GLACE -2

The 2nd phase of the Global Land-Atmosphere Coupling Experiment

Progress Report: June 29, 2009

Agenda:

-- Get updates on progress from different groups

-- Show skill scores for 6 participating models

-- Show “conditional” skill scores

-- Discuss GFDL water holding capacity experiment

-- Final comments

Updated Participant List

Group/Model	# models	Points of Contact
1. NASA/GSFC (USA): GMAO seasonal forecast system (old and new)	2	R. Koster, S. Mahanama
2. COLA (USA): COLA GCM, NCAR/CAM GCM	2	P. Dirmeyer, Z. Guo
3. Princeton (USA): NCEP GCM	1	E. Wood, L. Luo
4. IACS (Switzerland): ECHAM GCM	1	S. Seneviratne, E. Davin
5. KNMI (Netherlands): ECMWF	1	B. van den Hurk
6. ECMWF	1	G. Balsamo, F. Doblas-Reyes
7. GFDL (USA): GFDL system	1	T. Gordon
8. U. Gothenburg (Sweden): NCAR	1	J.-H. Jeong
9. CCSR/NIES/FRCGC (Japan): CCSR GCM	1	T. Yamada
10. FSU/COAPS	1	M. Boisserie
11. CCCma (?)	1	B. Merryfield
	13 models	

Potential new contributor

Fcst. Model	*Points of Contact*	*Progress to Date*
COLA GCM ; NCAR/ CAM GCM, via COLA	Paul Dirmeyer, Zhichang Guo	*-- COLA model: Baseline forecasts are complete* -- NCAR runs are underway.

NCAR (USA, via U. Gothenburg, Sweden)	Jee-Hoon Jeong	*-- Baseline forecasts are complete*
GEOS5 GCM; NSIPP GCM (NASA/GSFC)	Randal Koster, Sarith Mahanama	-- Simulated 50 years of land surface conditions for initialization for GEOS-5 *-- NSIPP GCM Series 2 runs finished;* Series 1 runs are underway -- Still dealing with technical issues for GEOS-5

Fcst Model	***Points of Contact***	***Progress to Date***
GFDL (USA)	Tony Gordon	*-- Baseline forecasts are halfway done (1st of each of month). Variants performed and examined (with and without corrected SSTs, with and without scaling…)* *-- Additional set of forecasts performed with model having increased water holding capacity (see below).*

Fcst. Model	*Points of Contact*	*Progress to Date*
KNMI (ECMWF uncoupled model	Bart van den Hurk, Helio Camargo, Gianpaolo Balsamo	*-- Baseline forecasts are complete, but Series 1 is being re-run to correct a snow initialization issue.*
ECMWF Coupled model	Gianpaulo Balsamo, Francisco Doblas-Reyes	*-- Baseline forecasts are complete. Forecasts being re-run?*
NCEP (via Princeton, USA)	Eric Wood, Lifeng Luo	*-- Baseline forecasts are halfway done (First-of-month starts).*

Fcst Model	*Points of Contact*	*Progress to Date*
ECHAM (via IACS, Switzerland)	Sonia Seneviratne, Roesch Andreas	-- Runs are proceeding.
CCSR/NIES/ FRCGC (Japan)	Tomohito Yamada	-- Runs are proceeding.
FSU/COAPS	Marie Boisserie	-- *Series 1 runs are complete*; Series 2 runs are proceeding.

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Overview of results (so far) from 6 models.

Focus right now on skill (r^2, relative to observations) rather than predictability.

Throw all start times into the calculations (after converting all forecasts into standard normal deviates):
-- 100 independent forecasts for COLA, ECMWF-Coup, ECMWF-AMIP, and NCAR
-- 50 independent forecasts for NCEP, GFDL.

Focus first on North America, where coupling tends to be high and precipitation measurements are adequately accurate.

Days 1-15

Precipitation Forecast Skill

Series 2 | Series 1 | Diffs: land impact

COLA

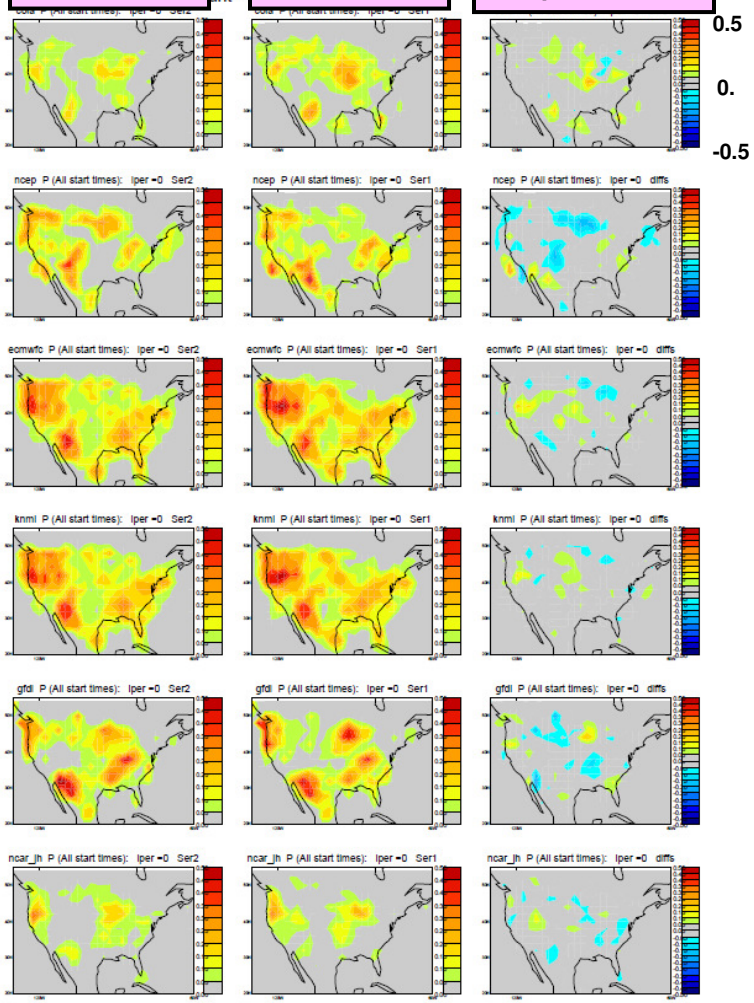
NCEP

ECMWF-Coup

ECMWF-AMIP

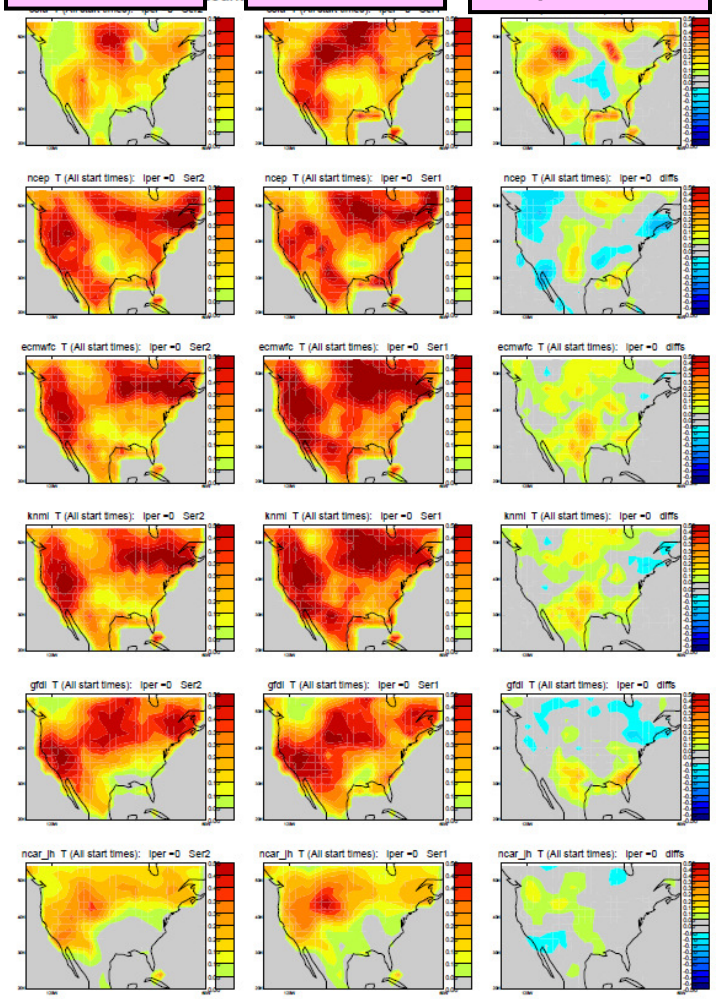
GFDL

NCAR

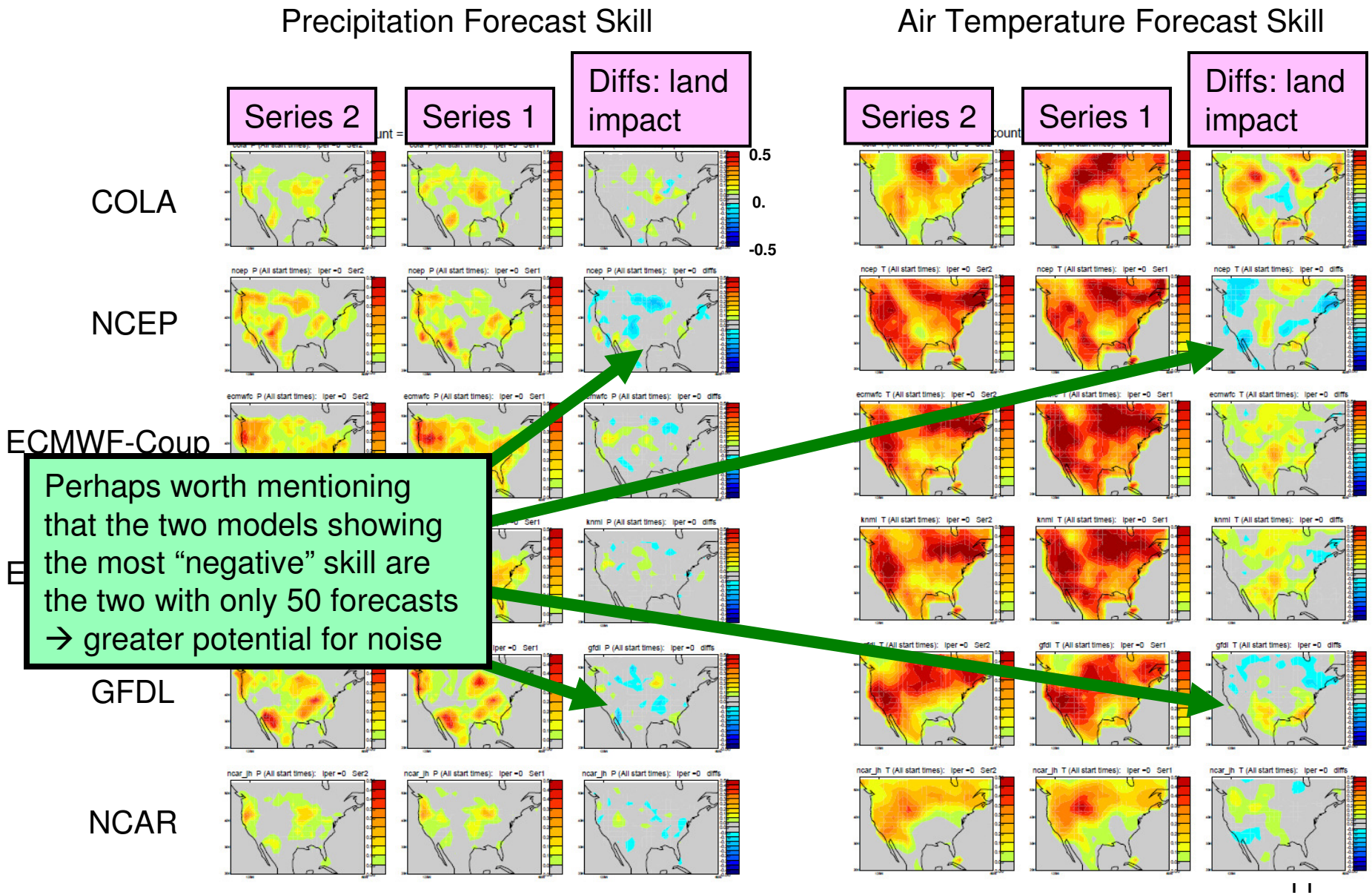


Air Temperature Forecast Skill

Series 2 | Series 1 | Diffs: land impact



Days 1-15



Perhaps worth mentioning that the two models showing the most "negative" skill are the two with only 50 forecasts → greater potential for noise

Days 16-30

Precipitation Forecast Skill

Series 2 | Series 1 | Diffs: land impact

COLA

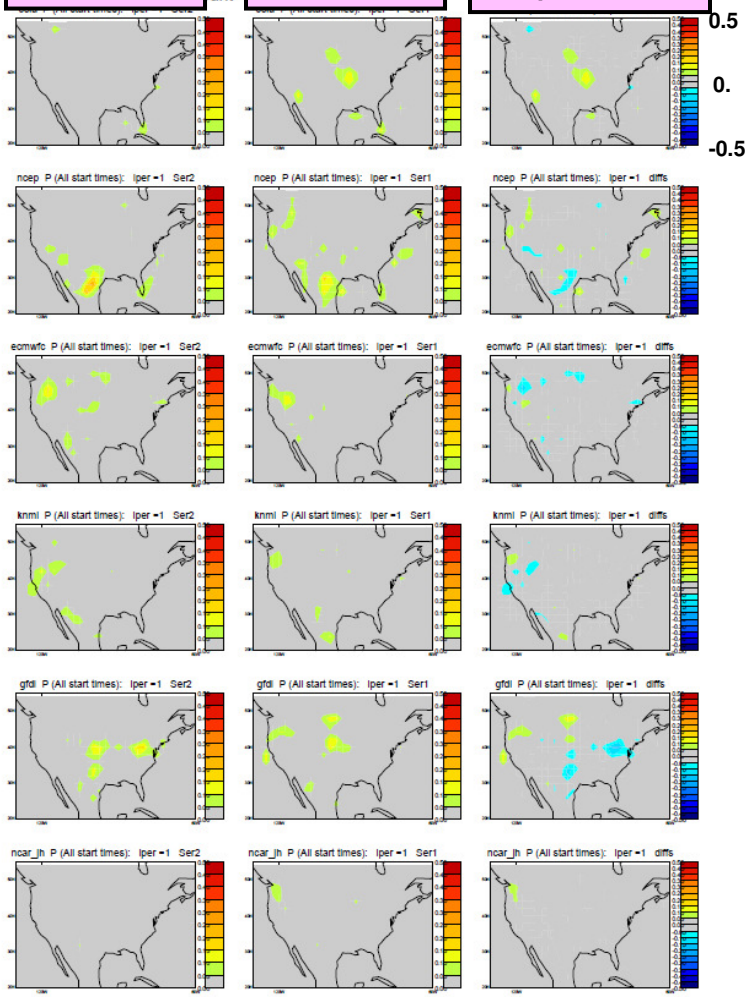
NCEP

ECMWF-Coup

ECMWF-AMIP

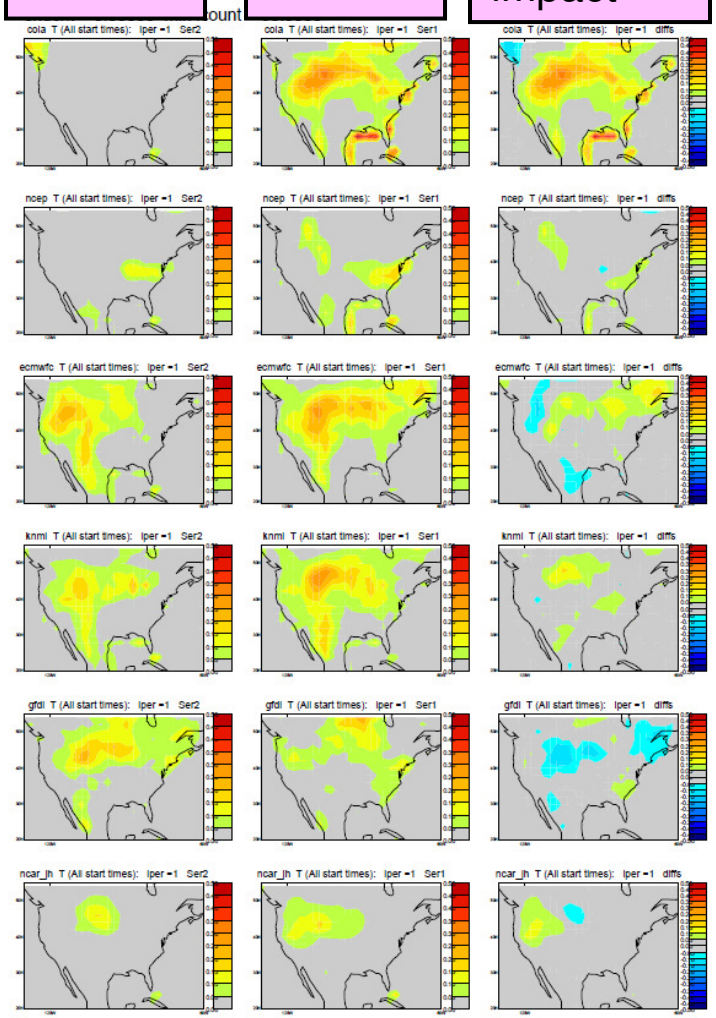
GFDL

NCAR



Air Temperature Forecast Skill

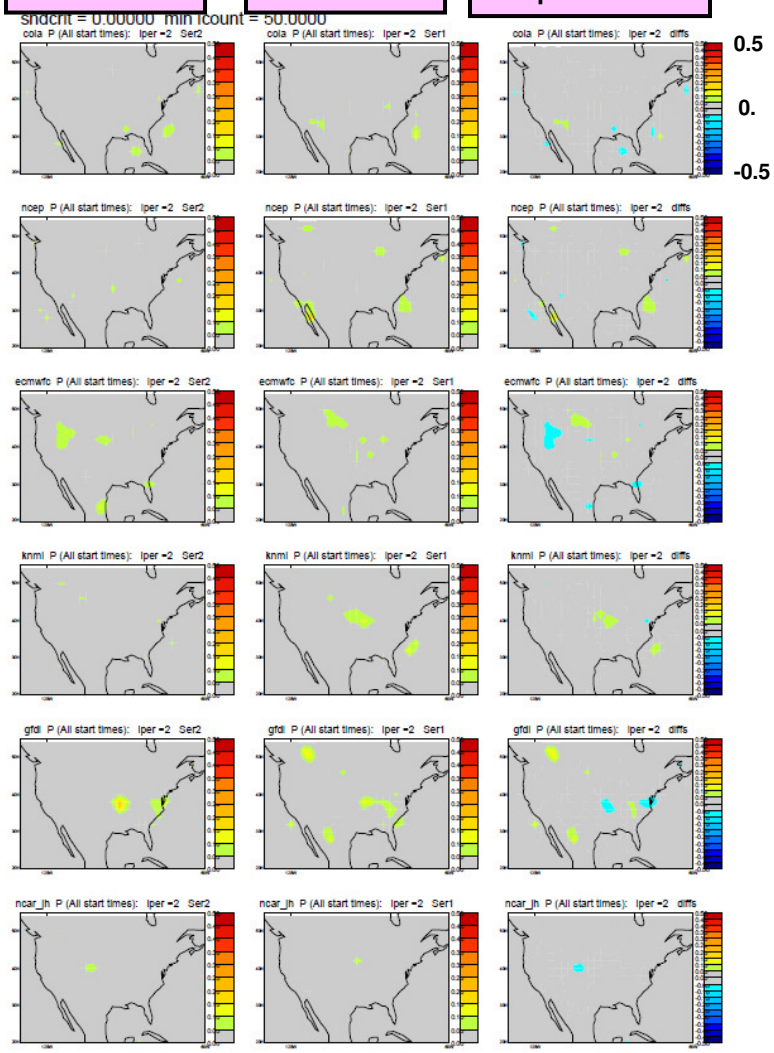
Series 2 | Series 1 | Diffs: land impact



Days 30-45

Precipitation Forecast Skill

Series 2 | Series 1 | Diffs: land impact



COLA

NCEP

ECMWF-Coup

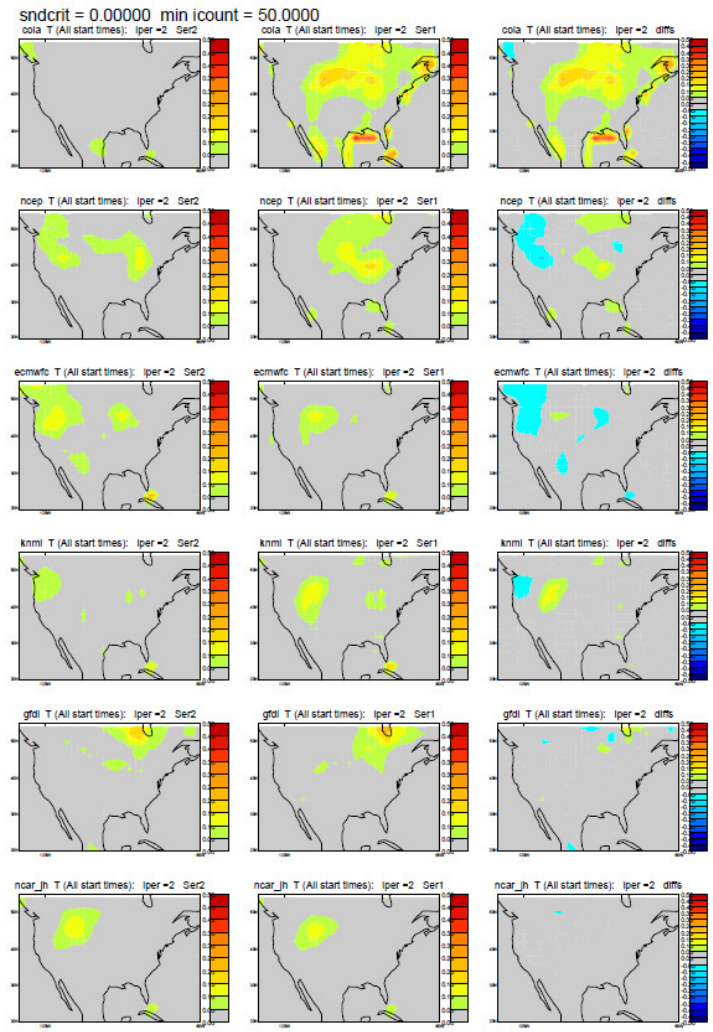
ECMWF-AMIP

GFDL

NCAR

Air Temperature Forecast Skill

Series 2 | Series 1 | Diffs: land impact



Days 46-60

Precipitation Forecast Skill

Series 2 | Series 1 | Diffs: land impact

COLA

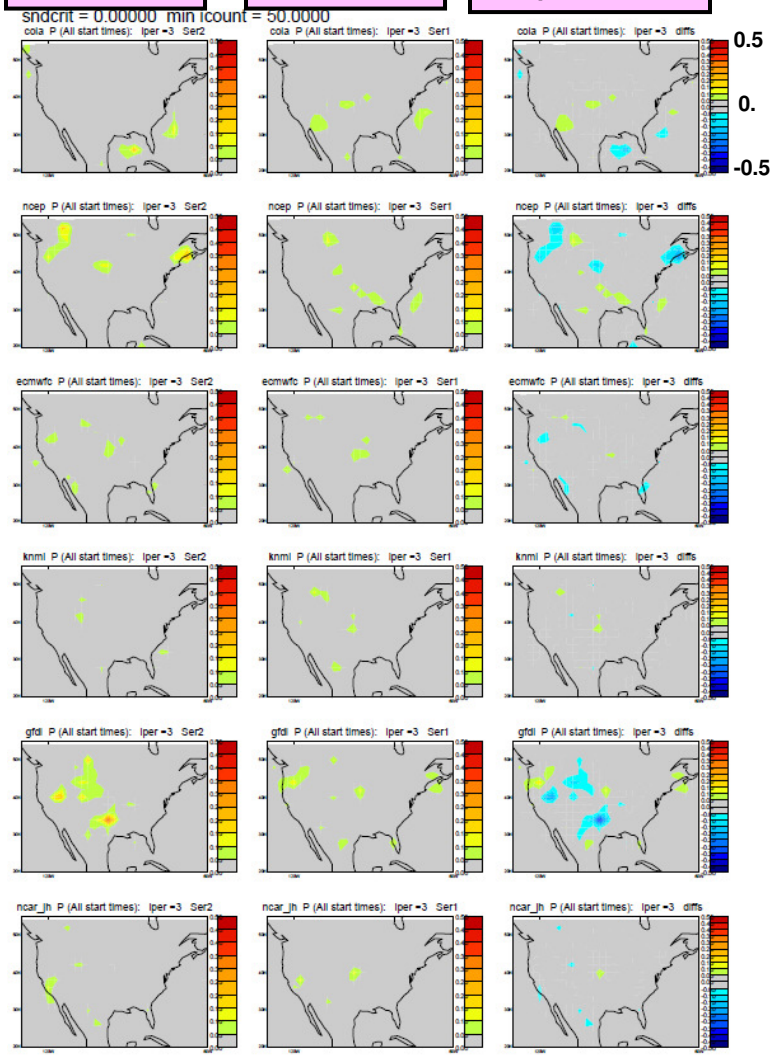
NCEP

ECMWF-Coup

ECMWF-AMIP

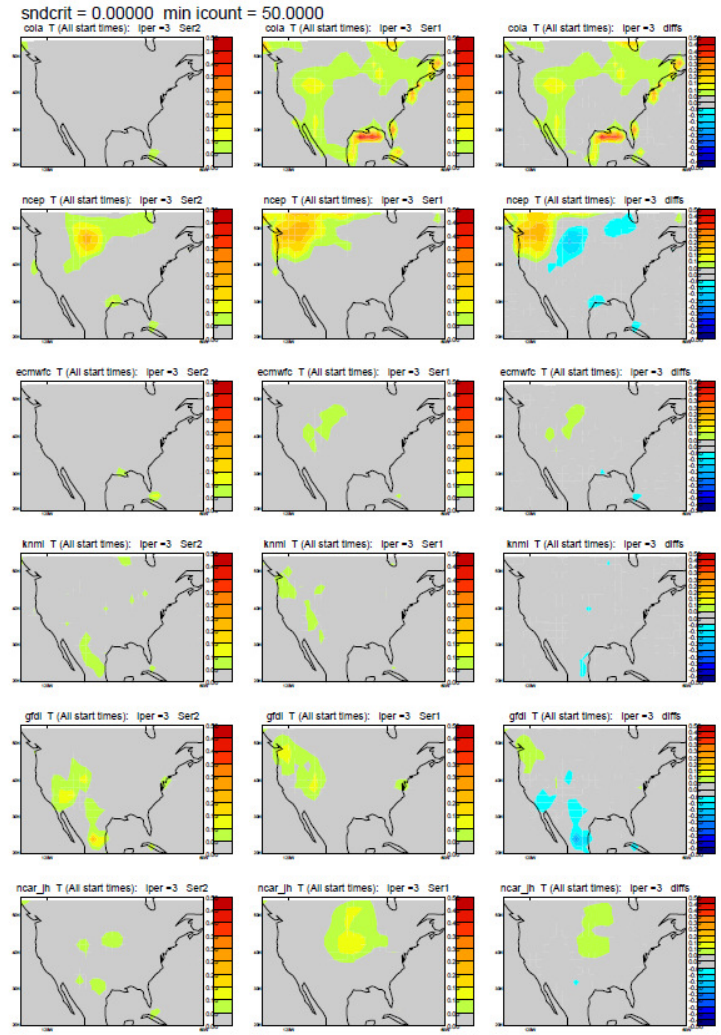
GFDL

NCAR

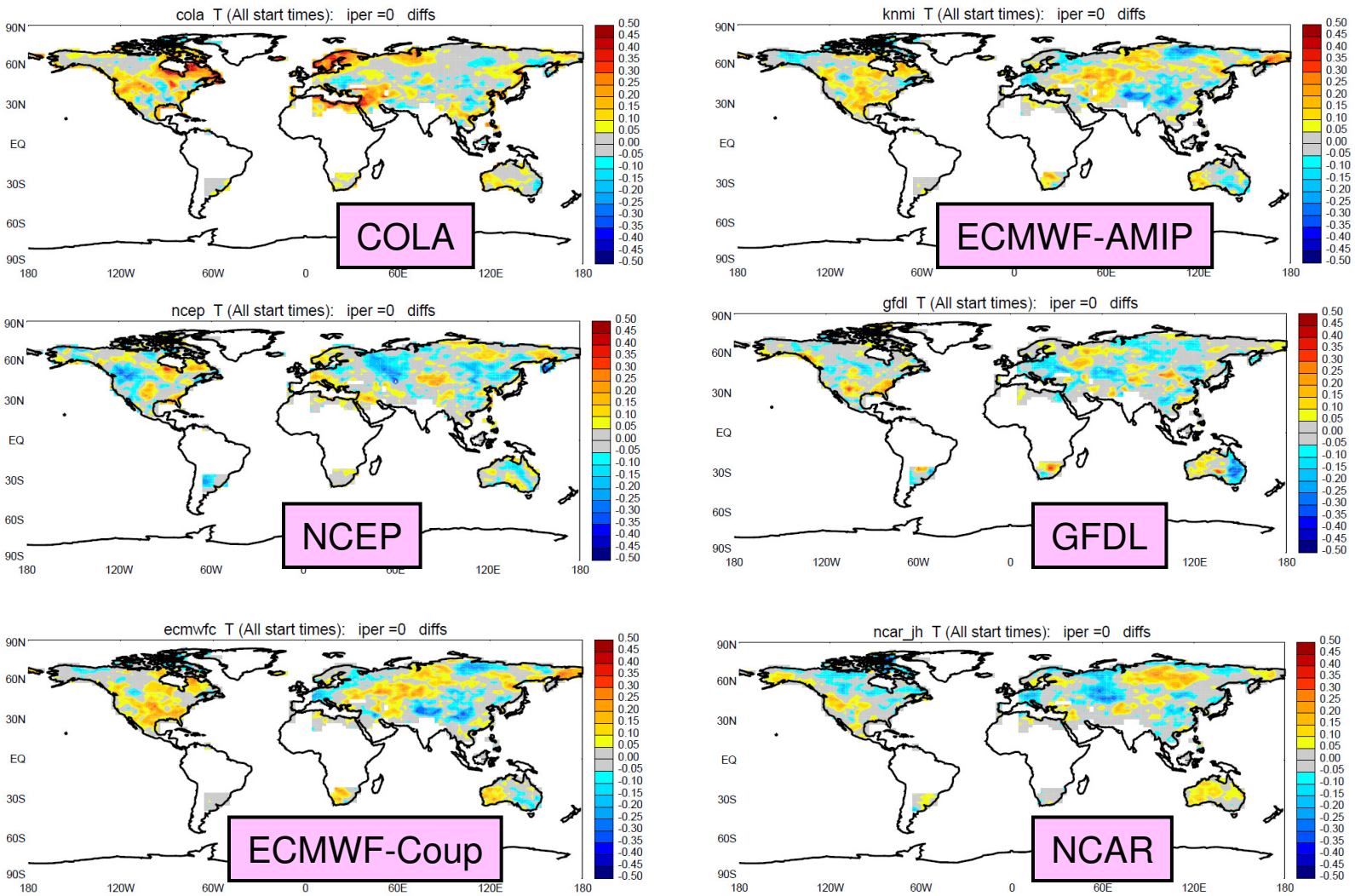


Air Temperature Forecast Skill

Series 2 | Series 1 | Diffs: land impact



Days 1-15 Air temperature forecast skill on the global scale. We're just starting to look at this. One big issue: how good is the forcing data in many of these regions?
→ How good can the model initialization be (let alone the validation)?



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Potential cause for optimism…

What if we compute skill over an objectively-chosen subset of the start dates? Can we identify higher skill *conditioned* on some initialization property?

Examine: forecasts for which the absolute value of the Z-score (standard normal deviate) of the initial soil moisture lies above a certain threshold. Implicit assumption here: effects are local.

We show skill averaged over the models, not the skill of a multi-model forecast. For now, we use a simple averaging, which may be suboptimal.

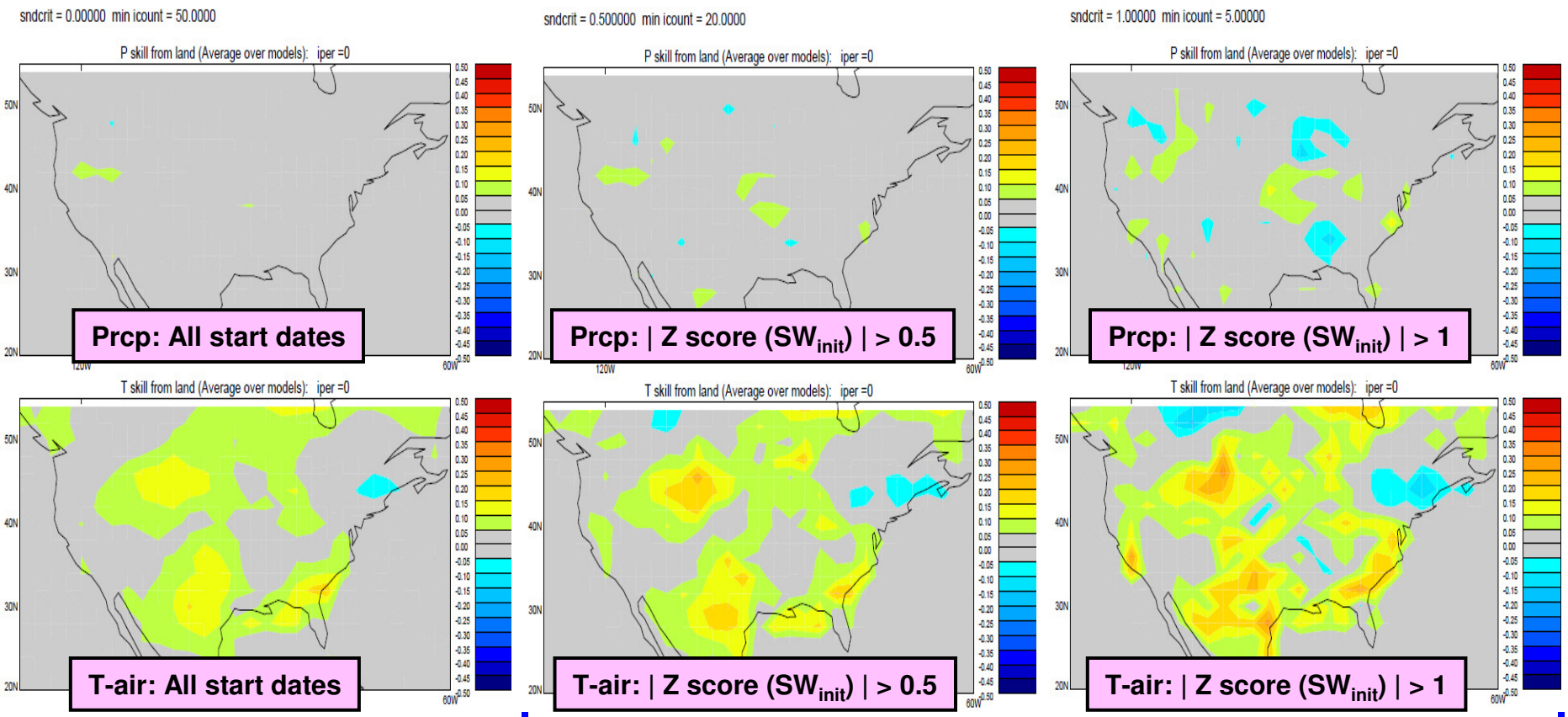
Also, the Z-scores we used for soil moisture were computed from a model with known problems in the early spring. Results may be better once we clean this up…

As they currently stand, the results seem promising, particularly for air temperature forecasts.

Impact of land initialization on forecast skill: mean over 6 models

(Skill from Series 1 minus Skill from Series 2)

Days 1-15

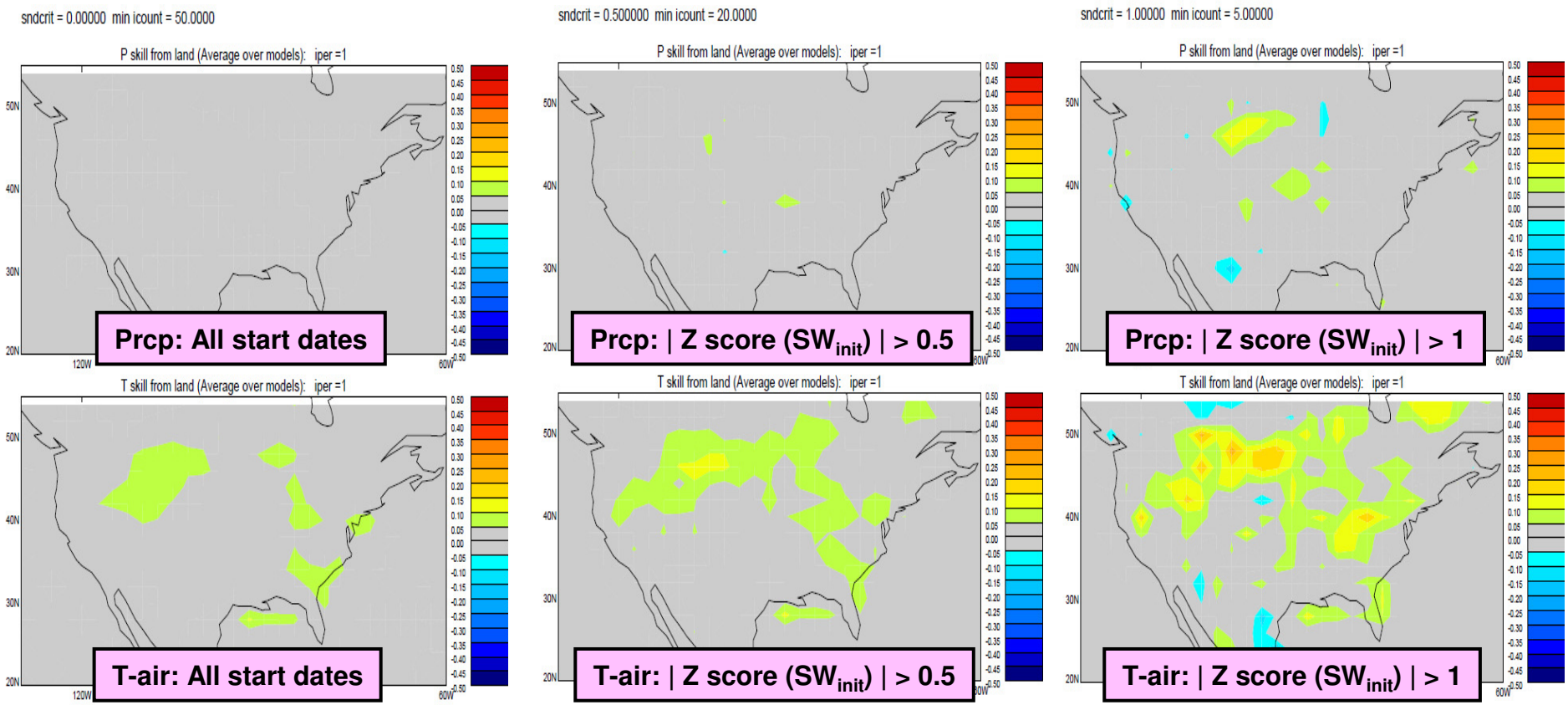


Skill increases conditioned on “extreme” soil moisture initial conditions

Impact of land initialization on forecast skill: mean over 6 models

(Skill from Series 1 minus Skill from Series 2)

Days 16-30

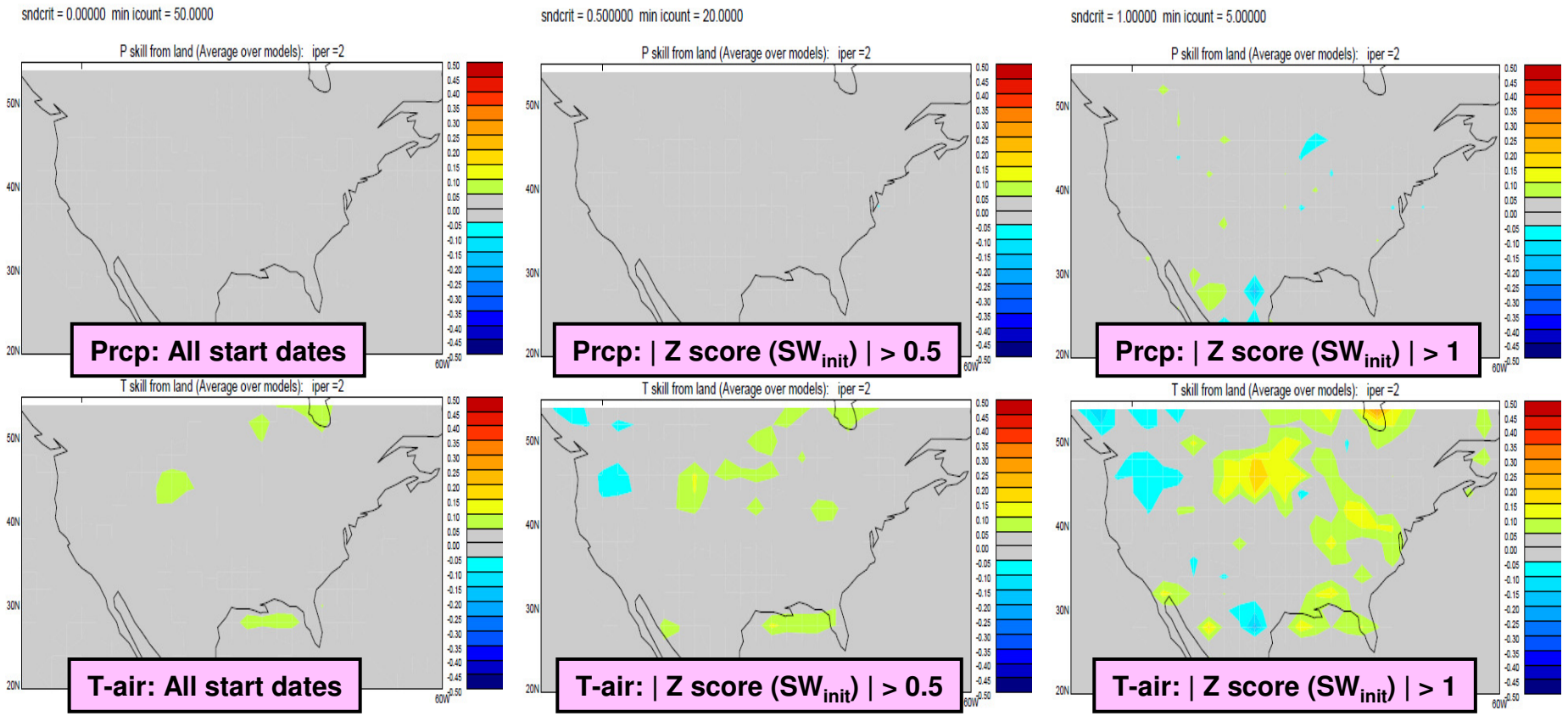


Skill increases conditioned on “extreme” soil moisture initial conditions

Impact of land initialization on forecast skill: mean over 6 models

(Skill from Series 1 minus Skill from Series 2)

Days 31-45

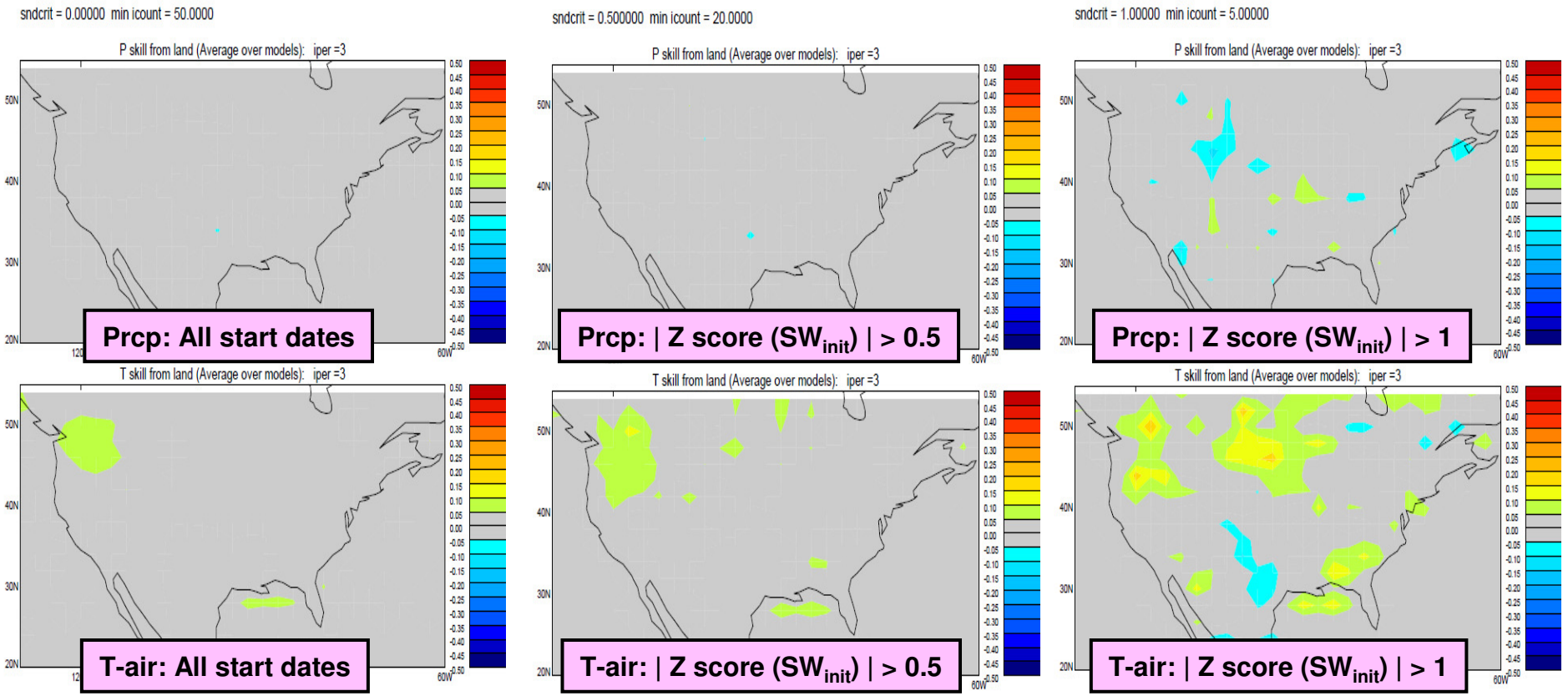


Skill increases conditioned on “extreme” soil moisture initial conditions

Impact of land initialization on forecast skill: mean over 6 models

(Skill from Series 1 minus Skill from Series 2)

Days 46-60



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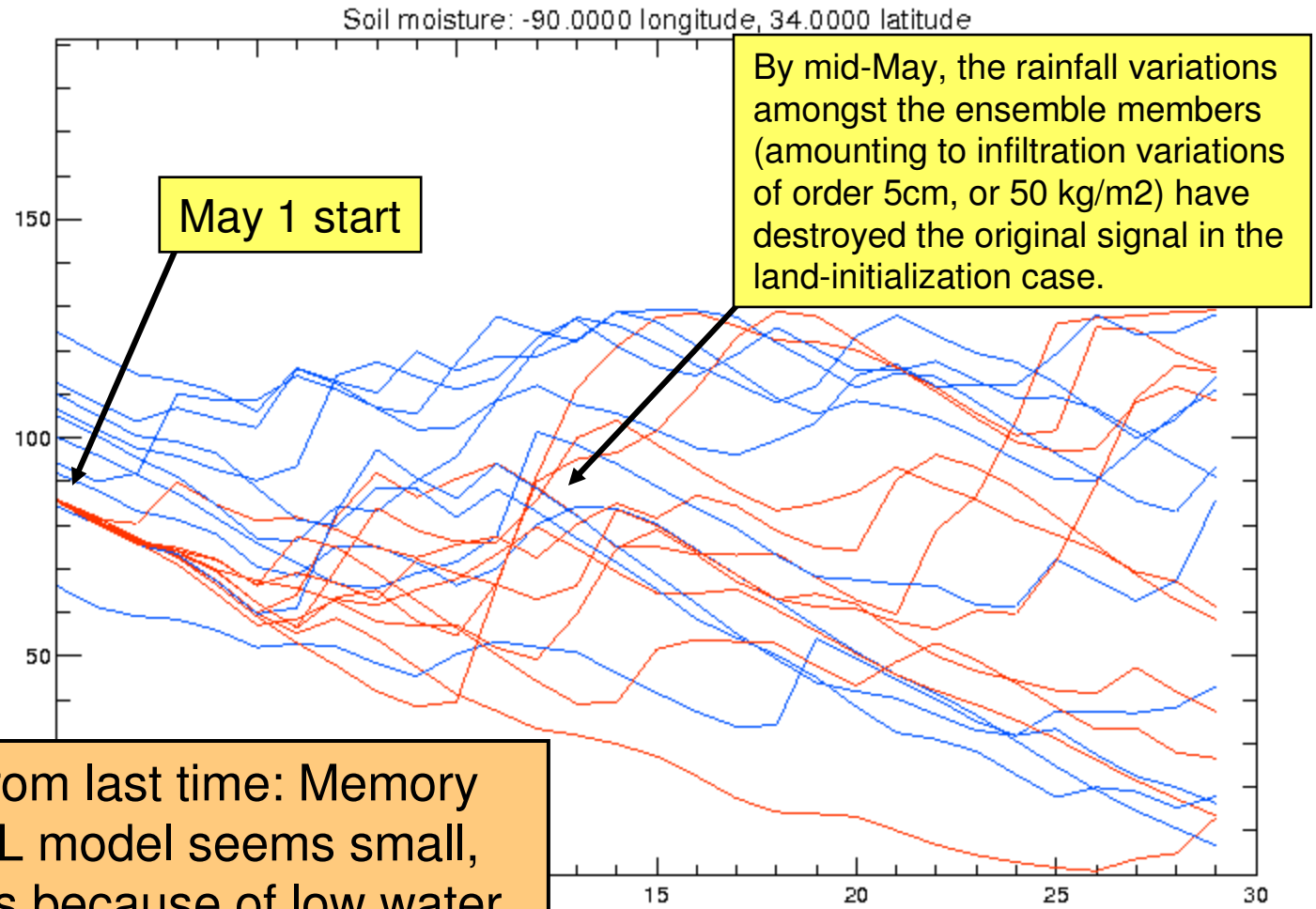
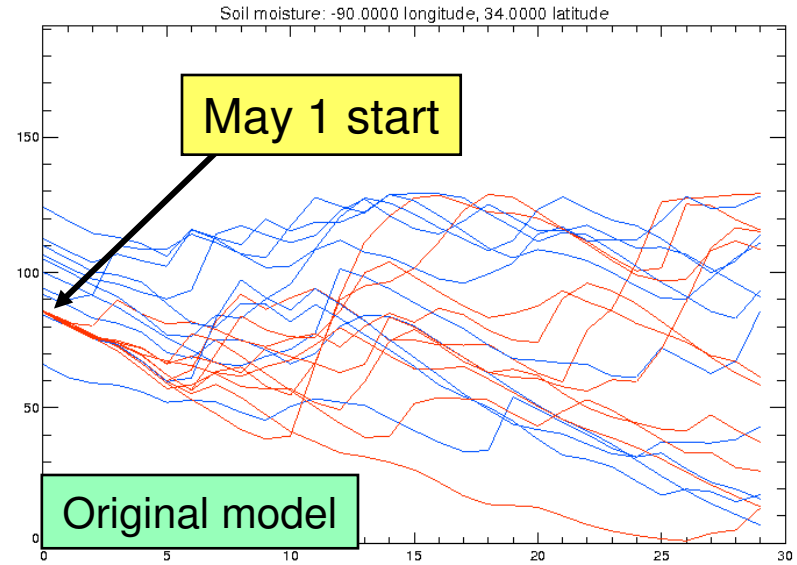
GFDL: Red: Land moisture initialized to realistic (scaled) value (series 1)
Blue: Initial land moisture taken from PDF (series 2)

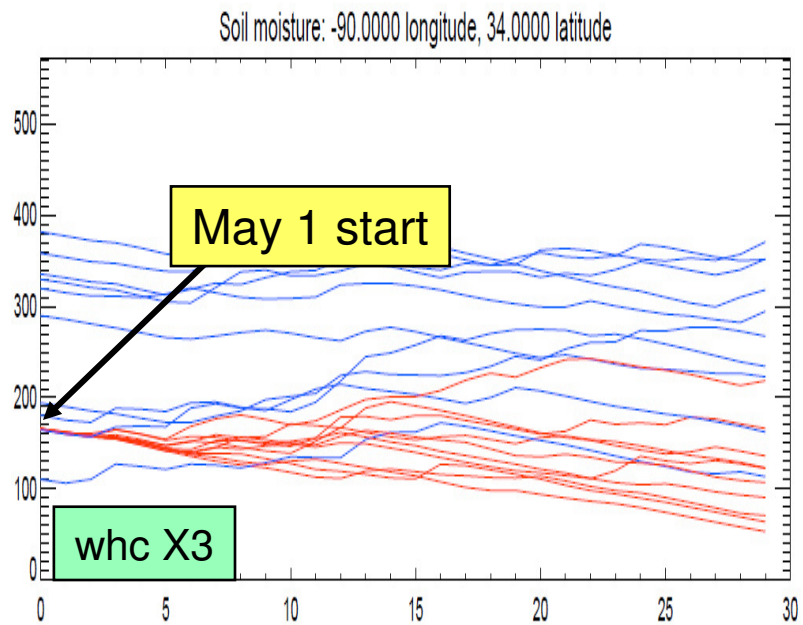


Issue from last time: Memory in GFDL model seems small, perhaps because of low water holding capacity. Could that explain low skill values?

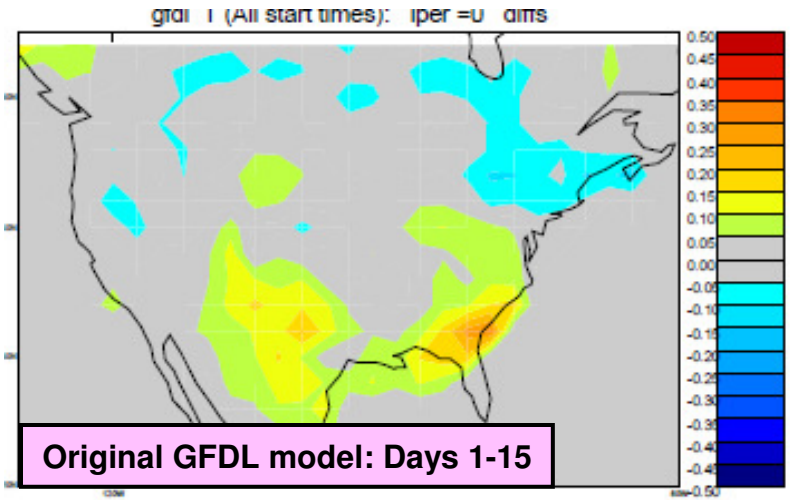
Tony Gordon re-did his runs using a land surface model with increased (x3) water holding capacity. Result: longer memory in the soil.

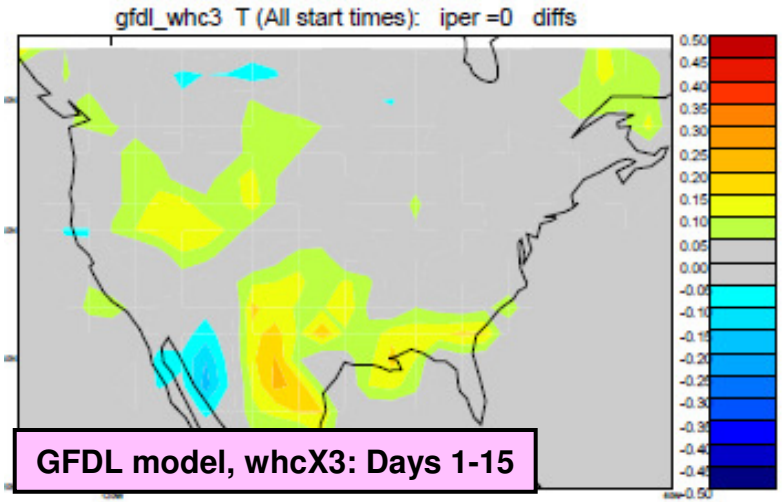
Did this change affect forecast skill?

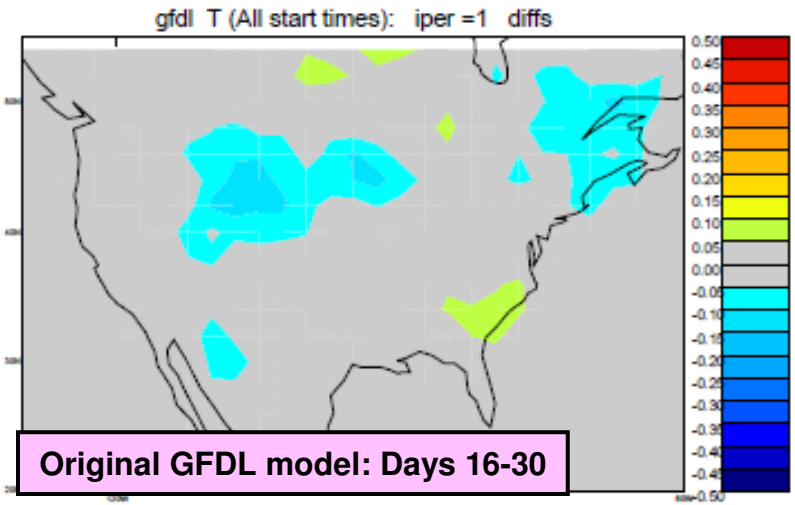


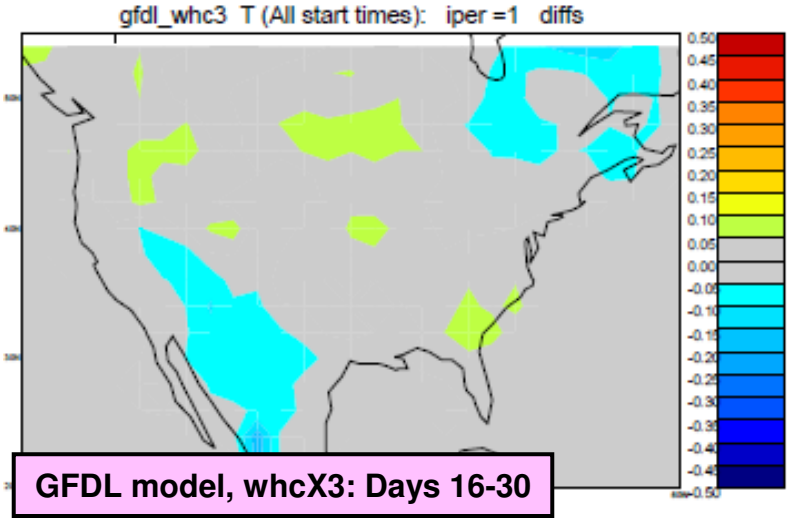


Air Temperature Forecast Skill









Yes, there is some indication of improvement…
(not quantified yet re significance)

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Some additional items:

1) “Transformation” of model forecasts using objective observations-based technique. The transformations have been applied to all models. Upshot: skill does improve, but for both Series 1 and Series 2. The impact on the difference (i.e., on the inferred land impact) is slightly positive but mixed. More later…

2) One idea: Can a (cross-validated) empirical prediction system using initial soil moisture conditions perform as well as the full modeling systems? Worth looking into…

3) COLA group is looking into the value of multi-model forecasts.

The floor is now open for additional discussion!