Using the resolution dependence of modeled extreme event fidelity to drive model development

Model evaluation within the CASCADE SFA

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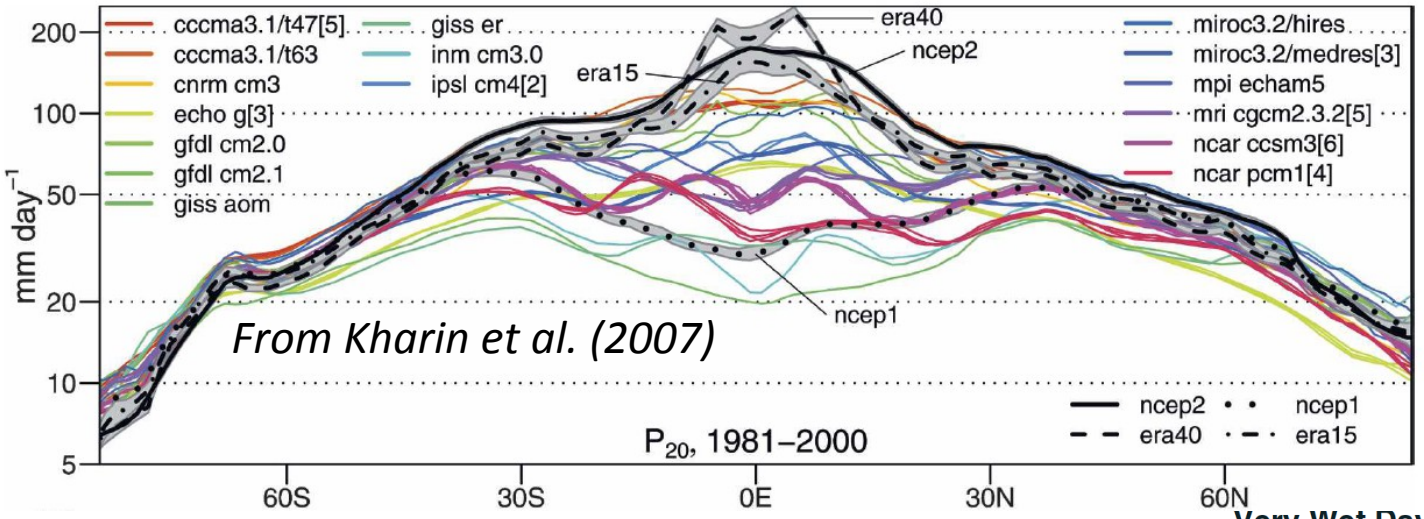
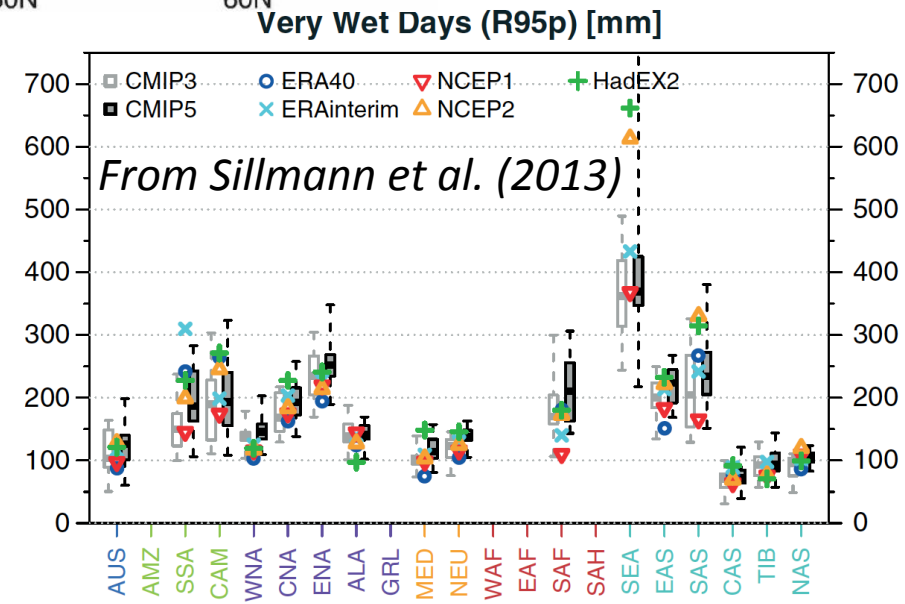
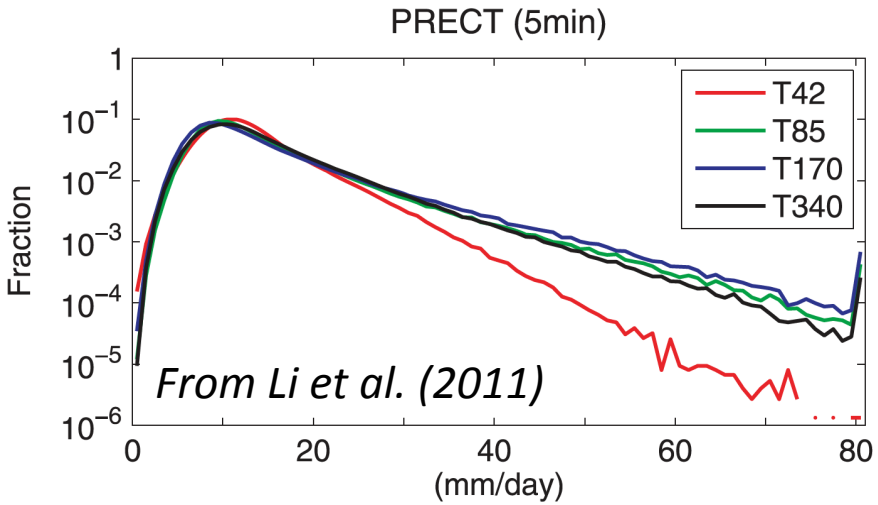
Current models have difficulty with extremes



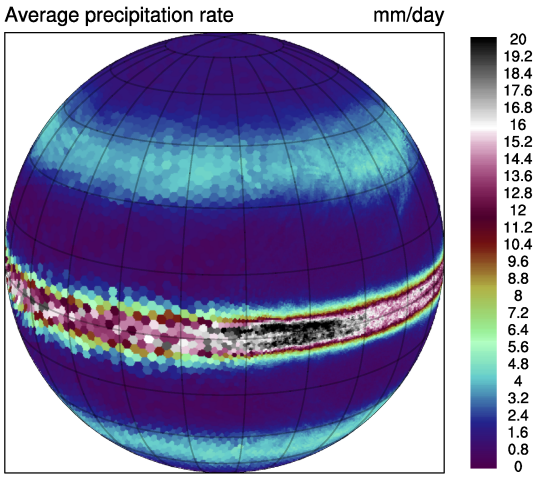


Little agreement on what constitutes *extreme* precipitation among CMIP3 (top) and CMIP5 (bottom) models.

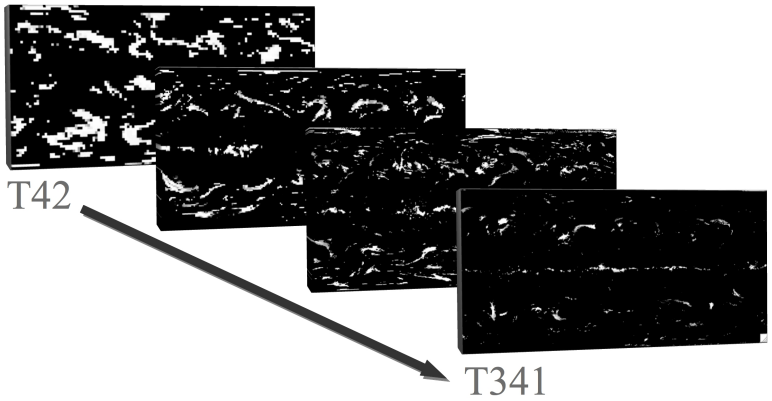
Resolution dependence is especially troubling



Extreme precipitation



Mean precip. in variable resolution



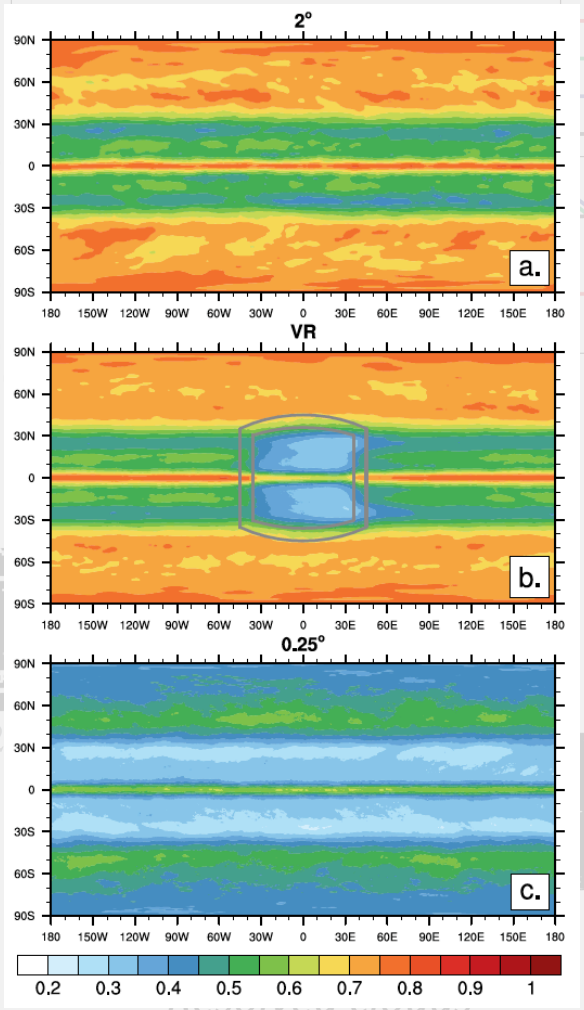
Resolved clouds

Clouds, mean precipitation, and extreme precipitation depend on resolution in CAM

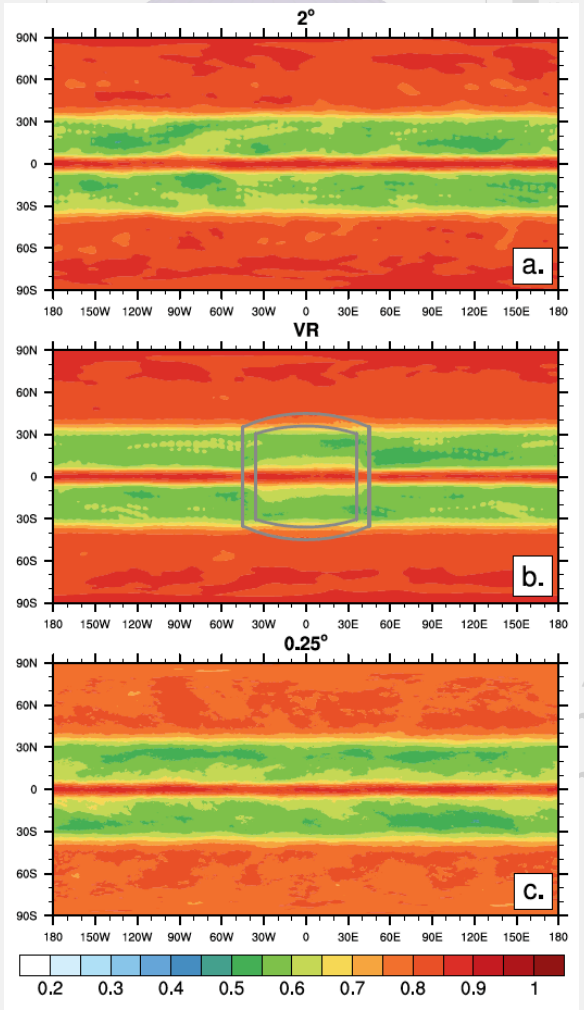
Recent developments have shown improvements

Reduced resolution dependence of cloud fraction

CAM4



CAM5



A systematic framework to evaluate resolution dependence

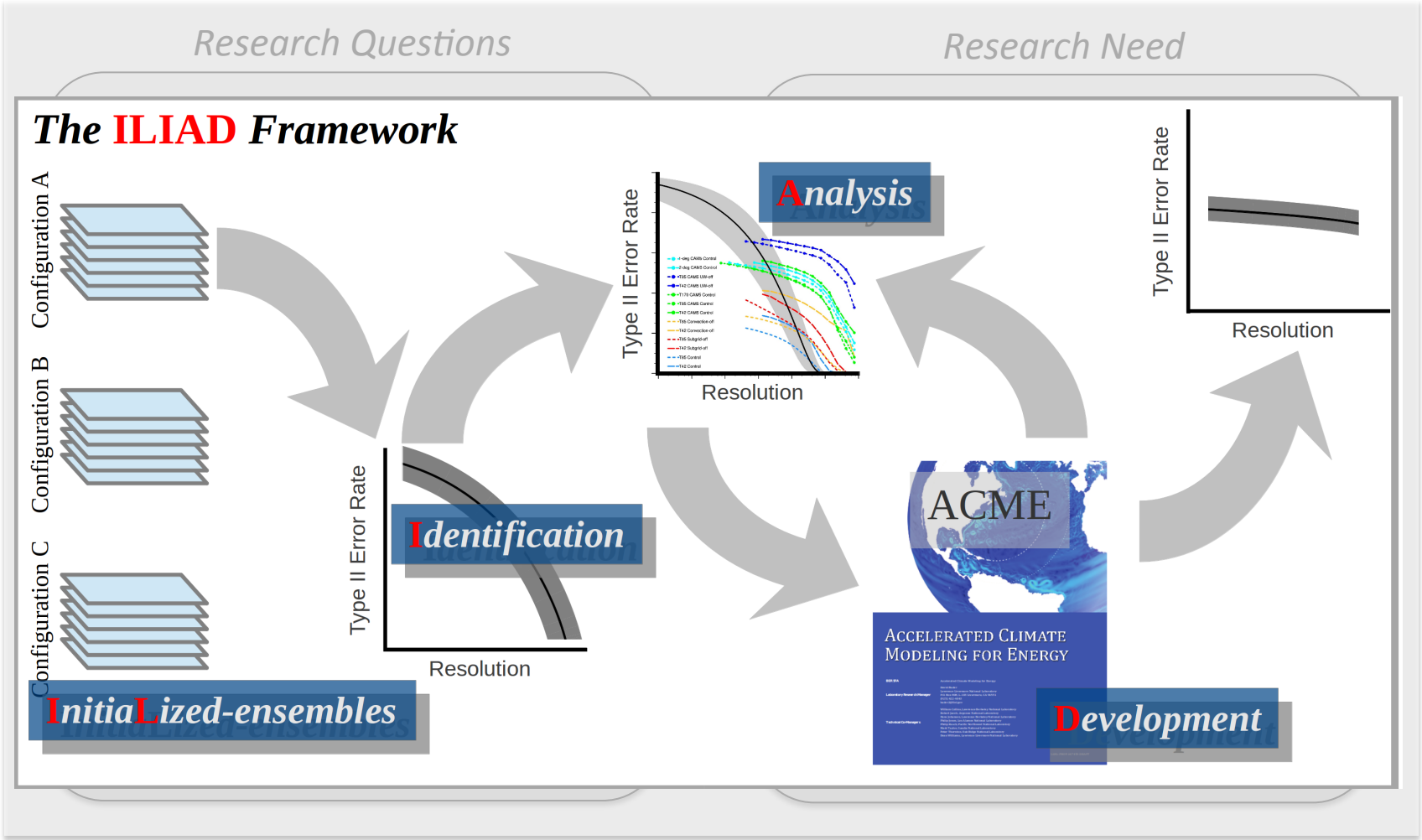
Research Questions

- How well does ACME reproduce extreme events?
- How does this fidelity change with resolution?
- How can we improve the fidelity and its resolution dependence?

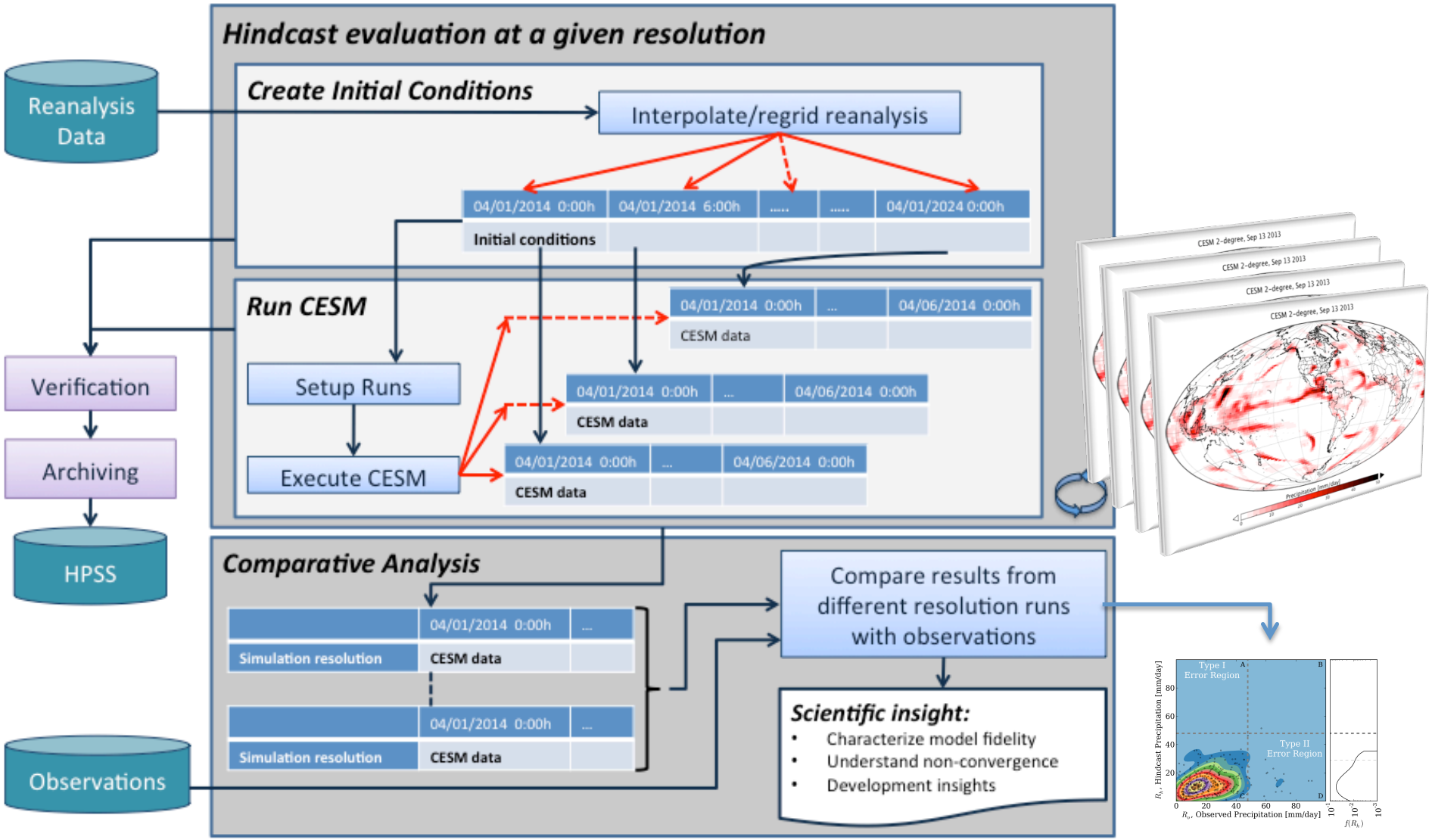
Research Need

- An experimental design to reproduce observed weather events
- A framework for analyzing resolution dependence
- A testbed for evaluating hypotheses about causes of resolution dependence

The ILIAD Framework



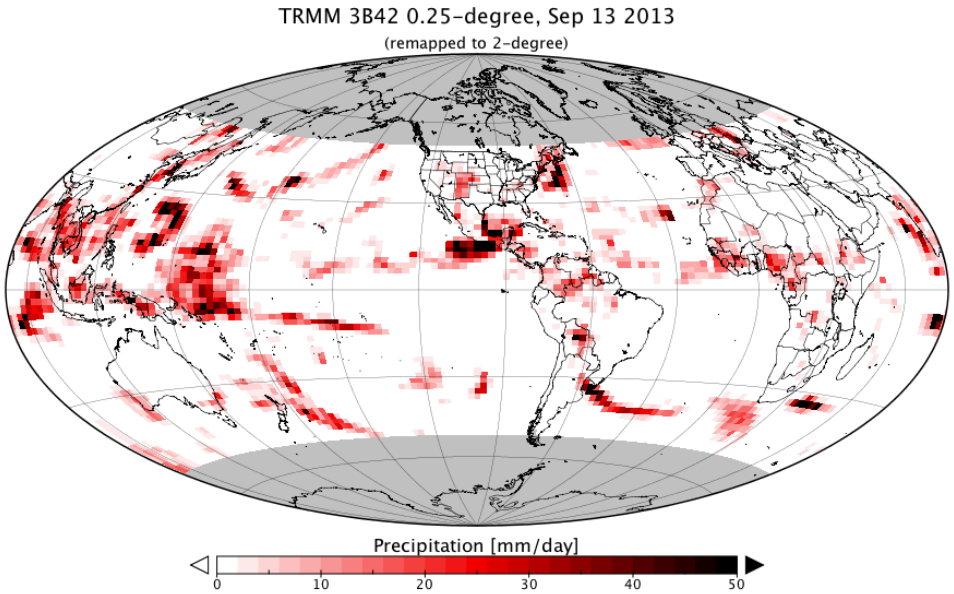
A workflow view of the ILIAD system

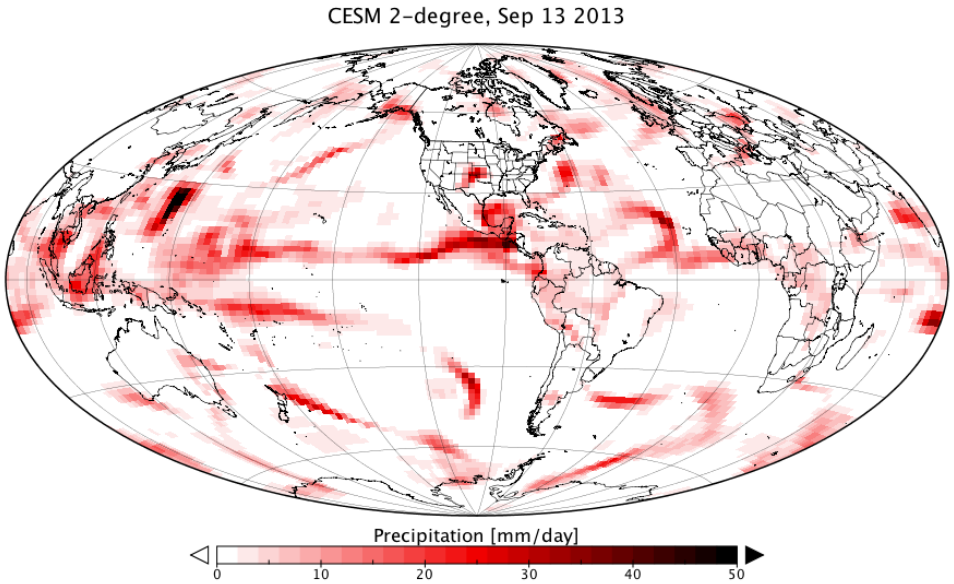


A hindcast snapshot from ILIAD: the Boulder Flood

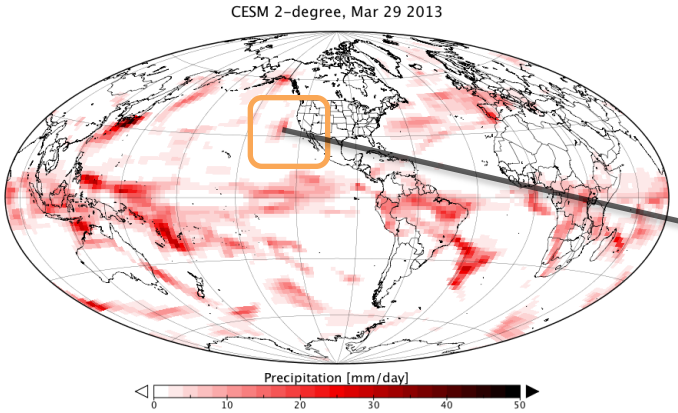
Observed

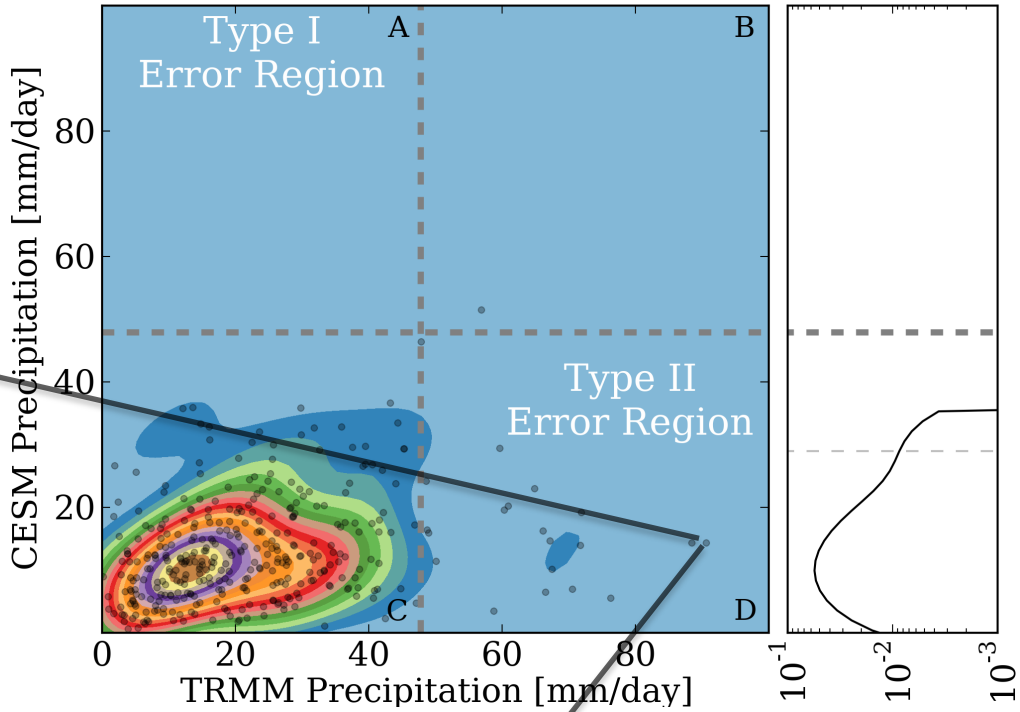
Hindcast (day 5)





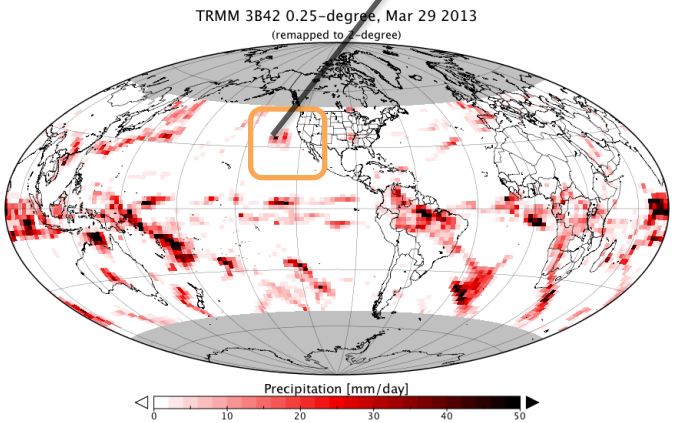
Statistics of precipitation in western North America





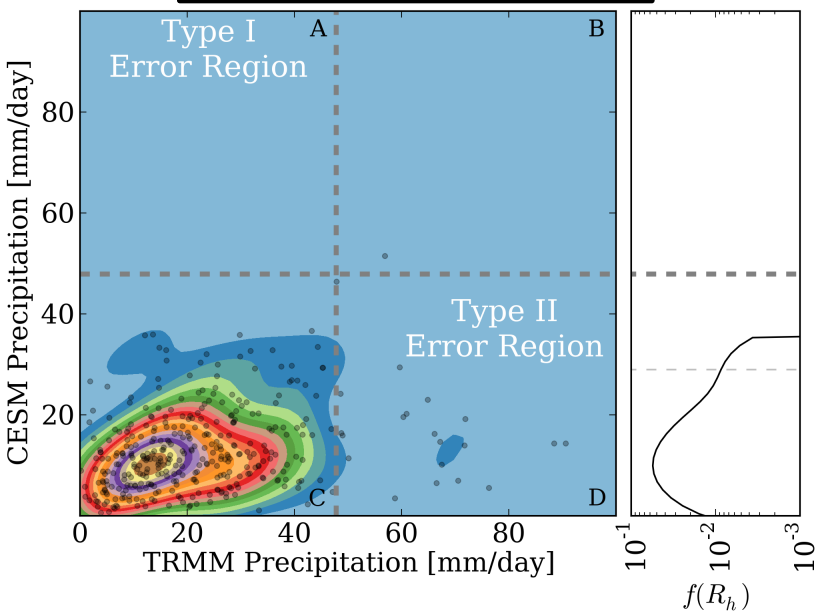
A kernel density estimation of the joint PDF of daily precipitation near western North America (following *Weller et al., 2012*).

Joint PDF estimated using method of *O'Brien et al. (2014; in review)*

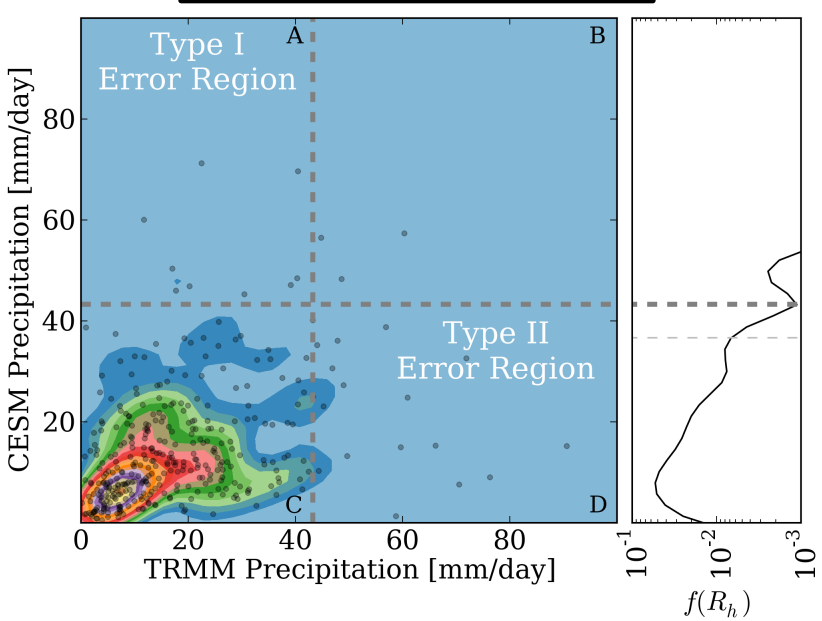


Resolution-dependent Type I Errors

2-degree resolution



1-degree resolution



Summary

- Developed framework for evaluating extreme event fidelity
  - A combination of Robust Regional Modeling Project and CAPT experimental designs
  - Uses hindcasts to examine model error rates as a function of resolution
- Have completed 1-degree and 2-degree hindcast ensembles for 2013
- Comparisons w/ TRMM suggests that Type I errors increase w/ resolution

Thank you!

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