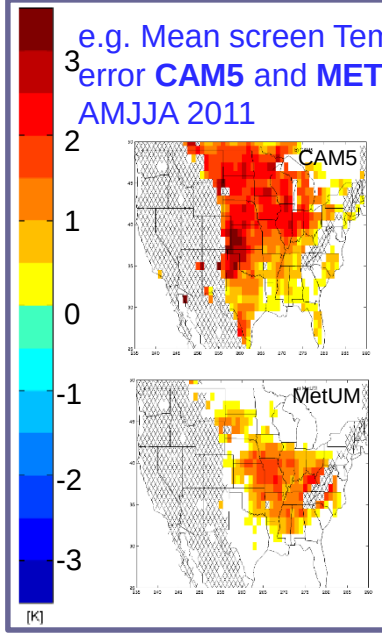
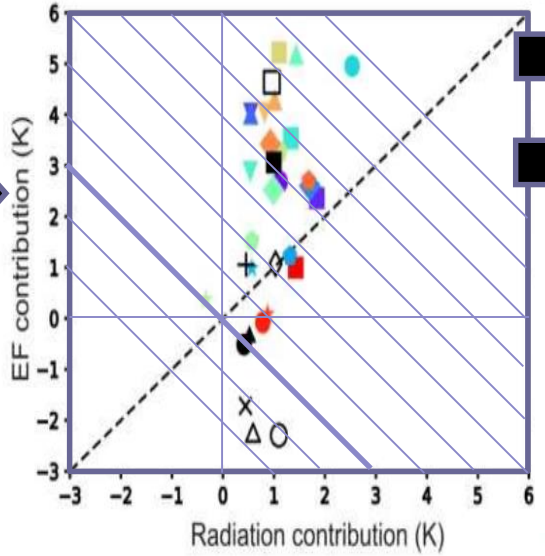
The causes of US Midwest surface temperature errors in climate models

The detailed diagnostics developed in CAUSES project provide the tools necessary for the model builders to use ARM observations to improve their models.

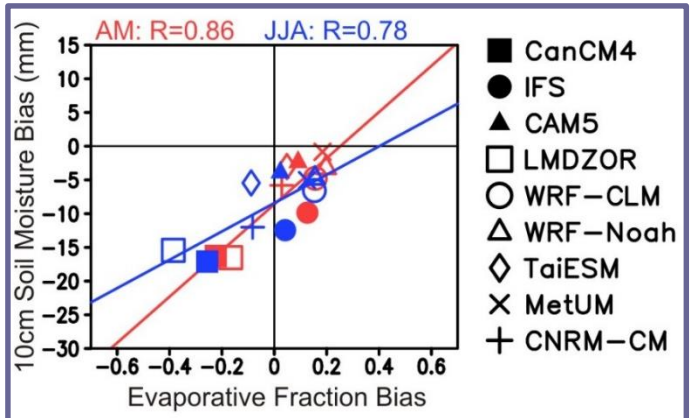
e.g. Mean screen Temp error **CAM5** and **METUM**: AMJJA 2011



Theoretical analysis: relative contribution of error from evaporative fraction & from radiation in hindcast and CMIP5 models.

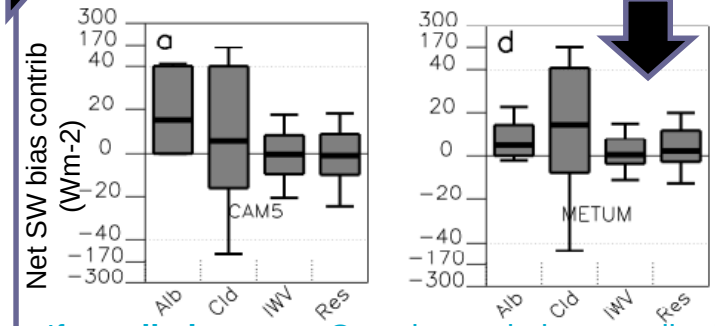


Evap fraction error explains 0-5 K of error, and most of error, when error is large.



Link between **evap fraction** error and soil moisture error.

Radiation error explain 0-2 K of the error.

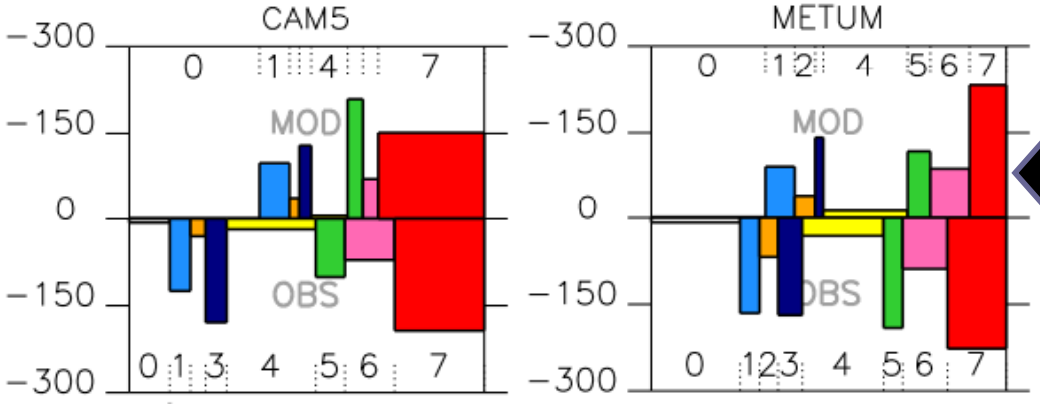


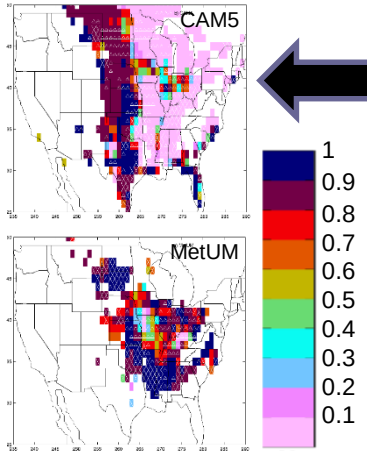
If a **radiation** error. Can show relative contribution from: surface albedo, **clouds**, water vapour.

If a **cloud** error: what kind of cloud, and is it frequency of occurrence or radiative properties?

For CAM5 can show: deep cloud regime is too frequent but has too small radiative impact when it occurs.

For GA6: deep cloud regime is too rare.





Is what we learn at SGP representative of what is happening elsewhere?

Large correlation of temp error over Midwest with temp error at SGP.

GASS GEWEX WCRP Global Atmospheric System Studies | ASR Atmospheric System Research | Met Office | PCMDI | RGCM

"CAUSES": A project led by **LLNL** and **UKMO.** 9 institutes & 11 models→**4 papers JGR-A**