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Evaluation of extreme subdaily precipitation in high-resolution global climate model simulations

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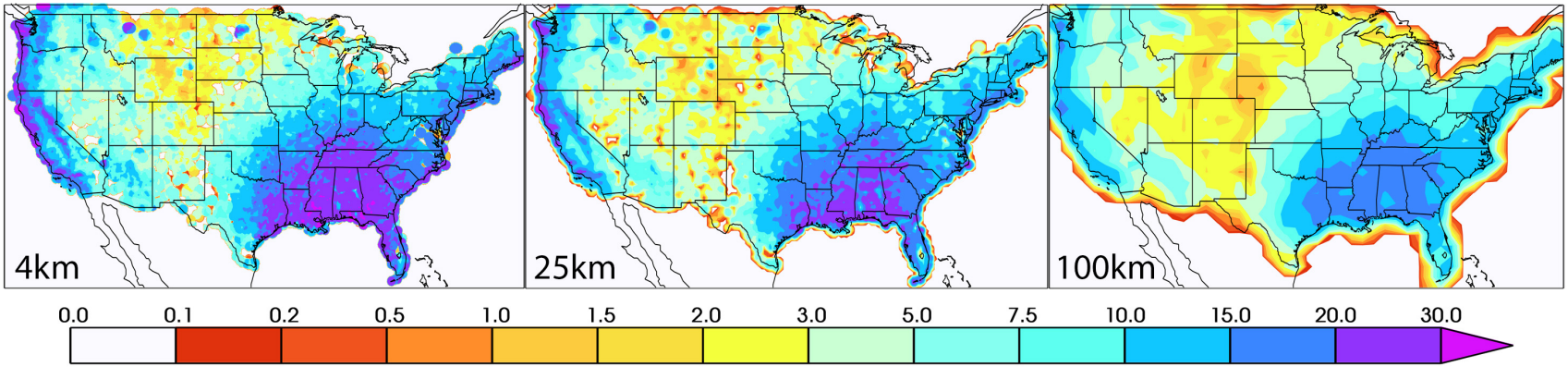
Motivation

- Extreme precipitation from a perfect model ***must*** be lower than is observed.
  - We can construct the resolution constrained standard.
- There is no improvement in extreme precipitation or temperature from CMIP5 to CMIP6.
  - CMIP5/6 ensembles are interchangeable in both skill and projections.
  - Against a scale dependent standard, there is no improvement in extreme precipitation skill from CMIP6 to HighResMIP.
    - Extreme precipitation is indeed higher, but percent errors are the same.



Wehner et al. (2020) Evaluation of extreme subdaily precipitation in high-resolution global climate model simulations. Submitted to *Phil. Trans. Royal Society*.
Wehner et al. (2020) Characterization of long period return values of extreme daily temperature and precipitation in the CMIP6 models: Part 1, model evaluation. *Weather and Climate Extremes* 30, 100283
Wehner (2020) Characterization of long period return values of extreme daily temperature and precipitation in the CMIP6 models: Part 2, projections of future change. *Weather and Climate Extremes* 30, 100284

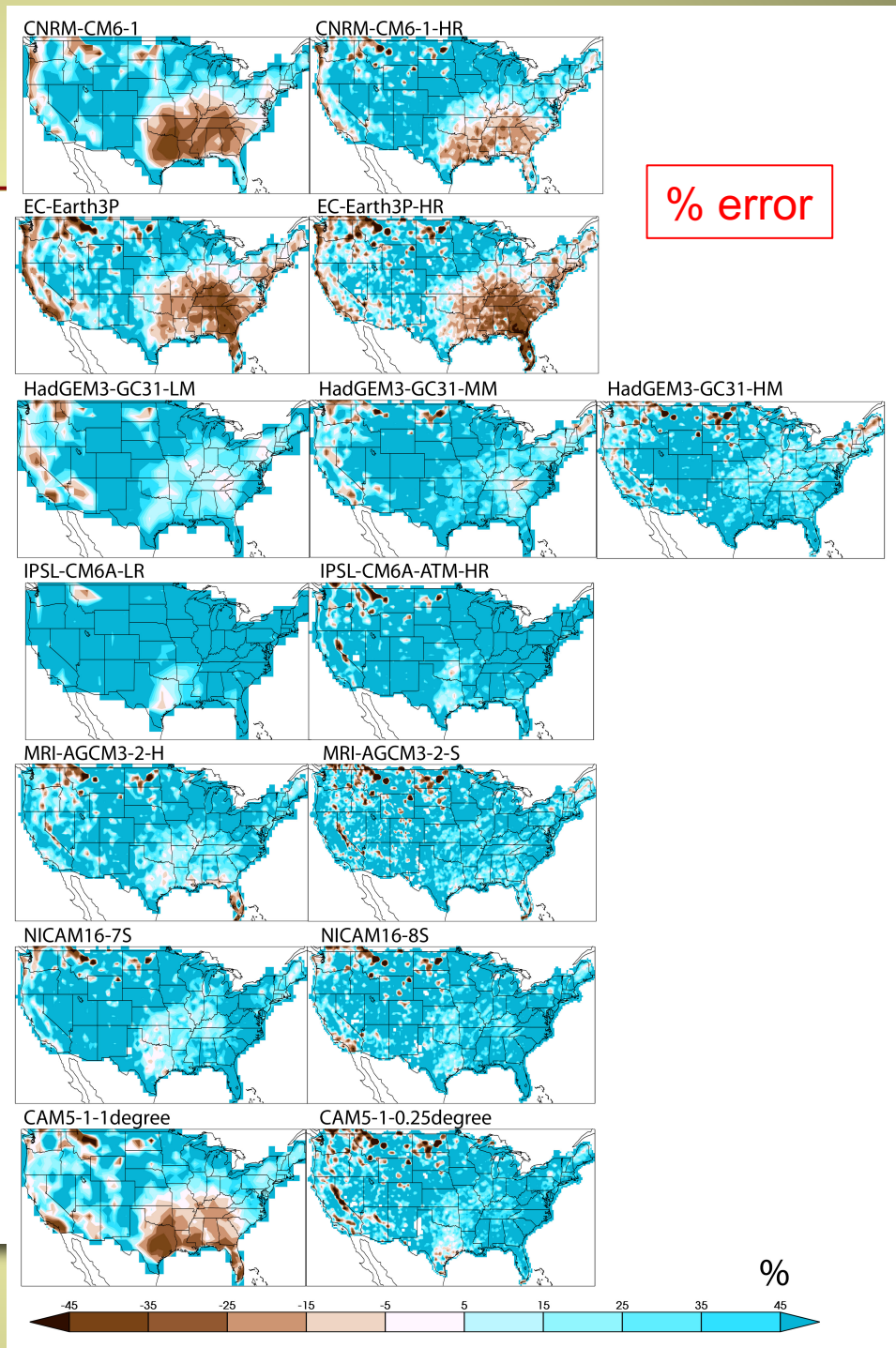
DJF model bias annual max 3hr pr

- Higher-resolution → more extreme pr

- When using the proper metric, model performance does not change much as resolution is increased.
  - This indicates that extreme storm processes in DJF (JJA) are not improved.

- Error pattern correlation with obs
  - 0.6 < DJF < 0.8
  - 0.5 < JJA < 0.6

- Q. Are the models fit for purpose?
- A. Maybe for pattern, not for magnitude.



White paper content

1. Extreme precipitation model performance metrics must be resolution dependent.
    1. We need to expand our diagnostics beyond bias maps, Taylor diagrams and Gleckler diagrams to better understand extreme precipitation performance.
2. Why don't the HighResMIP models show improved process representation of winter and summer storms?
    1. We know that they better represent tropical cyclones processes (SON).
    2. Is parameterized convection to blame?
    3. Do we need resolutions higher than 25km to adequately represent the strong gradients in temperature and moisture of extreme winter/summer storms?
3. We should develop resolution dependent scaling factors to apply simulated extreme precipitation to impact studies.
    1. Important for event attribution studies.
    2. Important for flood analyses (ICoM).
    3. Perhaps statistical downscaling can be of help.