Satellite observation assimilation



Enhanced Noah LSM Simulations with Satellite observation assimilation



LSM Soil Moisture Simulations Improved by Assimilating Satellite Observations



Time averaged improvement metric ($RMSE(\text{open loop}) - RMSE(\text{EnKF})$) for (top) surface soil moisture and (bottom) root zone soil moisture from the (left) Catchment LSM and the (right) Noah LSM assimilation experiments. Units are volumetric soil moisture (m^3/m^3) (Kumar et al 2008)

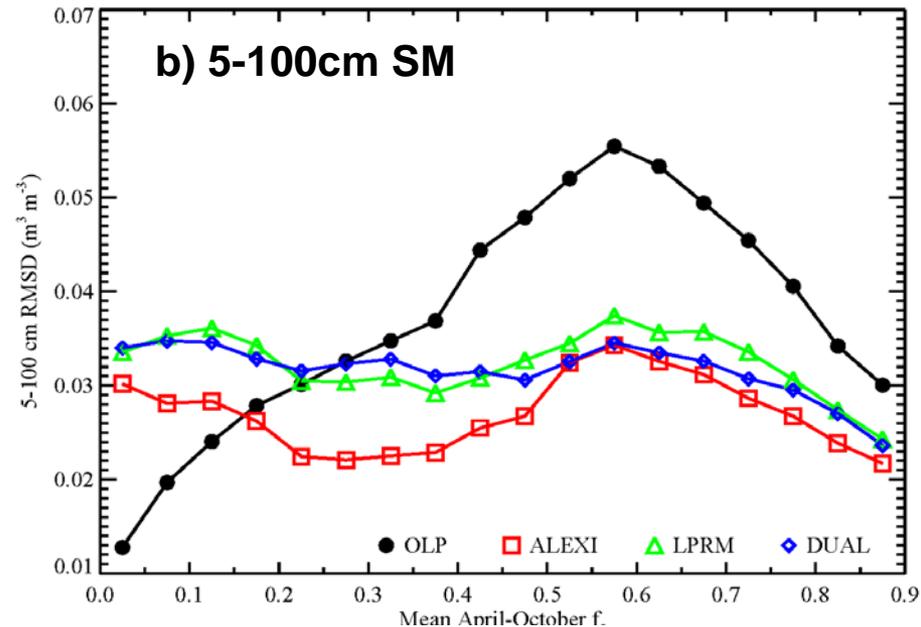
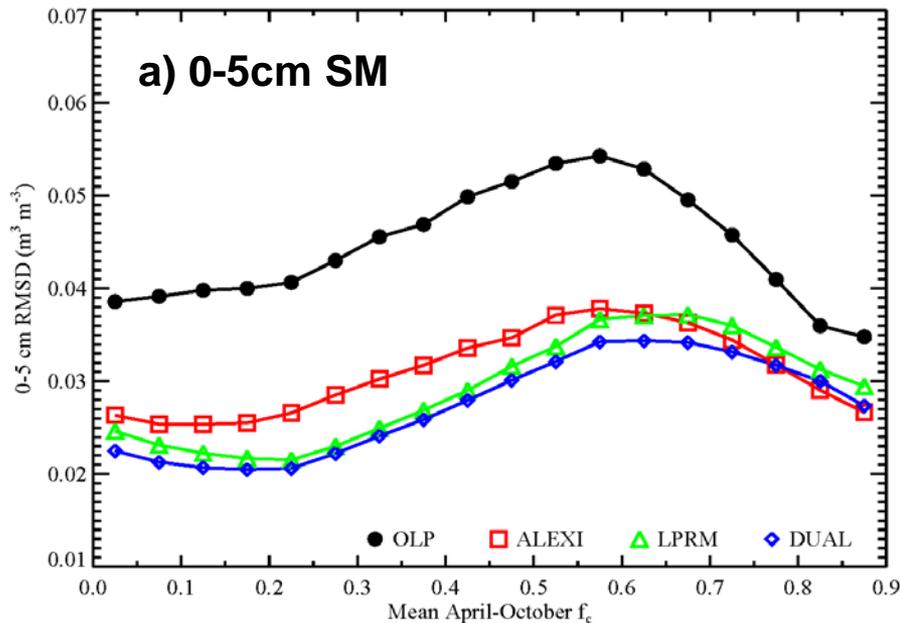
Dual Assimilation of MW and GOES-based ALEXI SM into Noah LSM

$$\theta_{LPRM} = \left(\theta_{LPRM}^o - \mu_{LPRM}^o \right) * \frac{\sigma_{LSM[LPRM]}}{\sigma_{LPRM}^o} + \mu_{LSM[LPRM]}$$

$$\theta_{ALEXI} = \left(\theta_{ALEXI}^o - \mu_{ALEXI}^o \right) * \frac{\sigma_{LSM[ALEXI]}}{\sigma_{ALEXI}^o} + \mu_{LSM[ALEXI]}$$

The rescaled observations θ_{LPRM} and θ_{ALEXI} are then used to construct the observation vector $\theta = \begin{pmatrix} \theta_{LPRM} \\ \theta_{ALEXI} \end{pmatrix}$ which is subsequently assimilated into Noah using the EnKF approach

Dual Assimilation of MW and GOES-based ALEXI SM into Noah LSM



Averaged RMSD [$\text{m}^3 \text{m}^{-3}$] in (a) 0-5 cm SM and (b) 5-100 cm SM predictions obtained from various data assimilation cases as a function of average April-October f_c . RMSD values are computed based on 5% f_c bins.

Next Steps:

- ❖ ***Noah LSM runs with or w/out NRT NPP/JPSS NDVI/GVF and Albedo***
- ❖ ***Noah LSM runs with or w/out NRT AMSR2 SM***
- ❖ ***LST data assimilation vs ALEXI SM assimilation***
- ❖ ***Noah LSM SM anomalies vs other drought indices comparison***