

SMAP and Agricultural Productivity Applications

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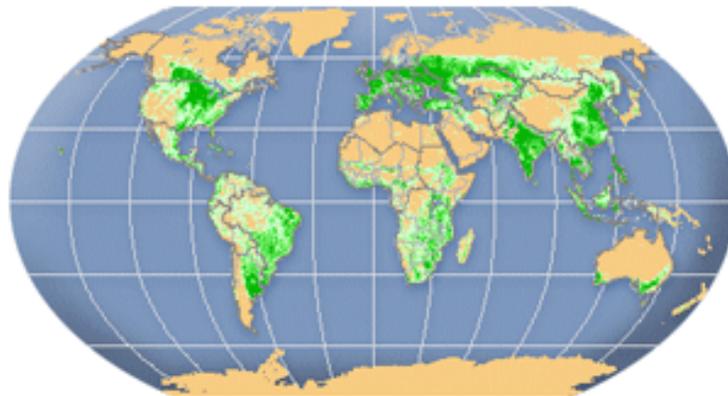
SMAP Applications Workshop



Potential Agricultural Users of SMAP Data Products

- Potential agricultural users are diverse (irrigation, crop insurance, yield forecasting, management practice assessment, etc).
- (Arguably) the most data-ready agricultural application is large-scale crop condition and production estimation.
- Within the United States, this activity is carried out by the USDA Foreign Agricultural Service (FAS) International Production Assessment Division (IPAD).

Linking U.S. Agriculture 
FAS  to the World



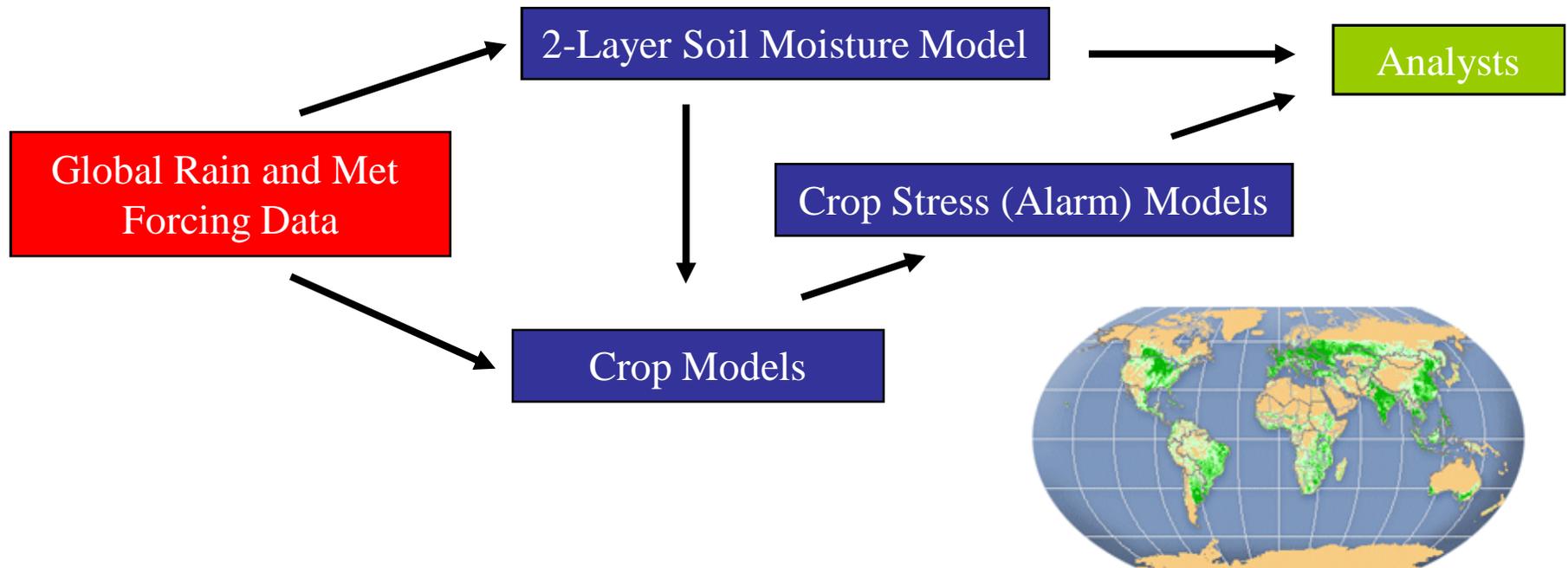
The USDA Foreign Agricultural Service (FAS) **International Production Assessment Division (IPAD):**

- Monthly global (end-of-season) production estimates for commodity crops.
- Vital for economic competitiveness, national security and food security applications.
- Analyst-based decision support system.
- Utilizes a wide-range of satellite data sources, input databases, climate data, crop models, and data extraction routines to arrive at yield and area estimates.
- Characterizing the extent and impact of agricultural drought (i.e. root-zone soil moisture limitations) is critical for monitoring variations in agricultural productivity.

Past USDA FAS/IPAD Treatment of Soil Moisture

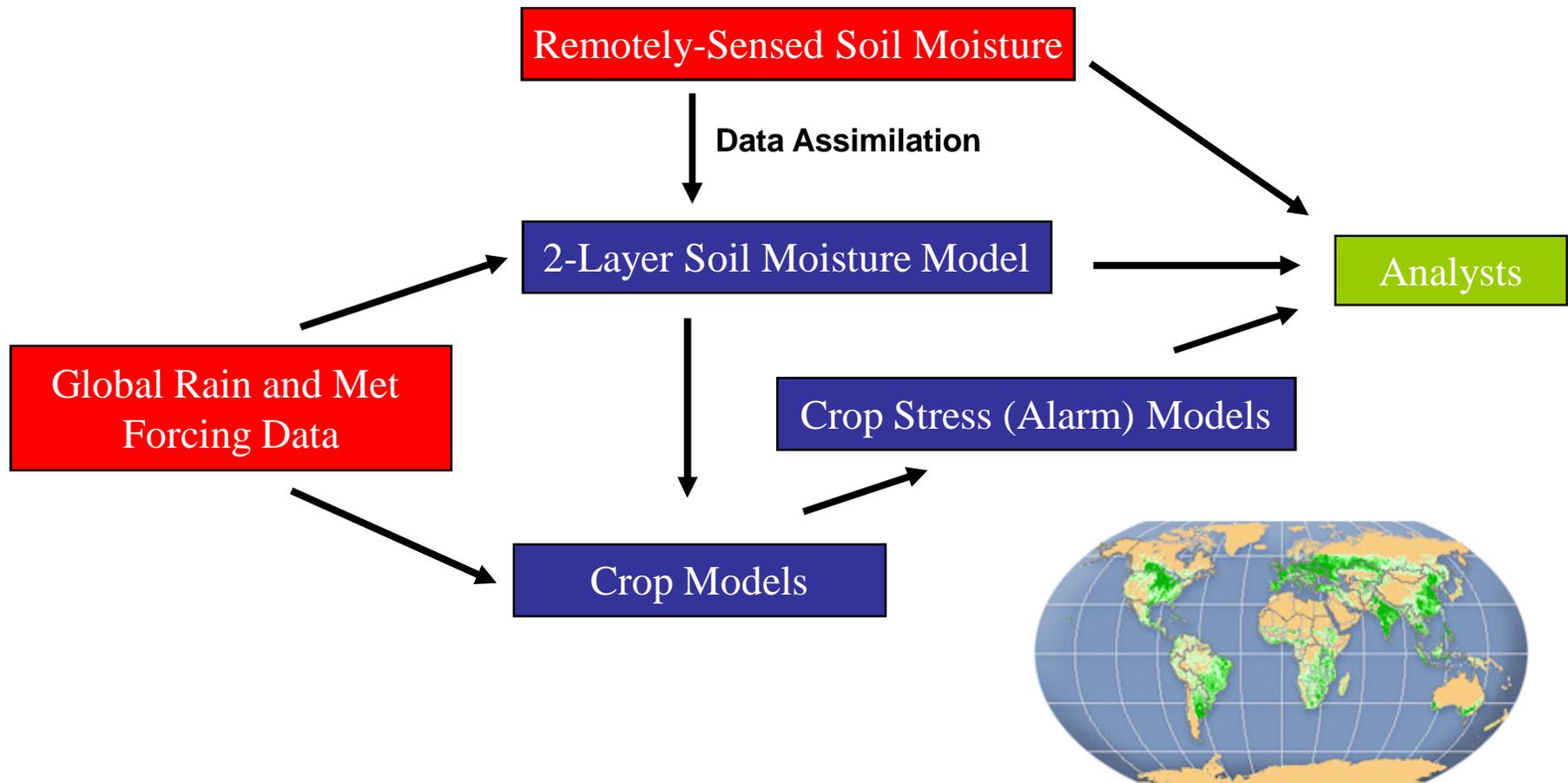
Time/space attributes:

- 12-km resolution
- Global coverage within agriculturally relevant areas
- Monthly reporting cycle (~ one-week latency)

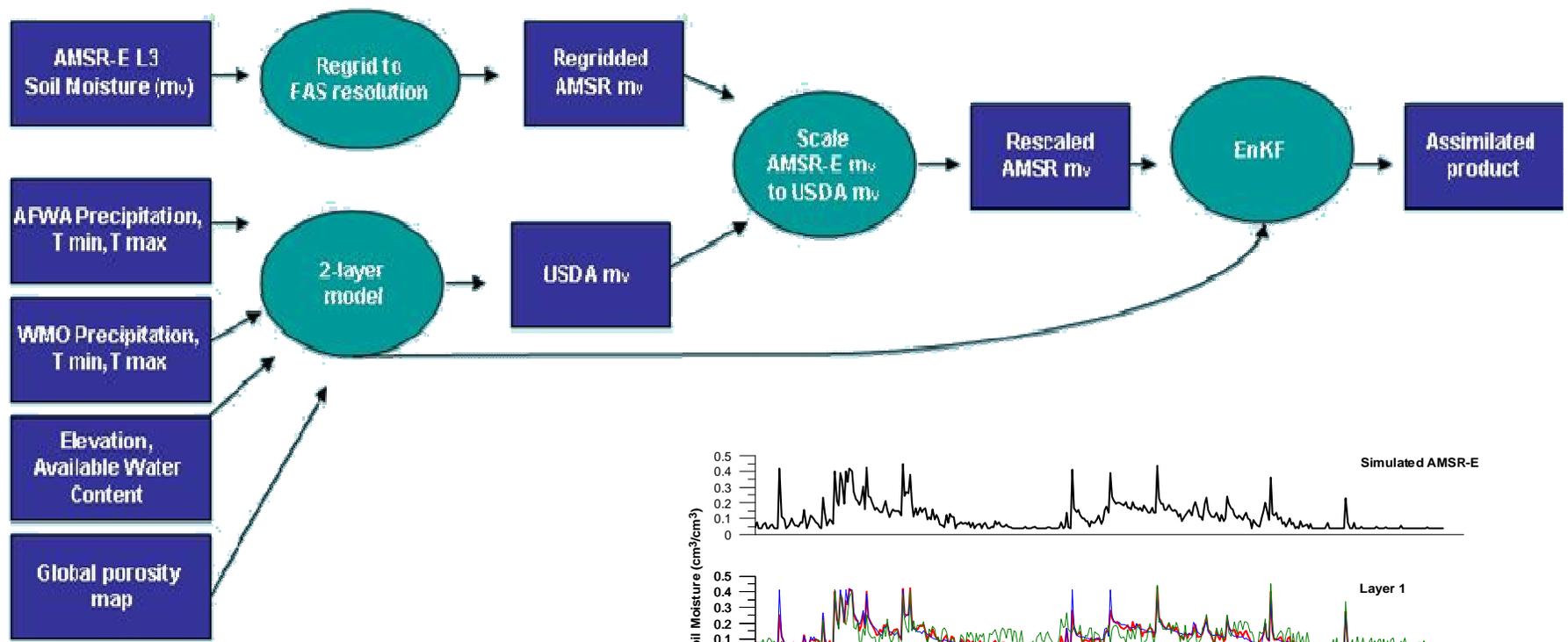


Integrating Remotely-Sensed Surface Soil Moisture

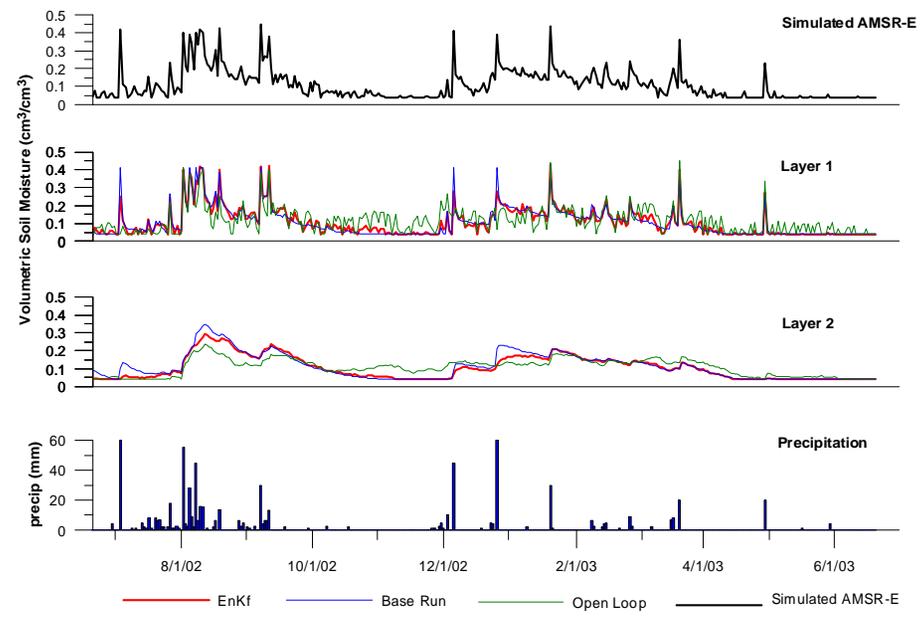
Funded by the NASA Applied Sciences Program (joint with NASA HSB, NESDIS STAR, USDA ARS, and USDA FAS, W.T. Crow PI, Brad Doorn, NASA HQ)



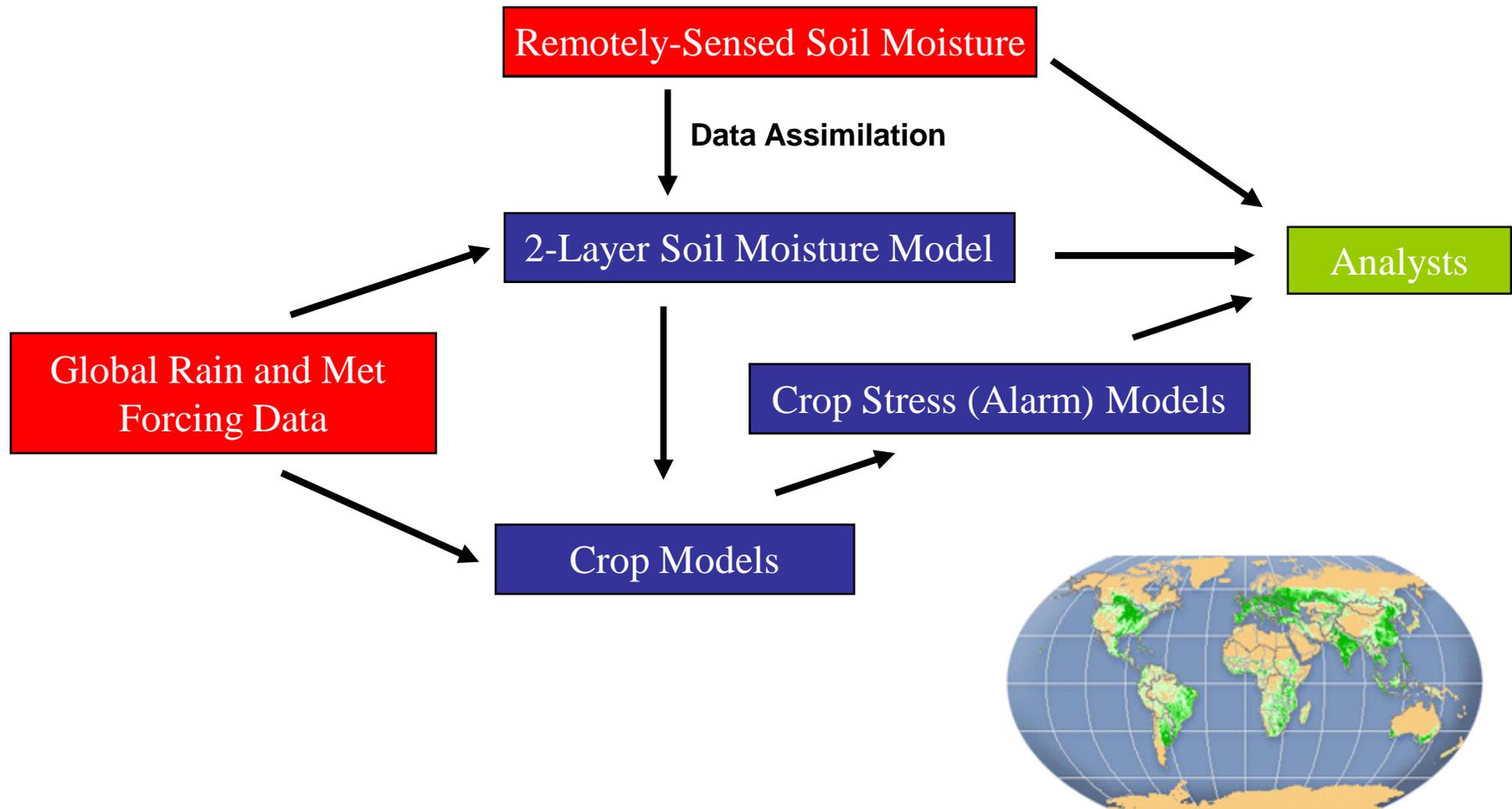
EnKF Assimilation Scheme



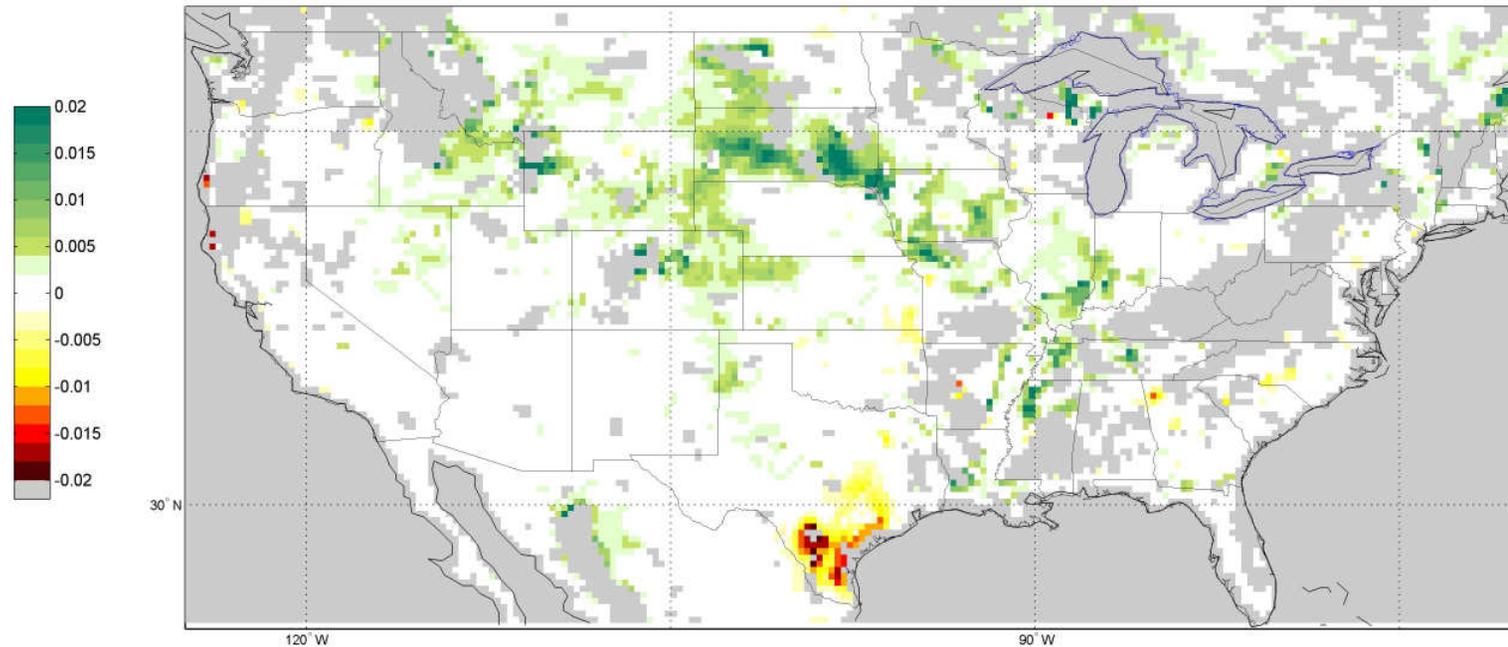
- NASA AMSRE soil moisture product.
- Root-zone soil moisture product delivered every 3 days with 4 day latency.



What is the added value of integrating remotely-sensed soil moisture information?

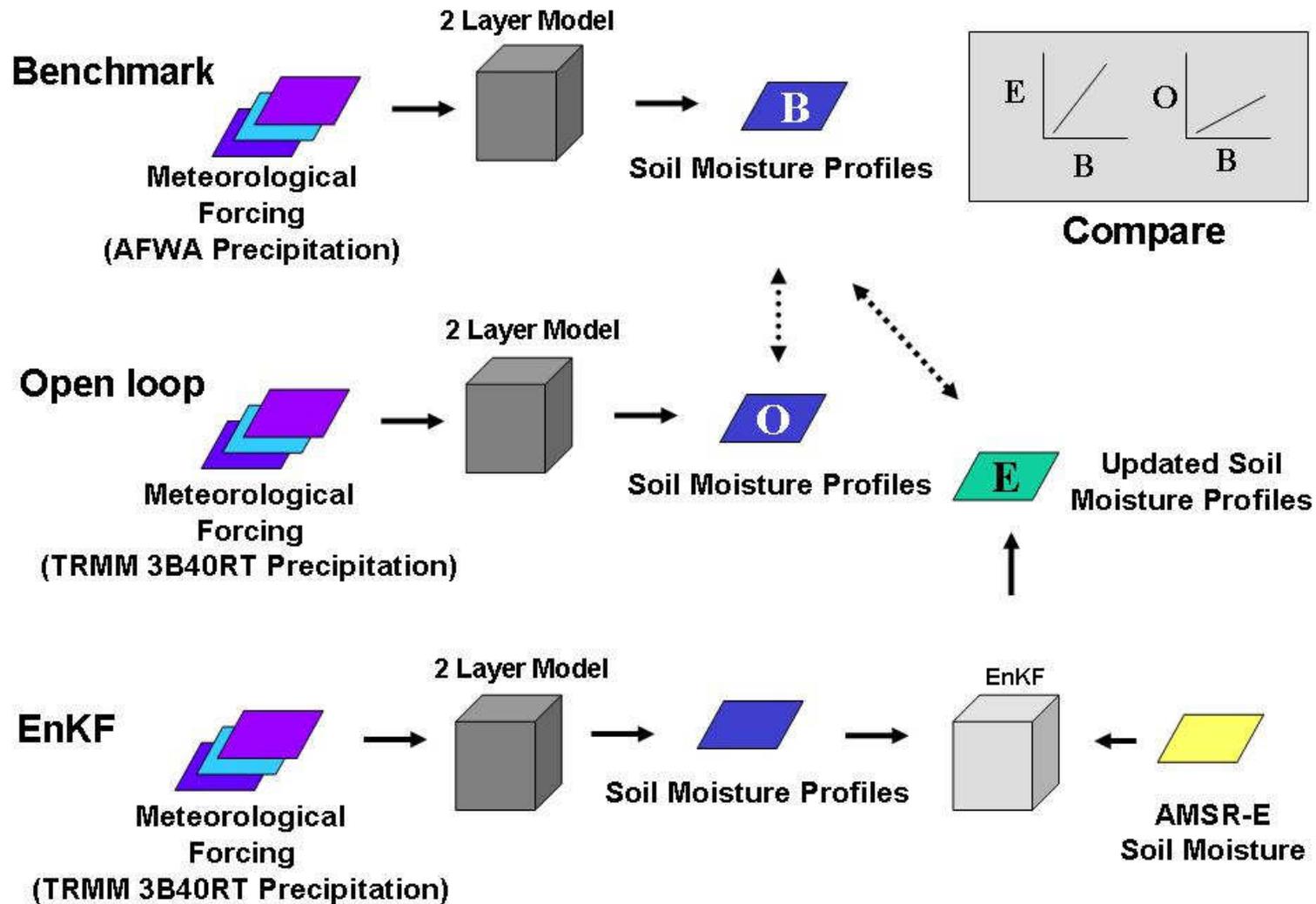


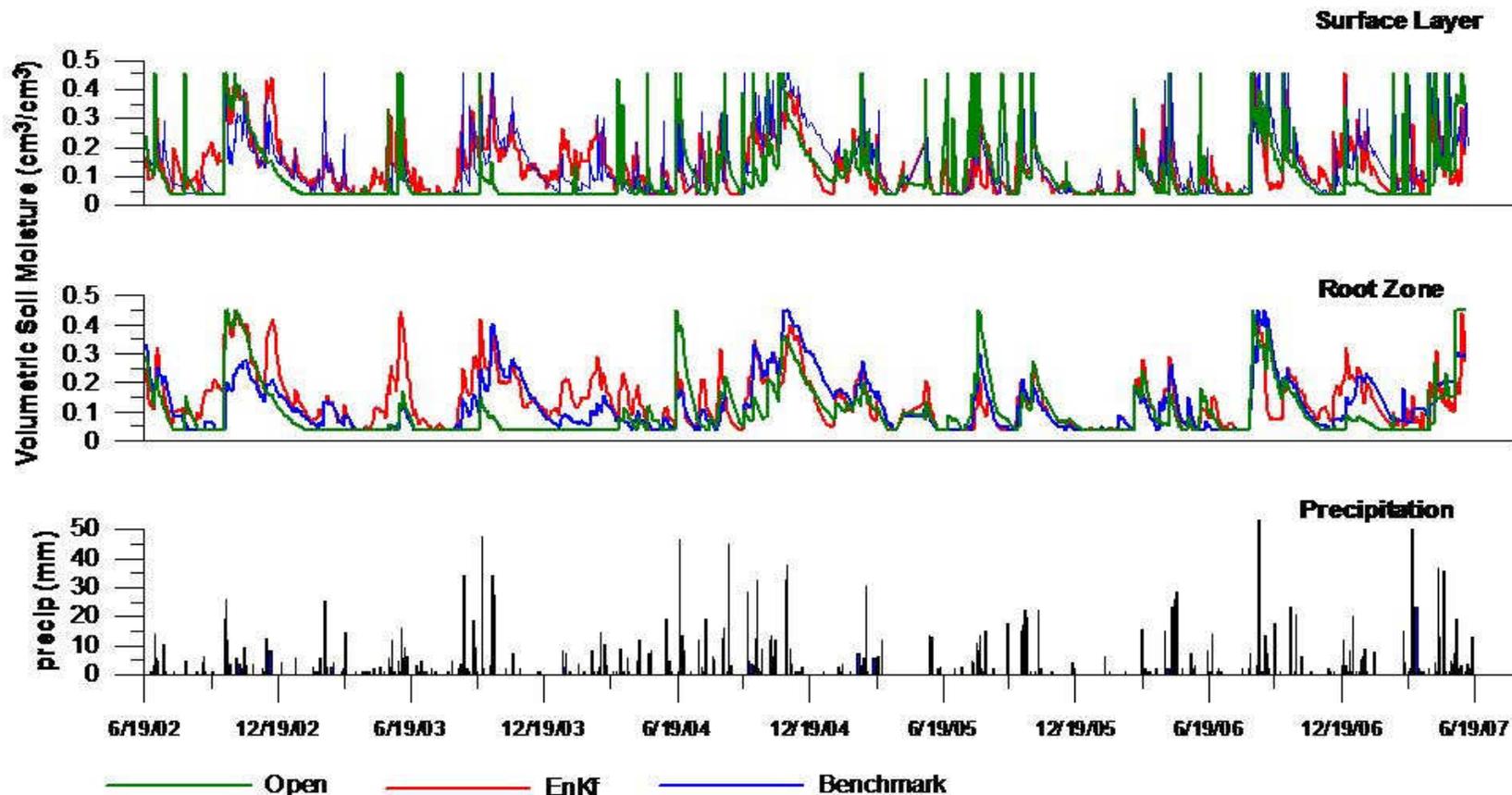
July 2009 AMSRE Soil Moisture Anomalies (VUA product – T. Holmes)



- 1) Can surface anomaly products be connected to root-zone dynamics?
- 2) Relative to baseline land surface models (forced by precipitation observations) – how much added skill is afforded by access to remotely-sensed surface soil moisture?

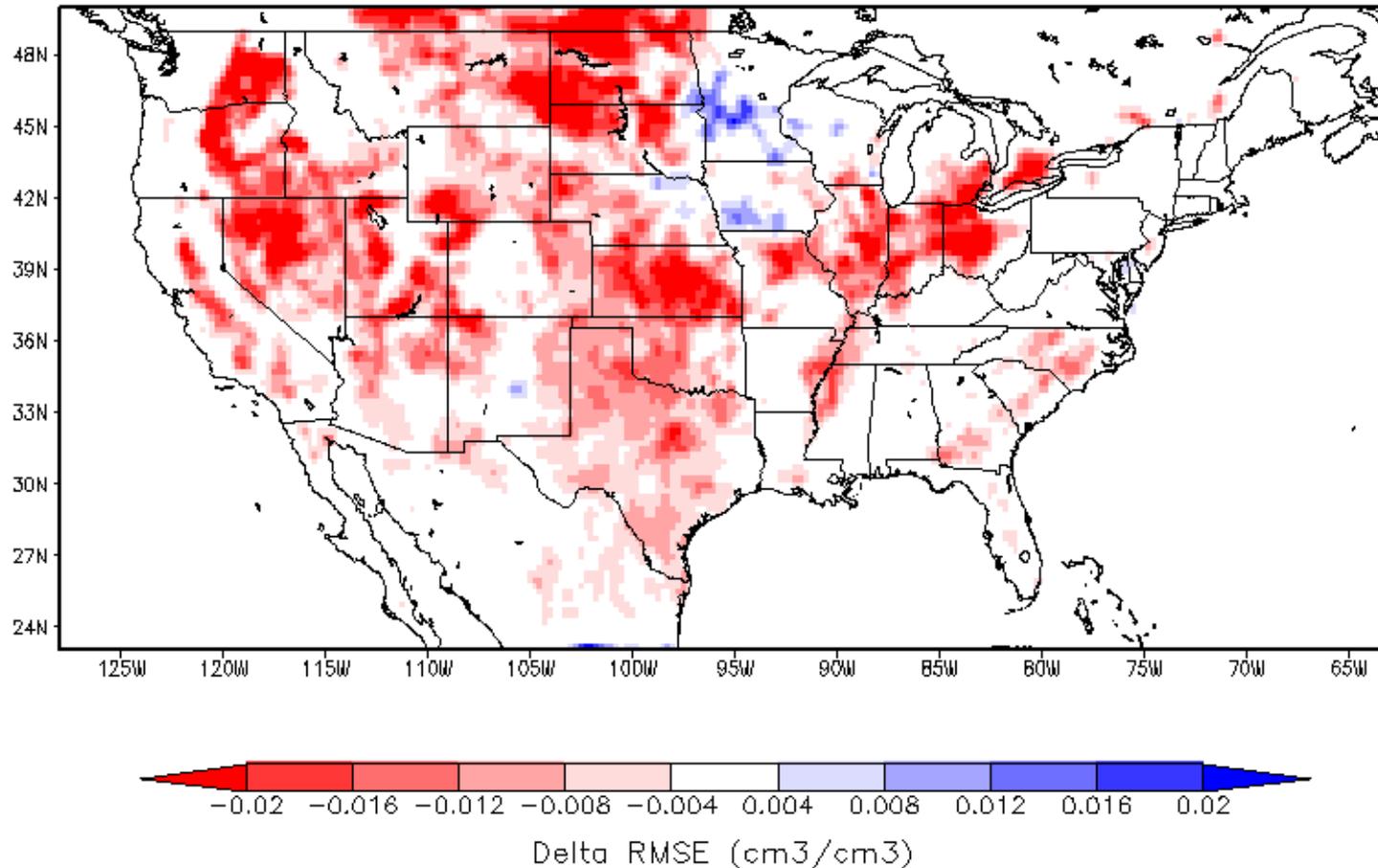
Data Denial Methodology





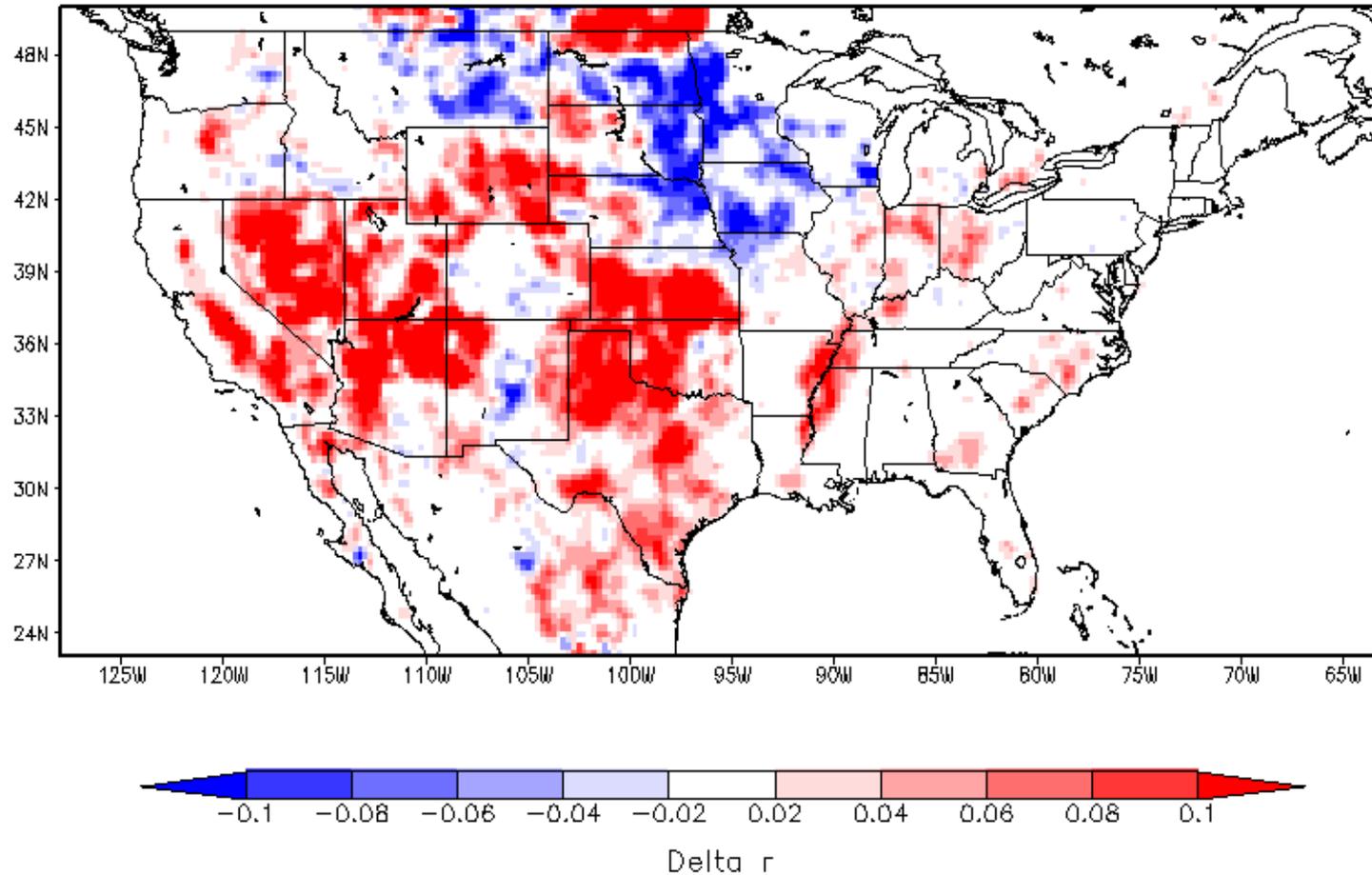
Can the poor-precipitation **open loop case** be corrected to resemble the good-precipitation **benchmark case** through the assimilation of remotely-sensed soil moisture (**EnKF case**)?

Improvement in root-zone RMSE Fit to Benchmark



Bolten et al., *IEEE Selected Topics in Applied Earth Observations and Remote Sensing*, in press, 2009.

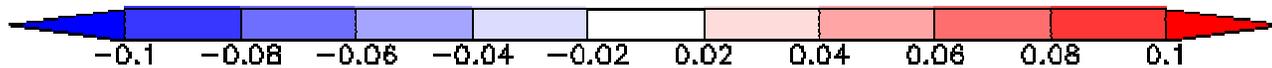
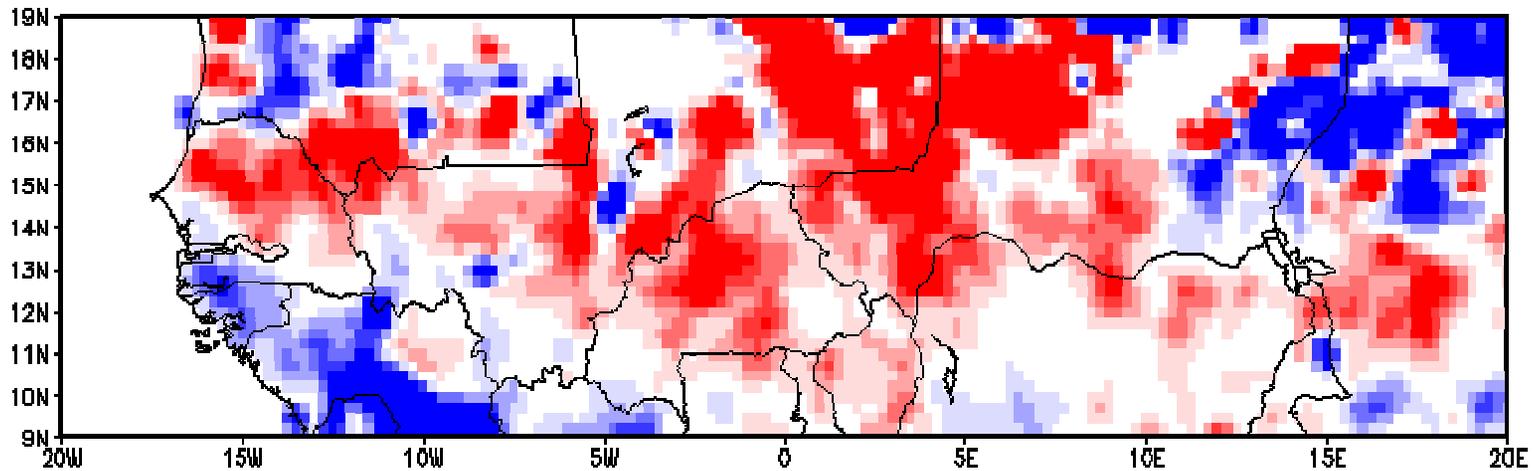
Improvement in root-zone anomaly R² Fit to Benchmark



Bolten et al., *IEEE Selected Topics in Applied Earth Observations and Remote Sensing*, in press, 2009.

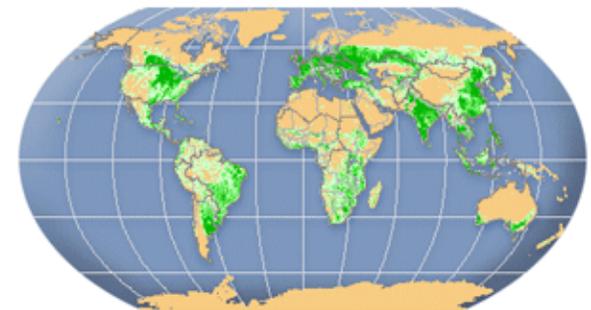
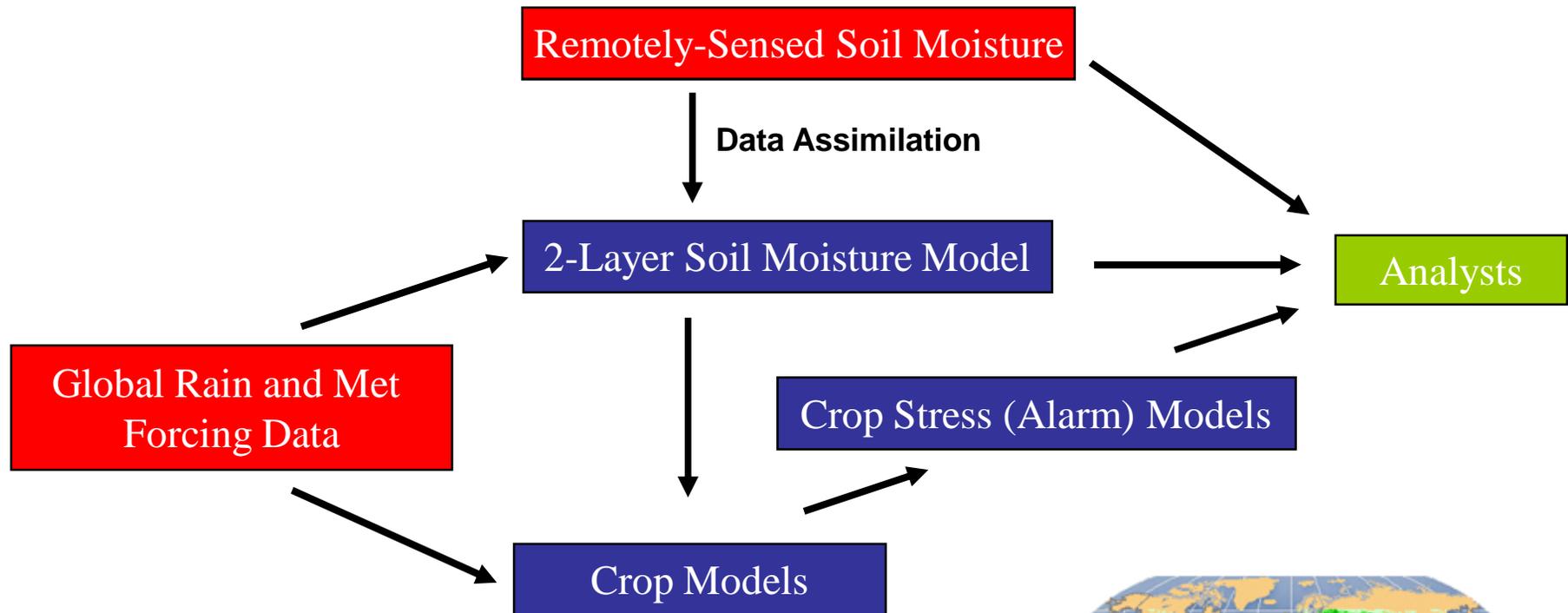
Improvement in root-zone anomaly R^2 Fit to Benchmark

West Africa – Based on AMMA precipitation (John Bolten – NASA GSFC)

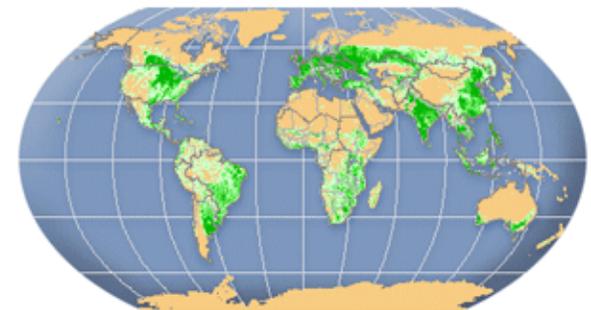
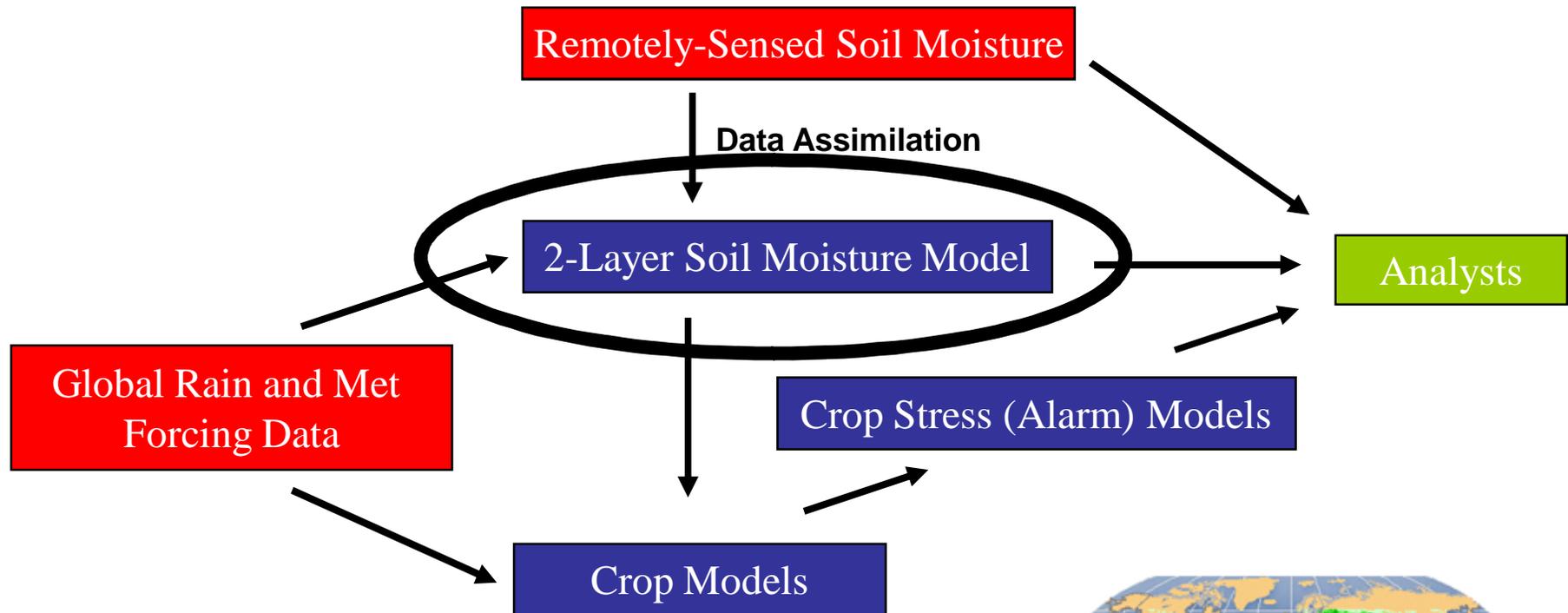


Delta r

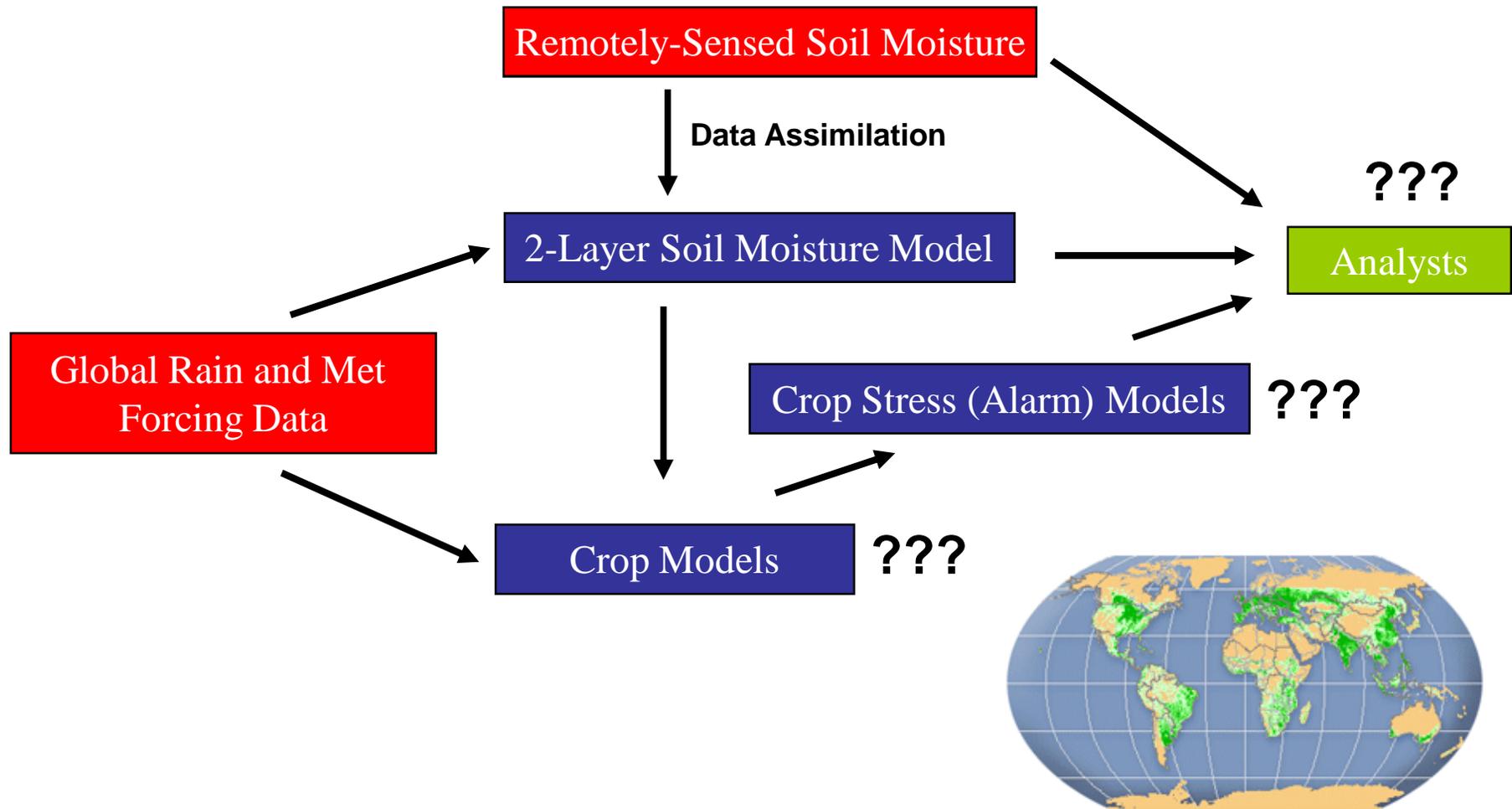
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Summary:

- 1) Large-scale crop production forecasting represents an important early adaptor for SMAP data products.
- 2) Observed added skill in root-zone soil moisture monitoring using AMSR-E.
- 3) Need to extend data denial experiments all the way to yield forecasting.
- 4) What level of products to integrate?
 - Tb and sigma observations (Level 2 or 3)
 - Surface soil moisture (Level 3)
 - Root-zone Soil Moisture (Level 4)