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GOAPP
Global Ocean-Atmosphere Prediction and Predictability

The role of soil moisture initialization in forecasting drought occurrence

Gordon Drewitt, *Aaron Berg*, *Bill Merryfield*, *Woo-Sung Lee*

DRI
DROUGHT RESEARCH INITIATIVE
RÉSEAU DE RECHERCHE SUR LA SÉCHERESSE

Canadian Foundation for Climate and Atmospheric Sciences (CFCAS)
Fondation canadienne pour les sciences du climat et de l'atmosphère (FCSCA)

GLACE-2

Study Motivation

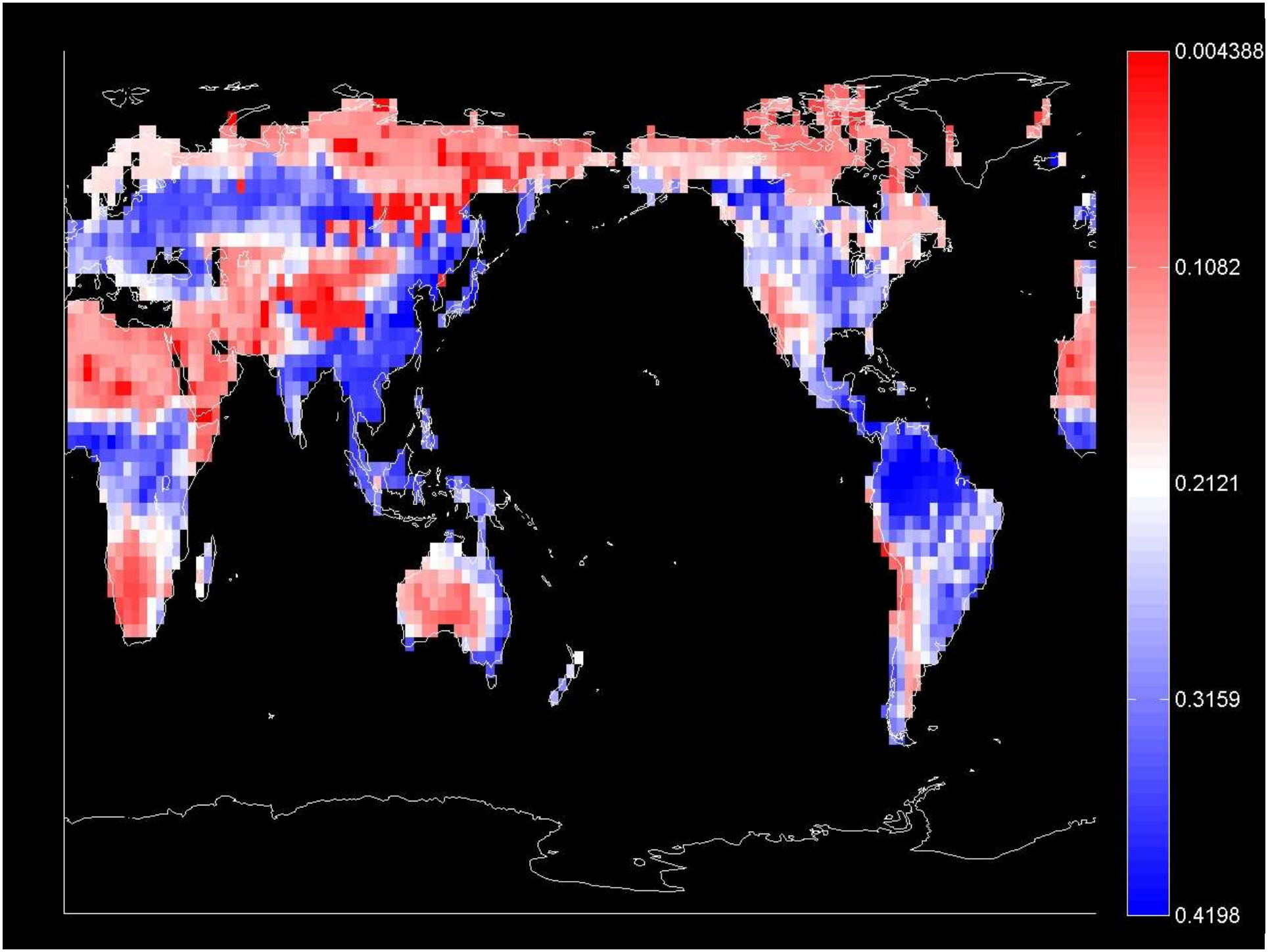
- Forecast model boundary conditions can be difficult to measure (e.g. Soil Moisture).
- SM can have a predictable behaviour weeks or months into the future.
- Realistic model SM initialization could increase forecast skill.

Study Goal

- Examine the role of REALISTIC soil moisture initialization on seasonal forecasts
- Determine cases where such initialization improves forecasts (e.g. droughts)

Step 1: Soil moisture data

- Calculate soil moisture over the globe using bias-corrected forcing data.
- CLASS 3.4, NCEP reanalysis data, various observational datasets.
- 2090 Grid points, 29 years, 30 minute timestep.
- 18 Land surface variables stored.


0.004388
0.1082
0.2121
0.3159
0.4198

Step 2: Forecast Experiment Model

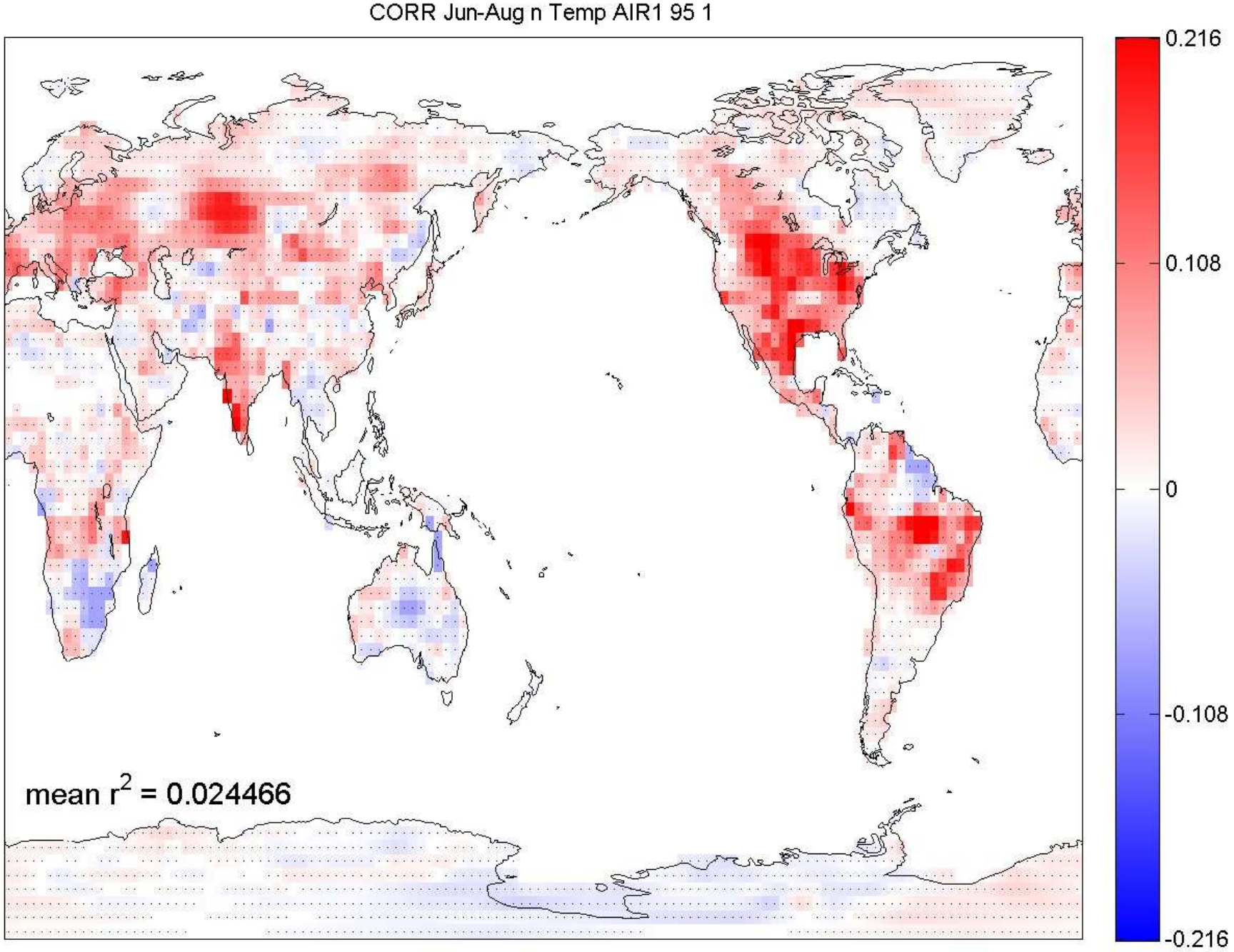
- CCCMA 3rd Coupled Global Climate model
- T63 grid (64 x 128)
- 1986 → 2004 (19 years)
- Boreal summer start dates (April – Aug)
- 60 day forecast length
- 10 ensembles per forecast

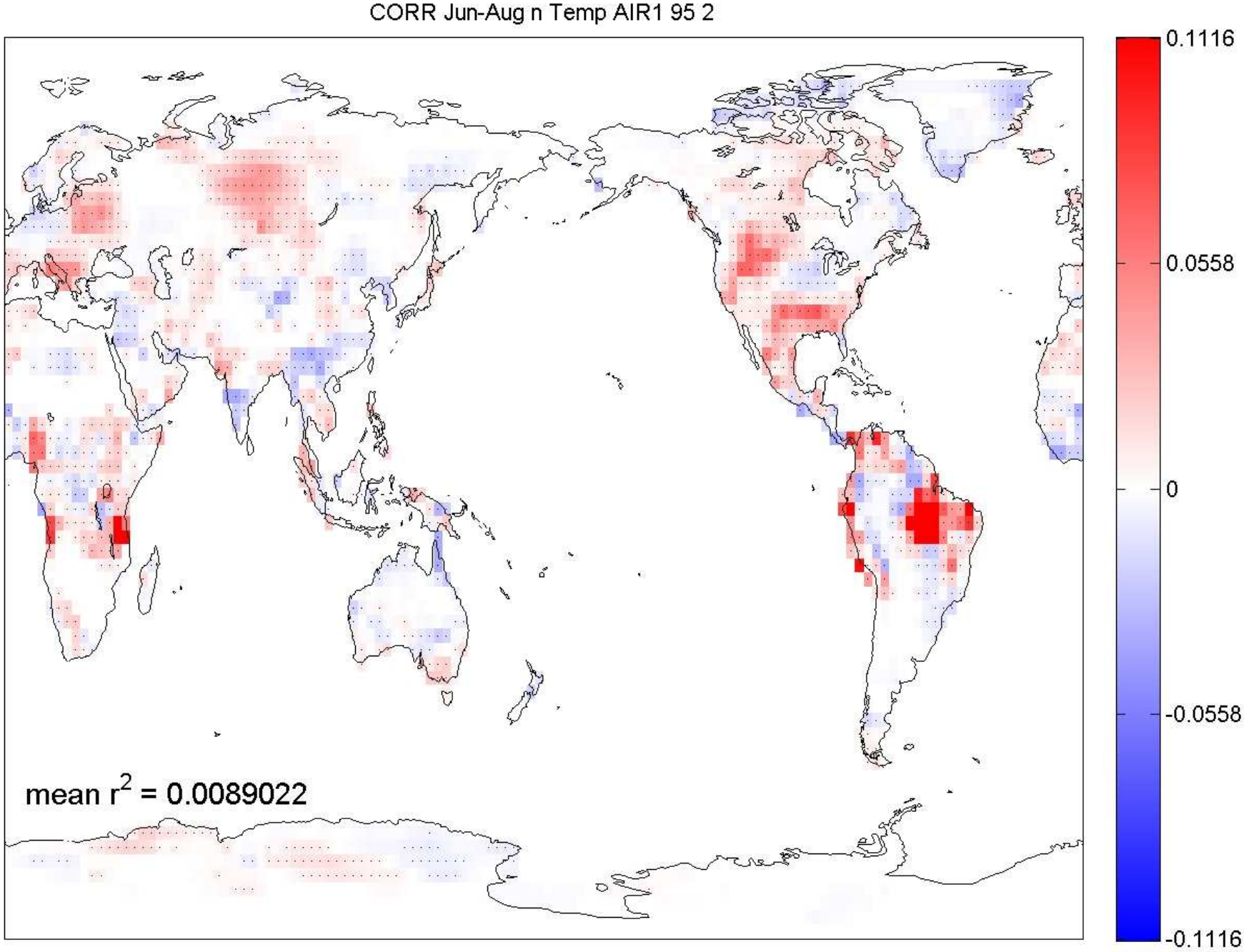
Step 2: Forecast Experiment model

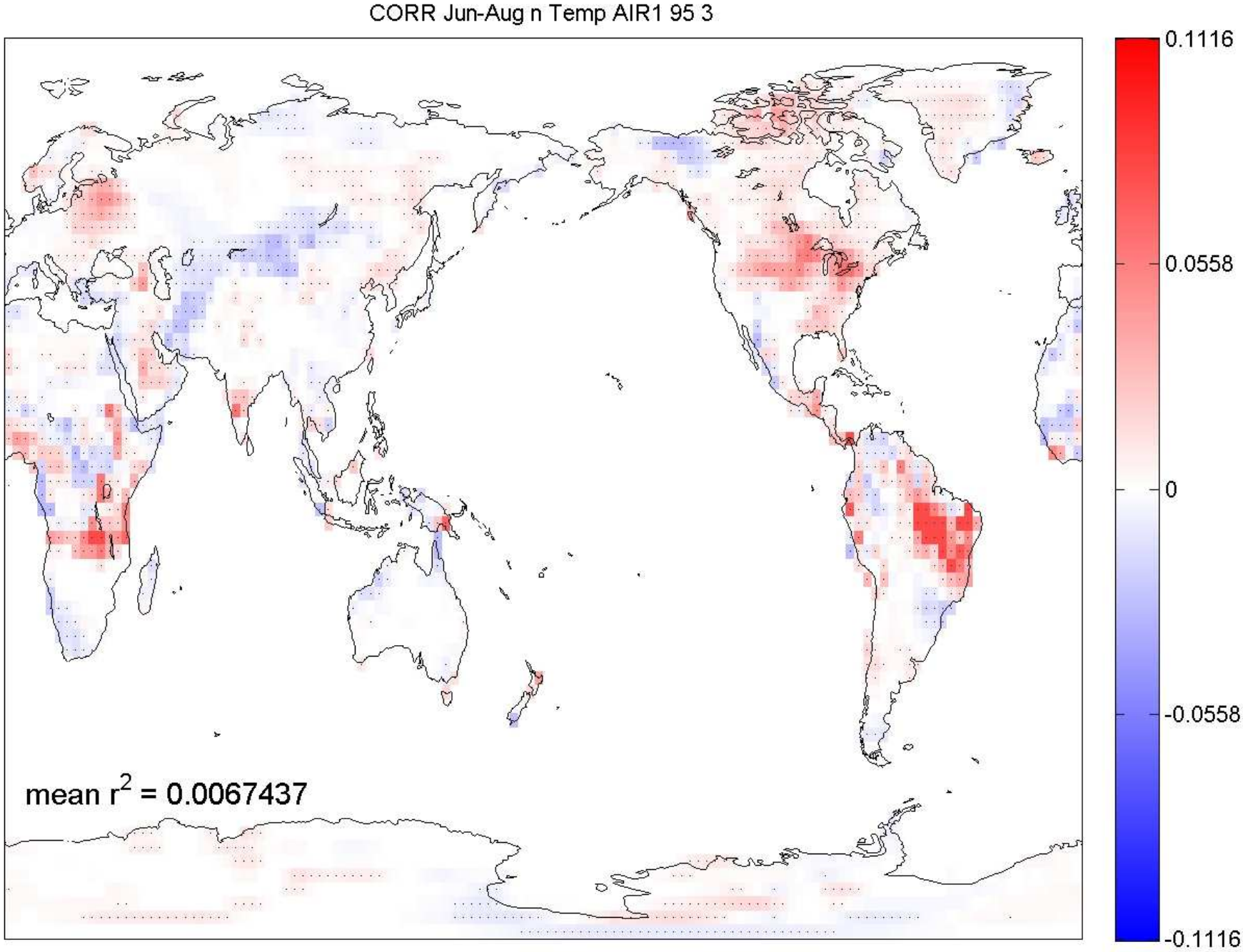
- 1 Run with realistic soil moisture initializations (SERIES 1)
- 1 Run with randomly shuffled soil moisture initializations (SERIES 2)
- Performed as part of the GLACE-2 experiment

Step 3: Forecast Skill Assessment

- Square of the correlation coefficient between 15-day forecast and observations (T derived from NCEP reanalysis)
- Difference in r^2 between series 1 and series 2 (r^2_{diff})
- Significance estimated with a monte-carlo simulation


CORR Jun-Aug n Temp AIR1 95 1
mean r2 = 0.024466
0.216
0.108
0
-0.108
-0.216


CORR Jun-Aug n Temp AIR1 95 2
mean r2 = 0.0089022
0.1116
0.0558
0
-0.0558
-0.1116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0.0558
0
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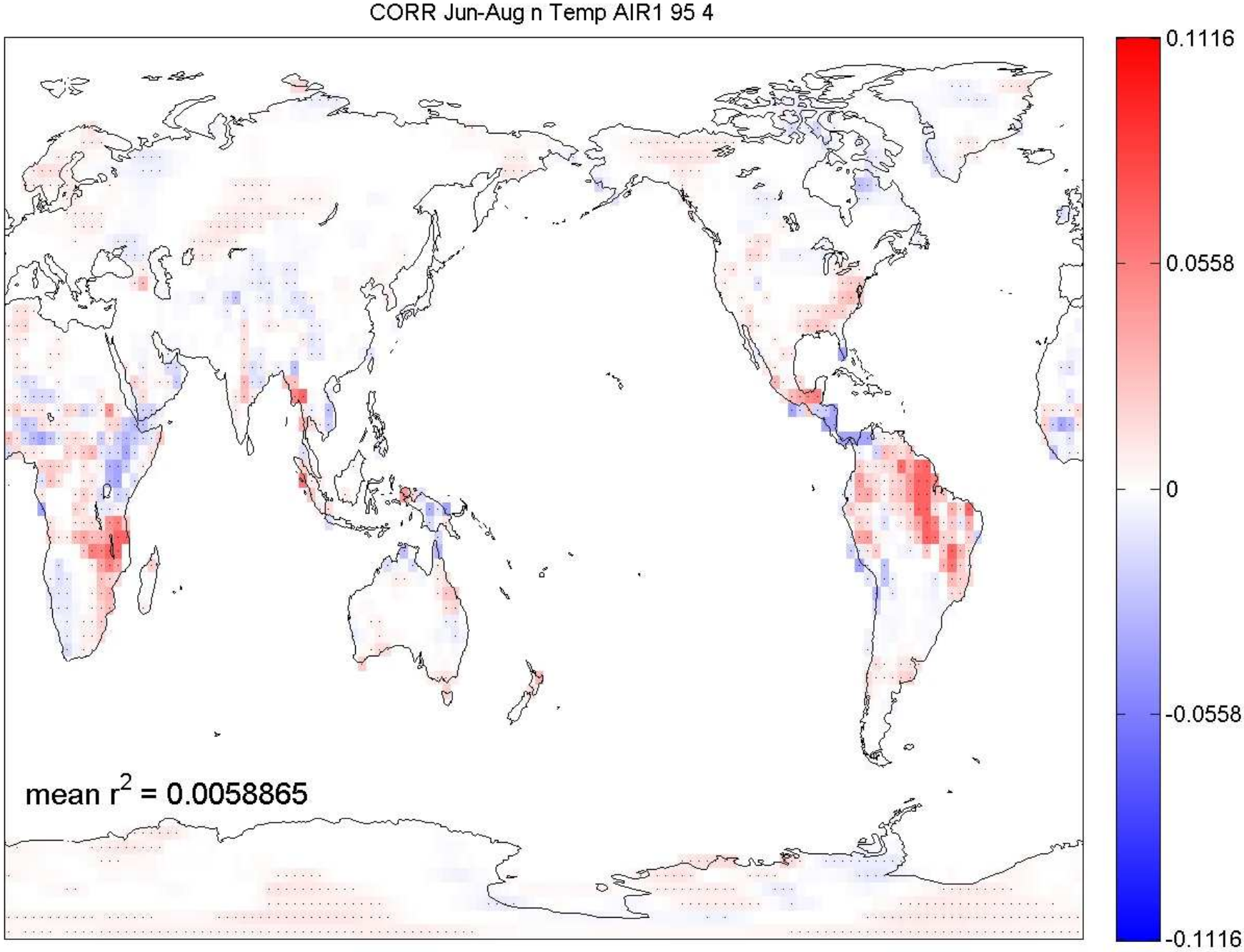
-0.1116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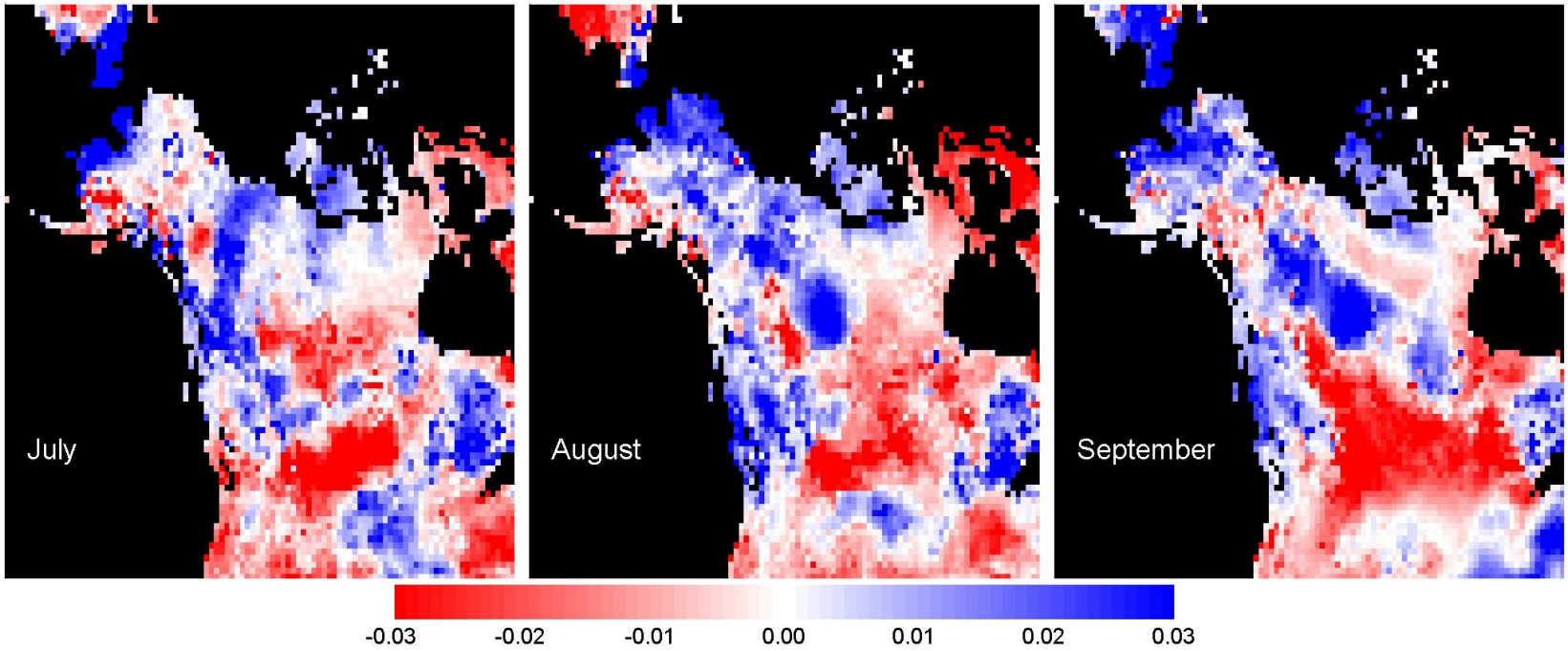
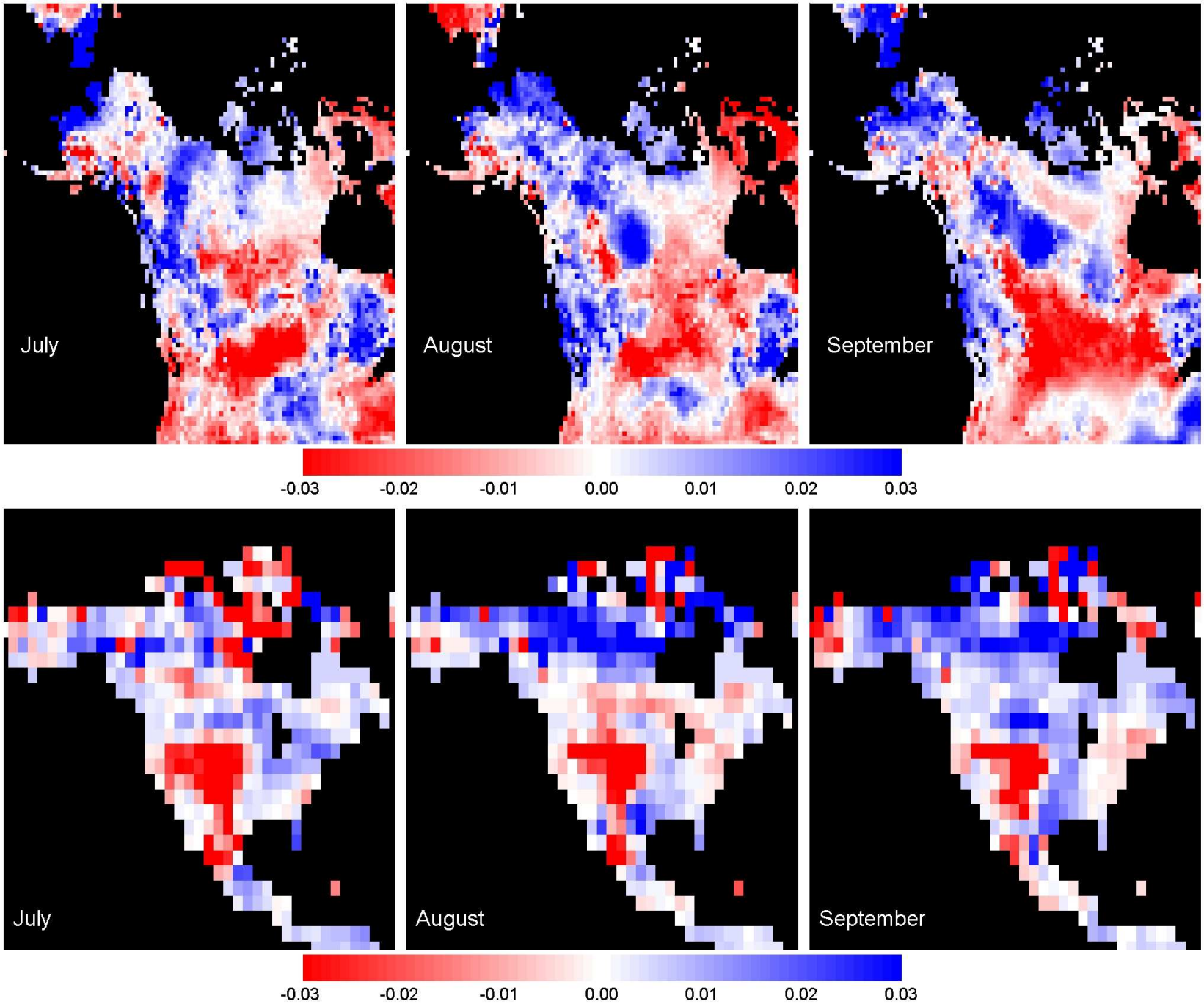
0.1116
0.0558
0
-0.0558
-0.1116


July
August
September
-0.03
-0.02
-0.01
0.00
0.01
0.02
0.03


July
August
September
-0.03
-0.02
-0.01
0.00
0.01
0.02
0.03
July
August
September
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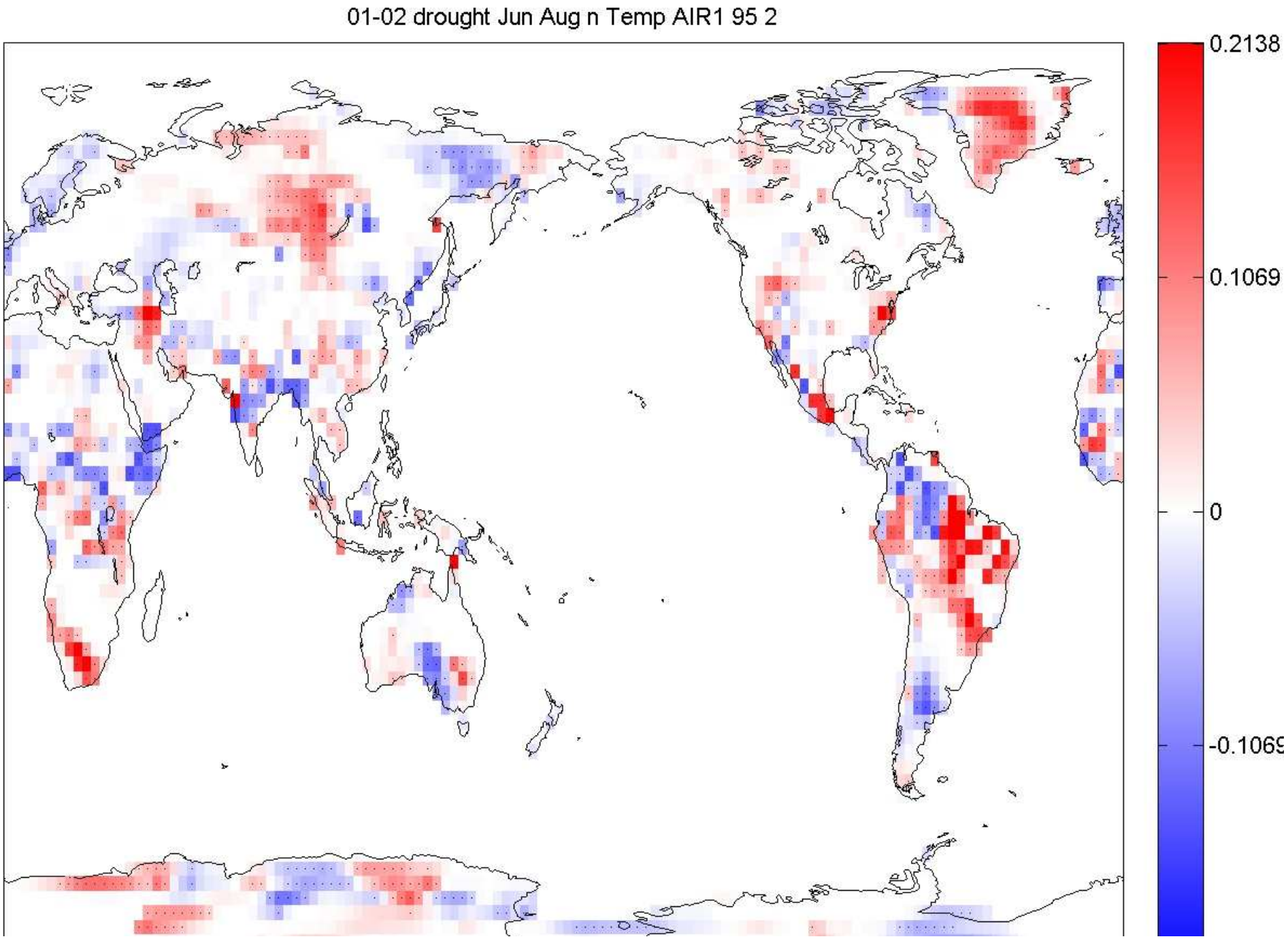
-0.02
-0.01
0.00
0.01
0.02
0.03


01-02 drought Jun Aug n Temp AIR1 95 2
0.2138
0.1069
0
-0.1069

Step 4: Research directions

- Soil moisture / forecast skill for extreme percentiles of dry/wet conditions
- Examine periods of particular forecast skill in regions to see what contributed to that success
- Examine variability of soil moisture in particular areas (e.g. Canadian Prairies)

The end

Thank you

Questions?