SHORT TERM DROUGHT PREDICTION BASED ON STABLE STATES BETWEEN THE LAND AND THE ATMOSPHERE

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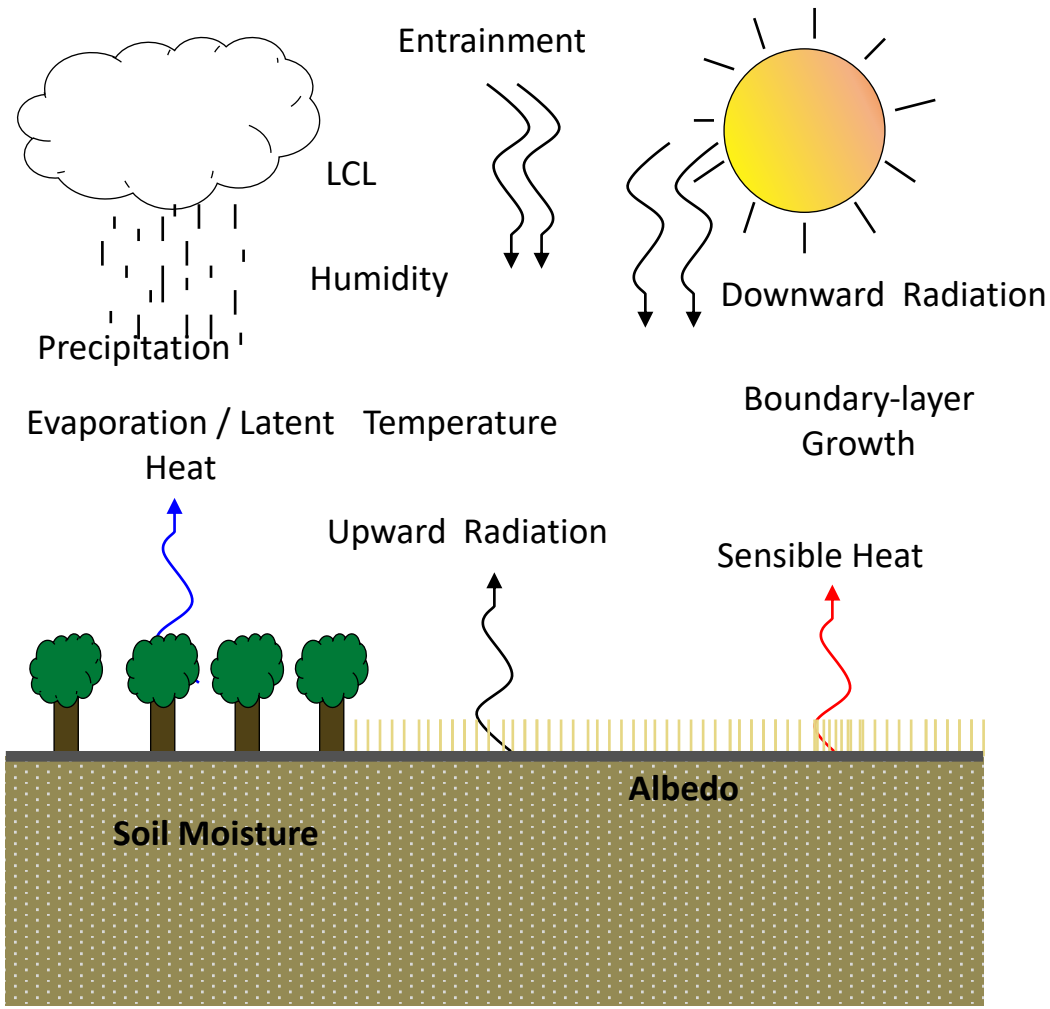
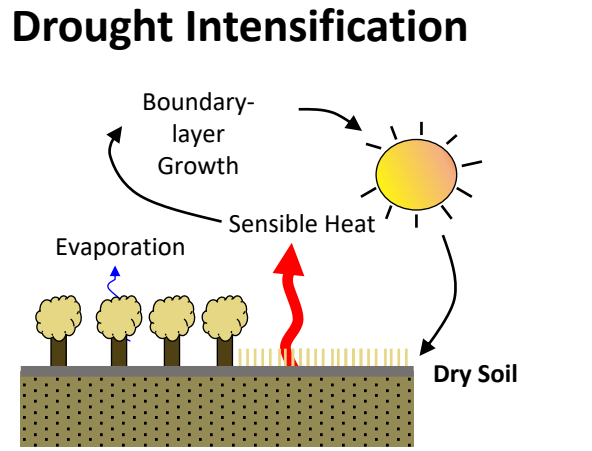
Monday January 29, 2024
Probabilistic Forecasting and Uncertainty Analysis: Theory and Application II
AMS Annual Meeting

Funding:
NASA-Soil Moisture Active-Passive Science Team
NNH19ZDA001N-SMAP

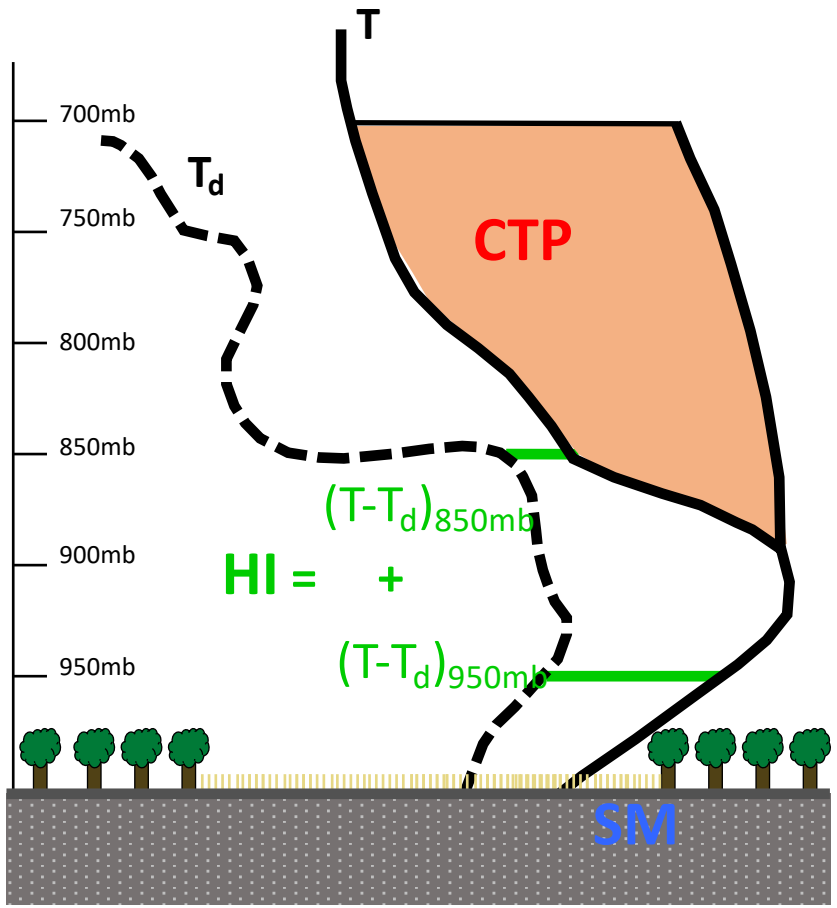
Land Atmosphere Interactions Impact on Extreme Events





While land-atmosphere coupling plays a role in these events, consistent large-scale forcing is also necessary

CTP-HI are used to classify these regimes

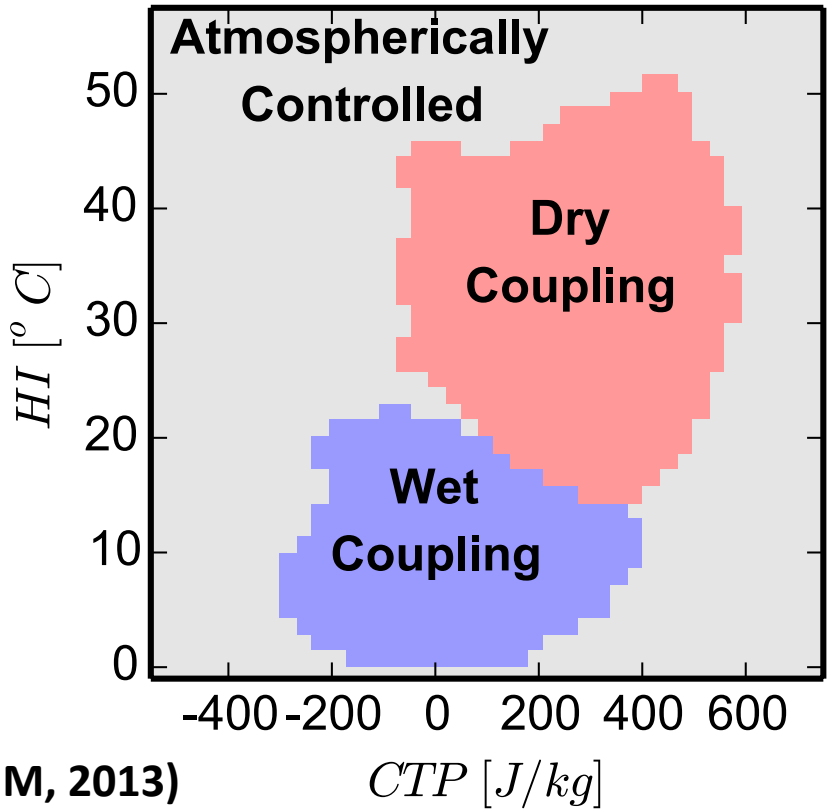


Based on the work of Findell and Eltahir (JHM, 2003).

Once the CTP-HI space is classified, only CTP-HI is needed for daily classification

Historic Sample

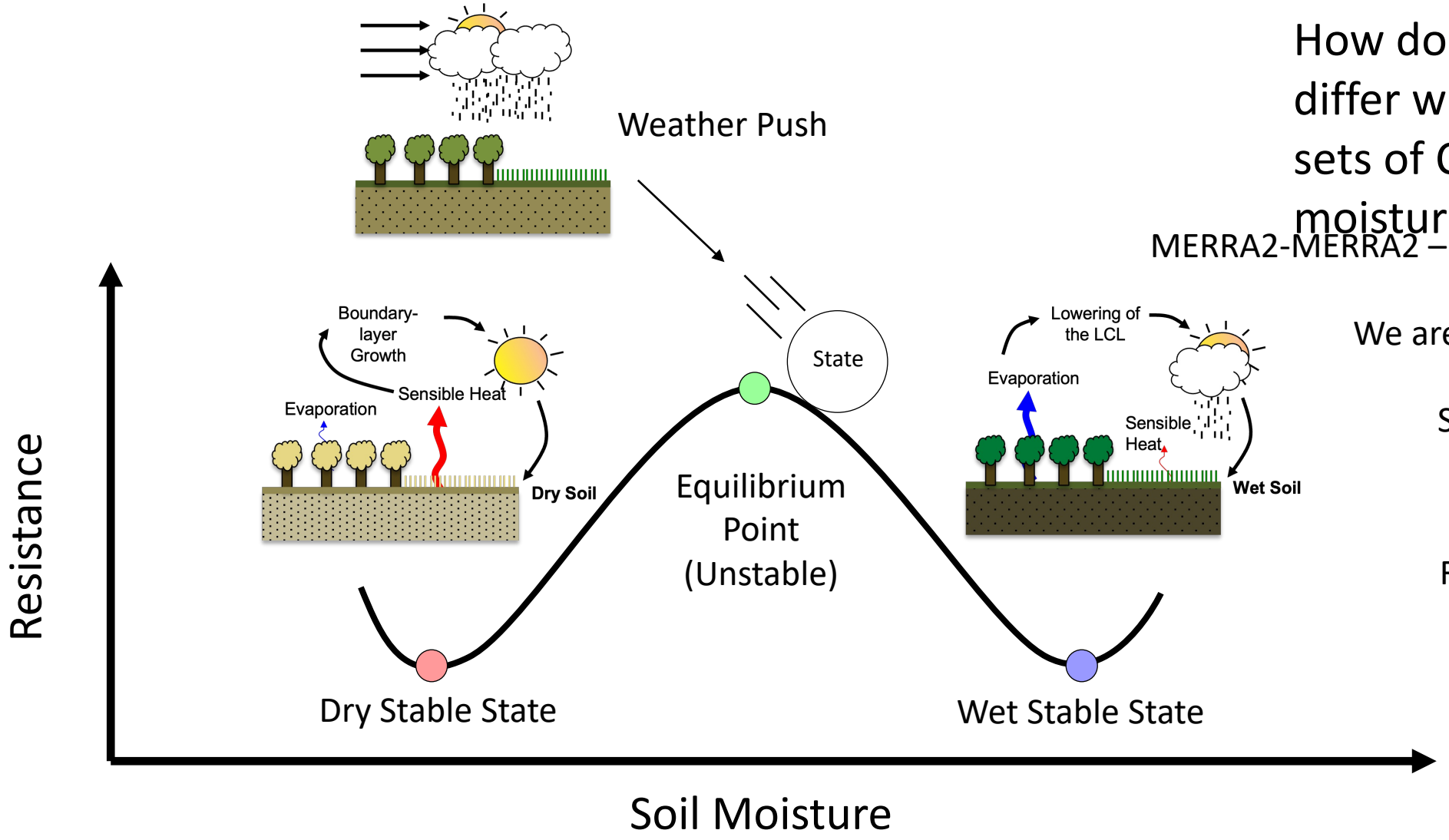
CTP-HI Space



Roundy et al. (JHM, 2013)

$$CDI = \frac{Dry_{Coupling} - Wet_{Coupling}}{Total_{Days}}$$

L-A Coupling Stable States



How do these stable states differ with different data sets of CTP-HI and soil moisture?

MERRA2-MERRA2 – Reanalysis

We are looking at three data sets:

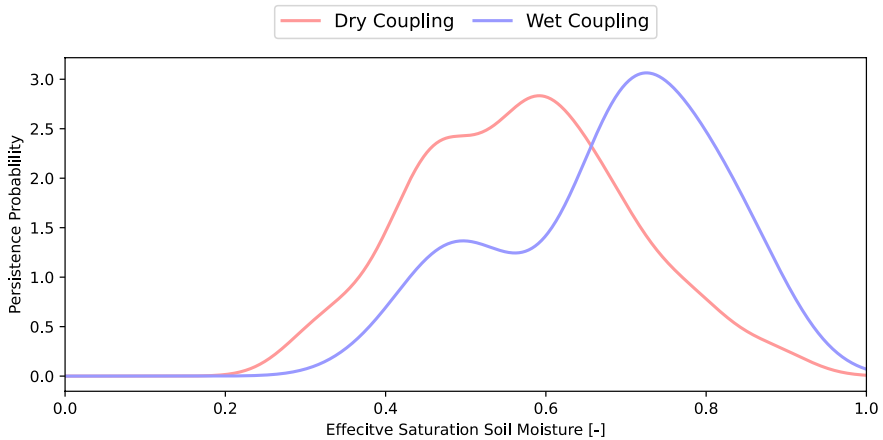
Satellite Remote Sensing:
AIRS-SMAPL4

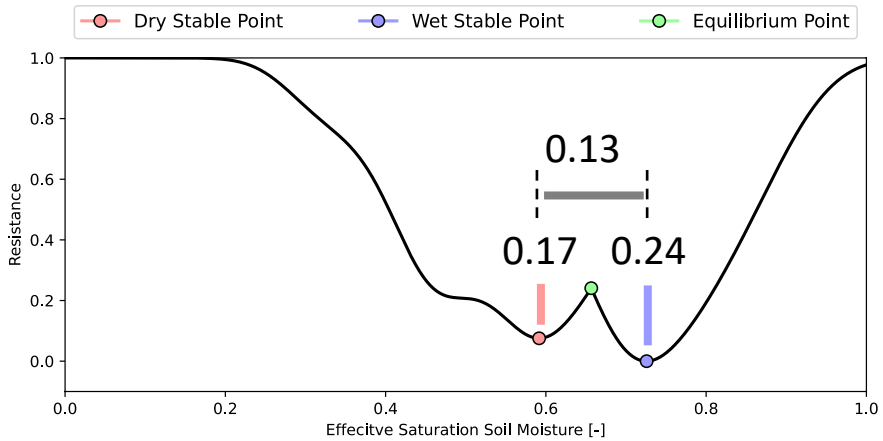
Reanalysis:
MERRA2
ERA5

These Stable L-A coupling States can provide a tool for prediction.

Stable Coupling States Eastern Kansas

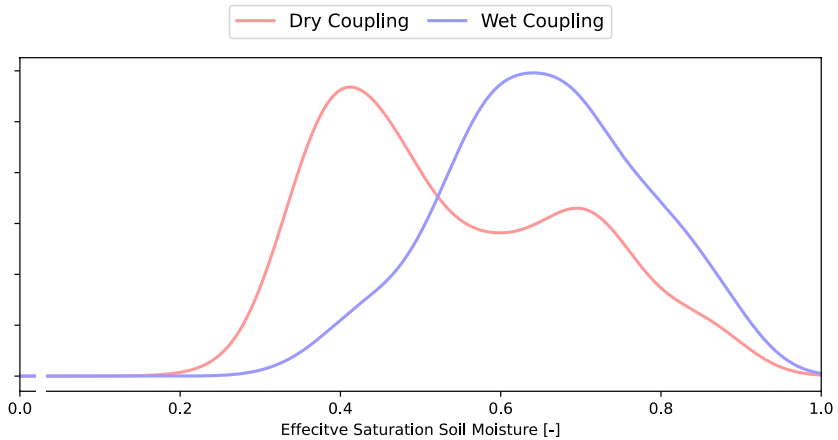
AIRS-SMAPL4

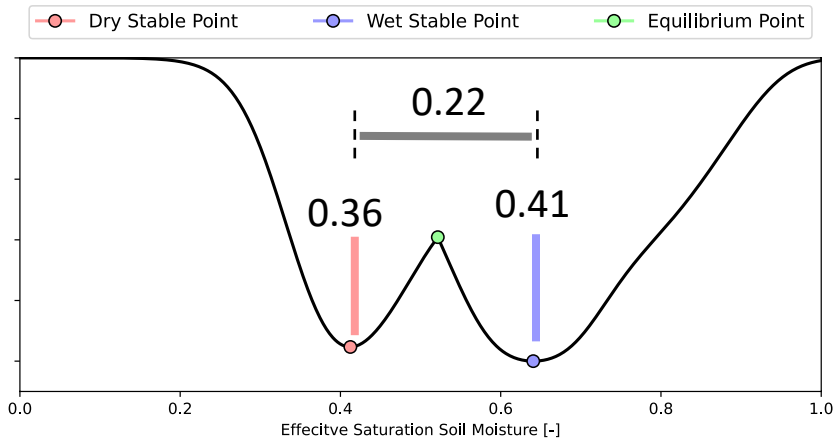




DS = -0.07

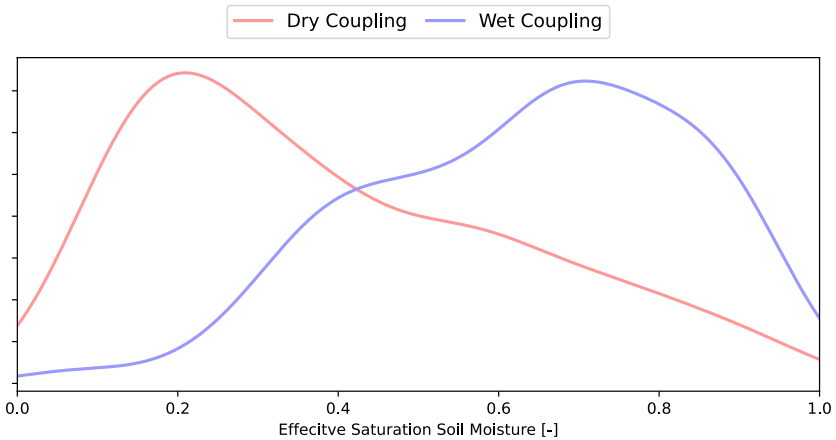
MERRA2

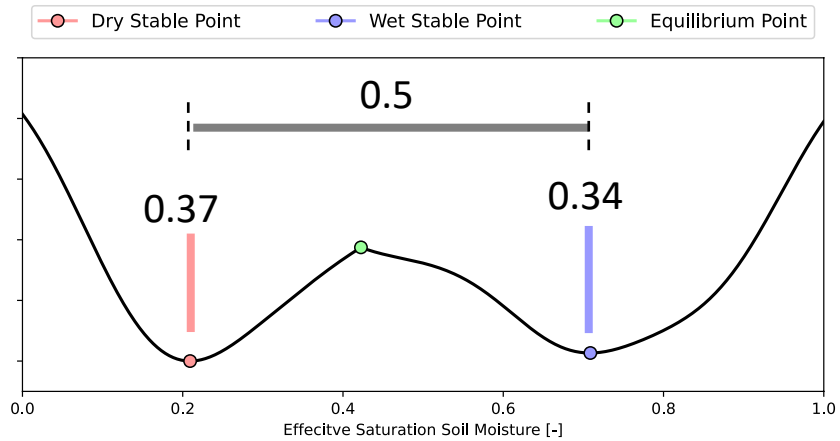




DS = -0.05

ERA5



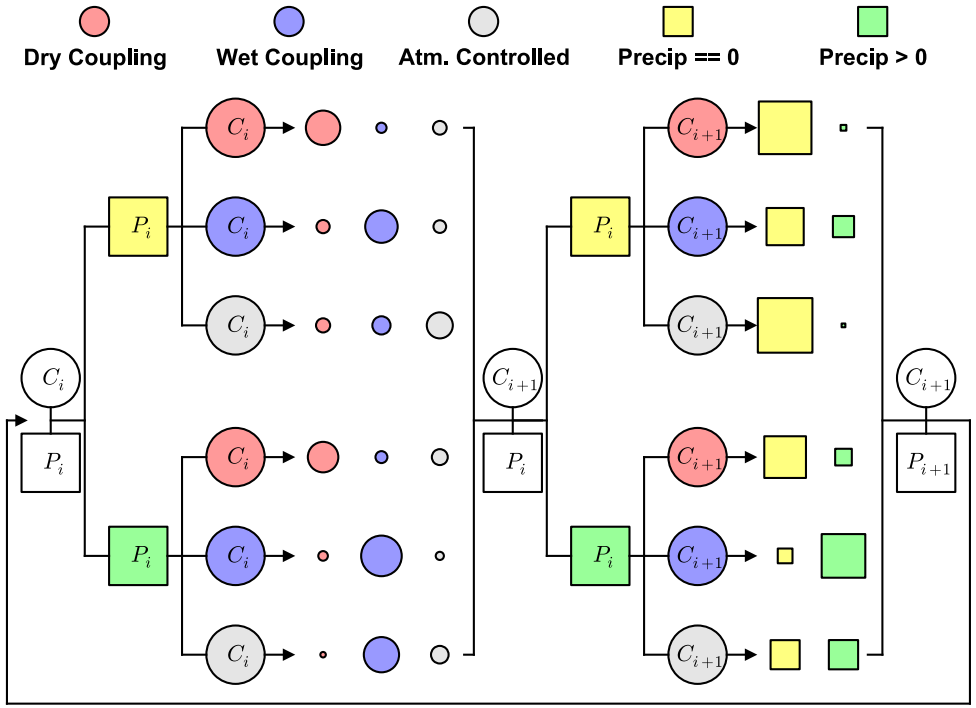


DS = 0.03

This shows that these data sets represent coupling differently, so which is correct?

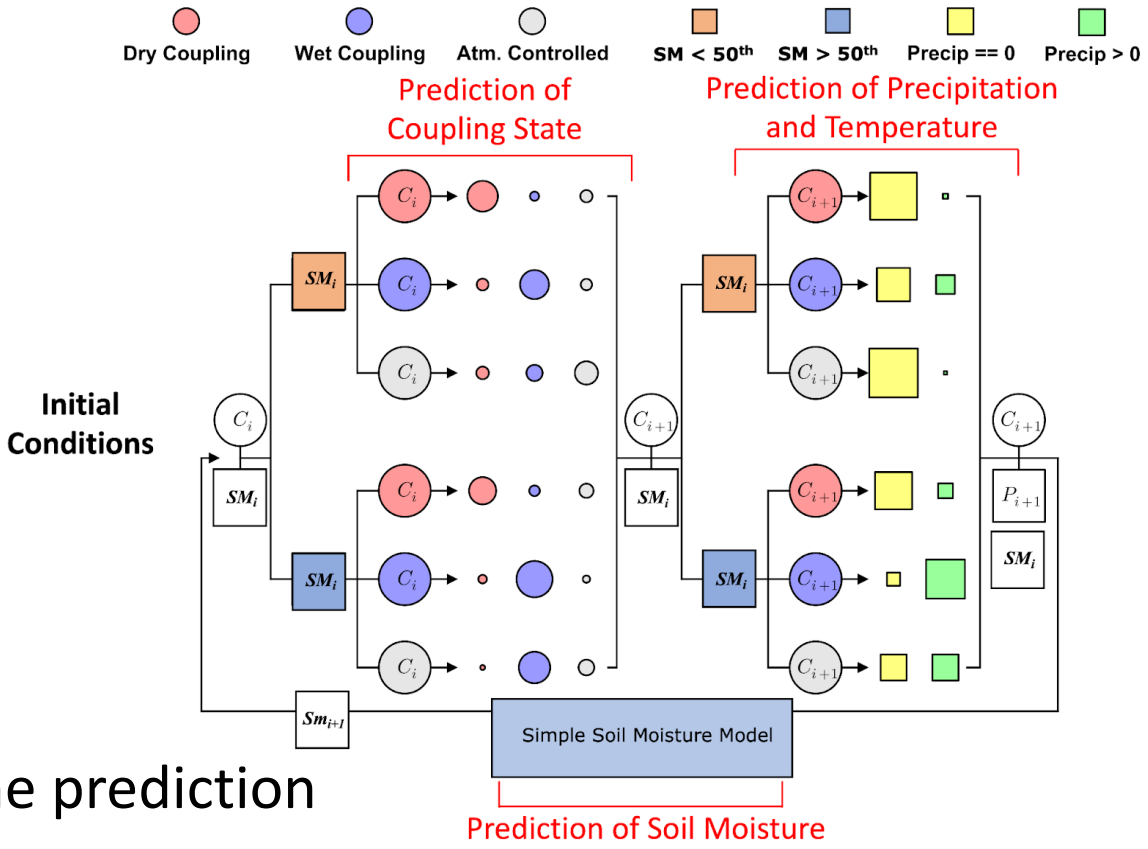
Coupling State Provides a means for Prediction

Stochastic Model Based on Persistence of Coupling State



Roundy and Wood 2014

Stochastic Model Based on Persistence of Coupling State **with Soil Moisture**



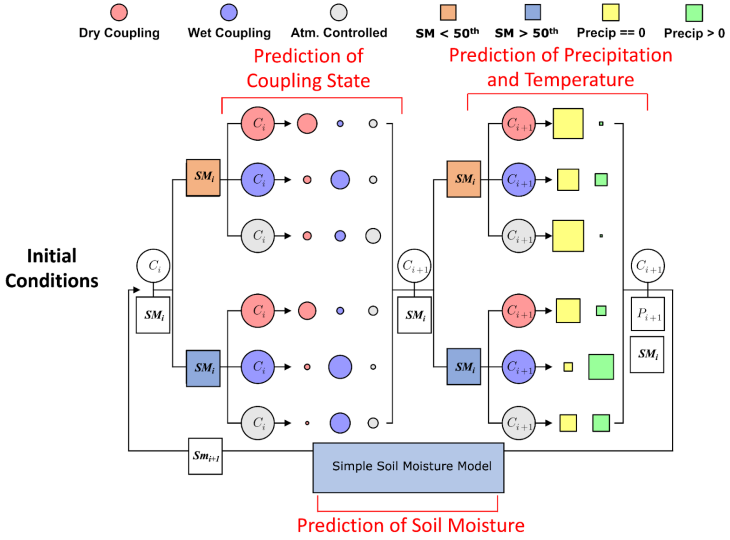
How do different Coupling data sets impact the prediction skill?

Can this say something about which data set better represents the coupling?

Hindcasts for Eastern Kansas

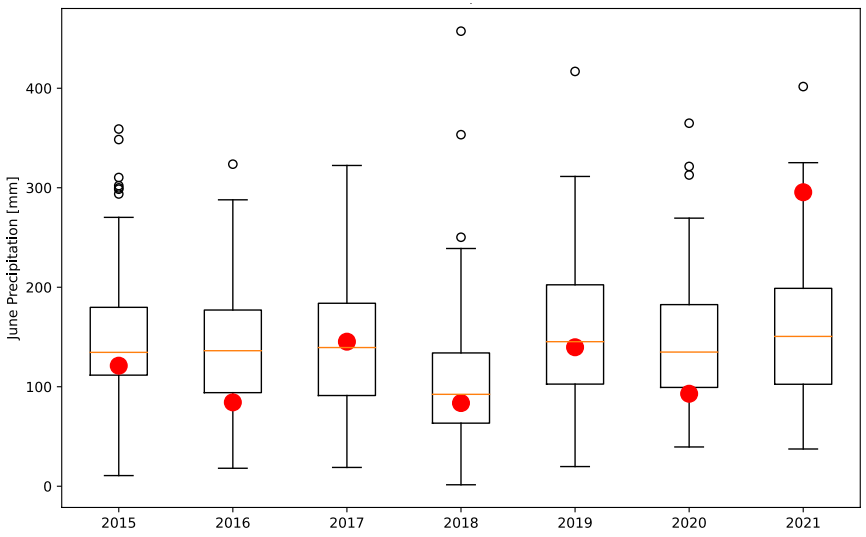
Hindcast Properties

- Initiate May, Forecast June
- 7-years (2015-2021)
- 100-member ensemble (includes uncertainty in initial conditions and statistical sampling)

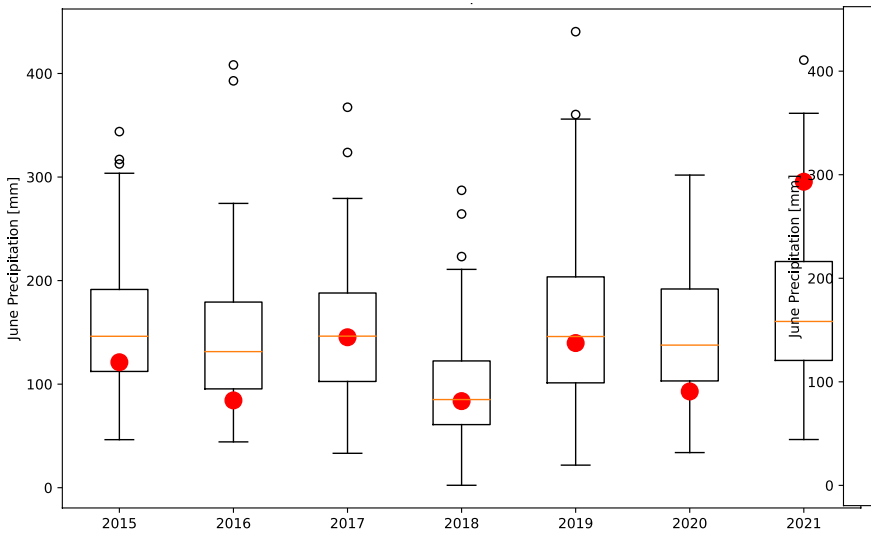


June Precipitation Prediction

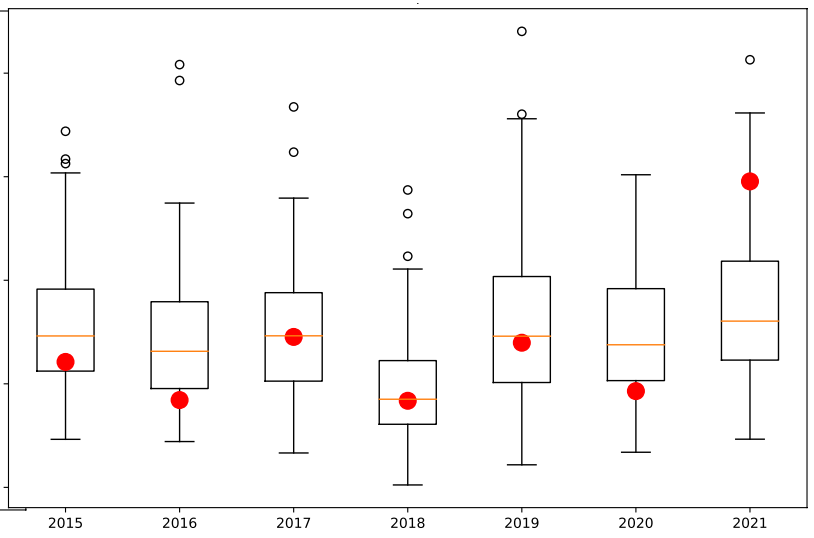
AIRS-SMAPL4



MERRA2

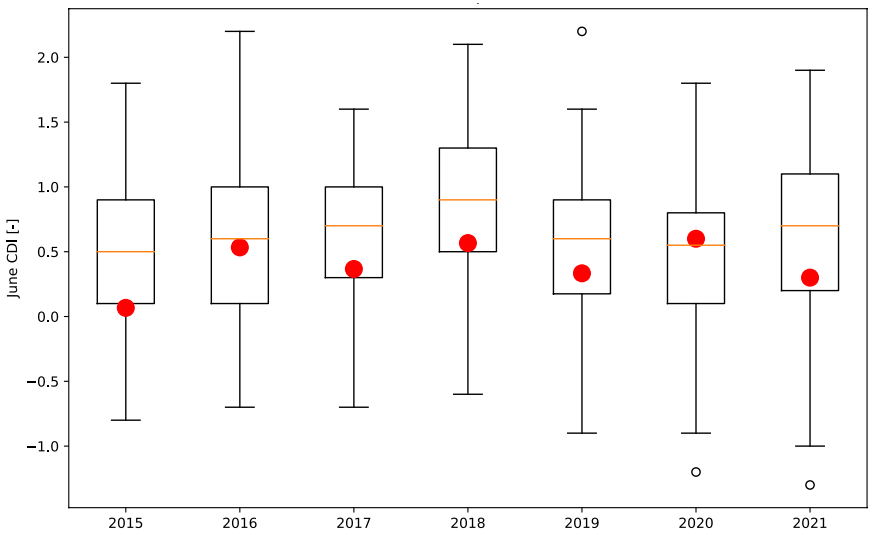


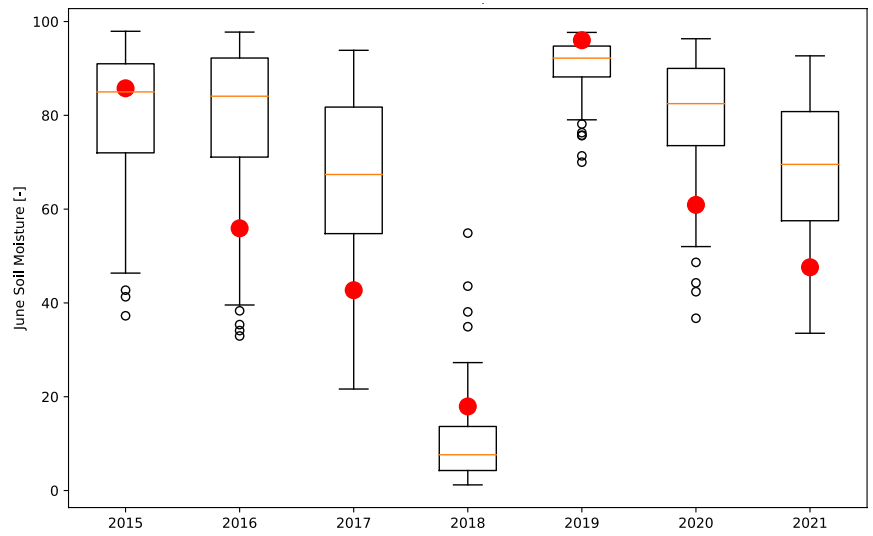
ERA5



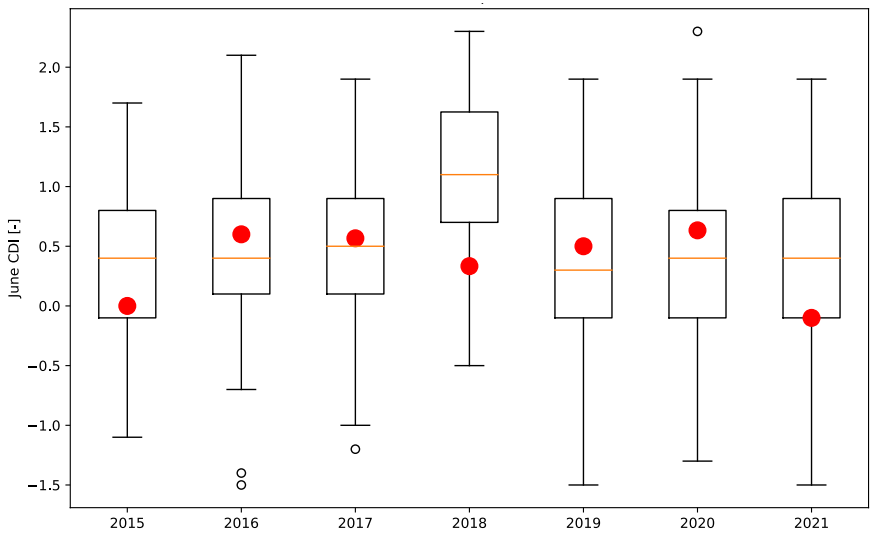
Hindcasts for Eastern Kansas

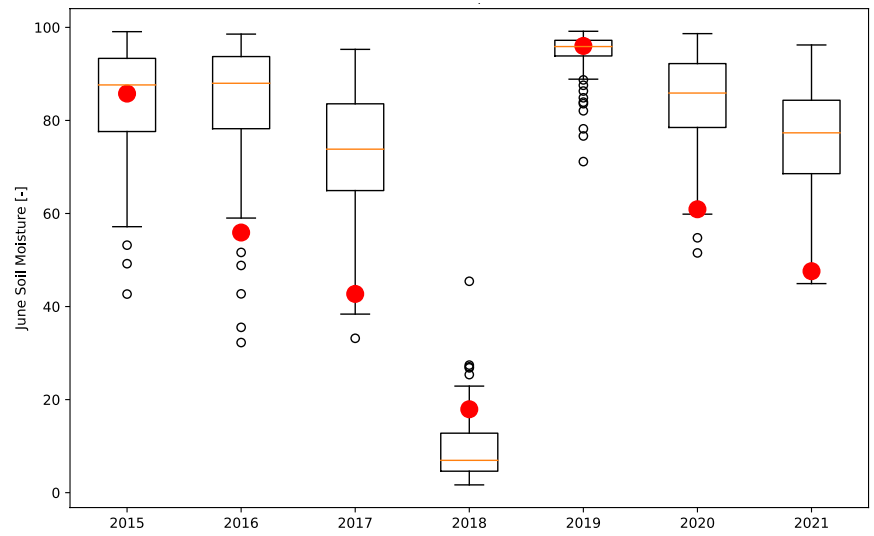
AIRS-SMAPL4



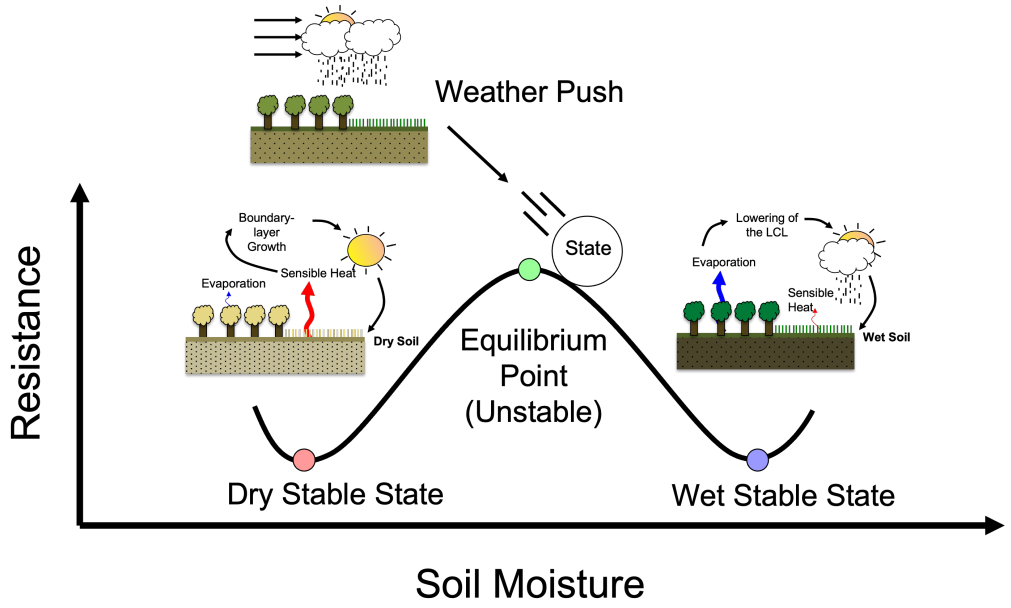


MERRA-MERRA





Conclusions and Future Work



Conclusions

- This analysis shows that there is potential for short term prediction skill for drought from a L-A coupling statistical model.
- Different data sets show similar predictions, this could be due to using the same precipitation data set (MERRA) or that SMAPL4 has a model component.

Future Work

- More work needs to be done to test a larger variety of data sets and for locations all over the globe and for different seasons.
- Need to consider different precipitation data sets as well as a cross validation framework (short prediction period 2015-2022).