

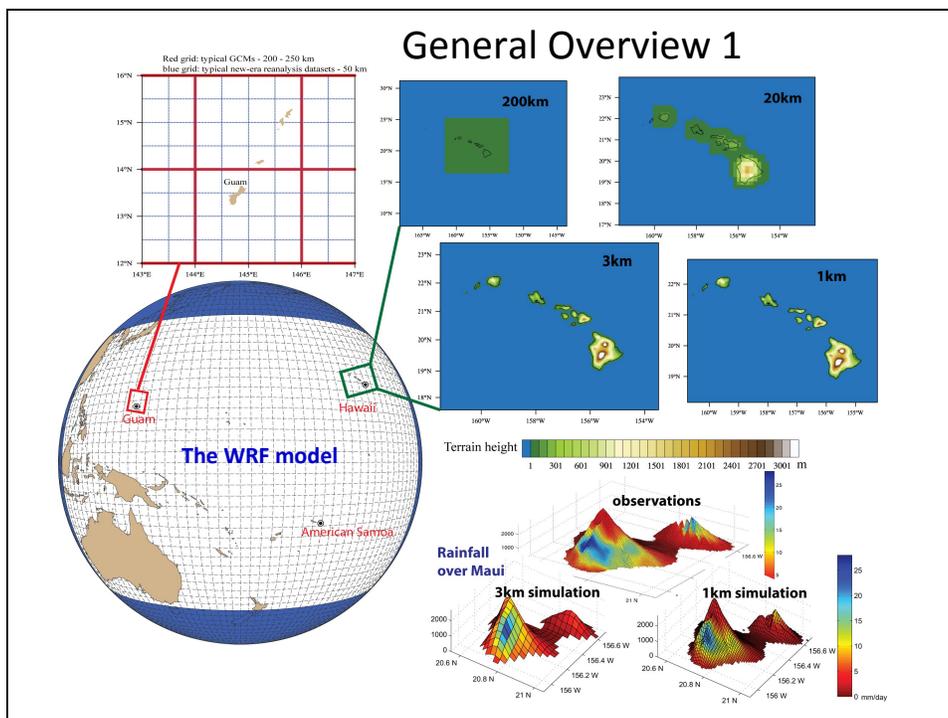
PICSC Downscaling Workshop

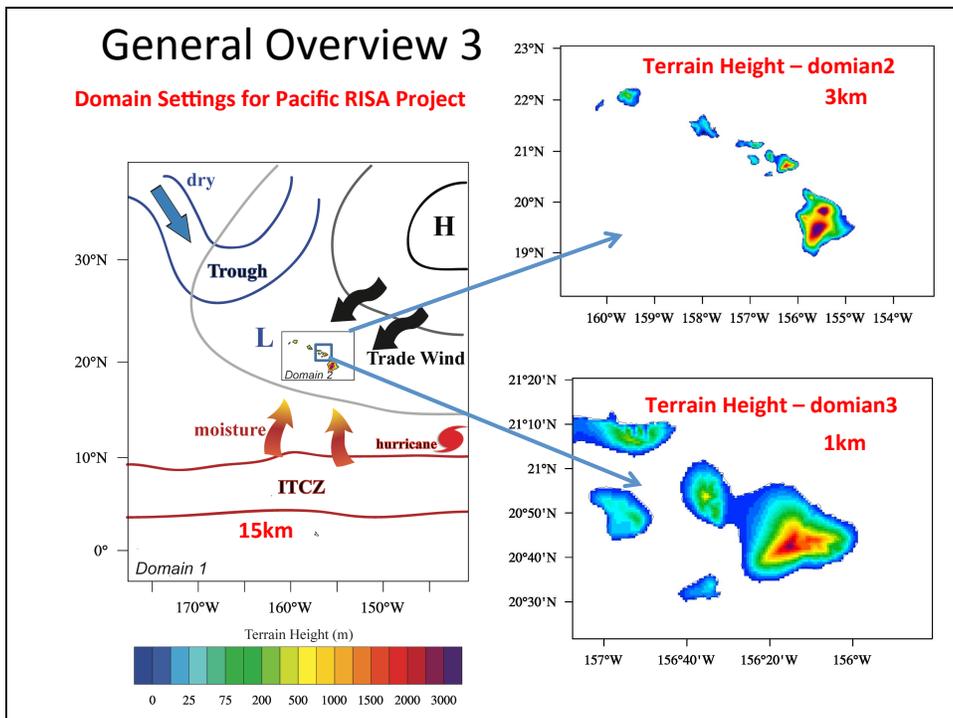
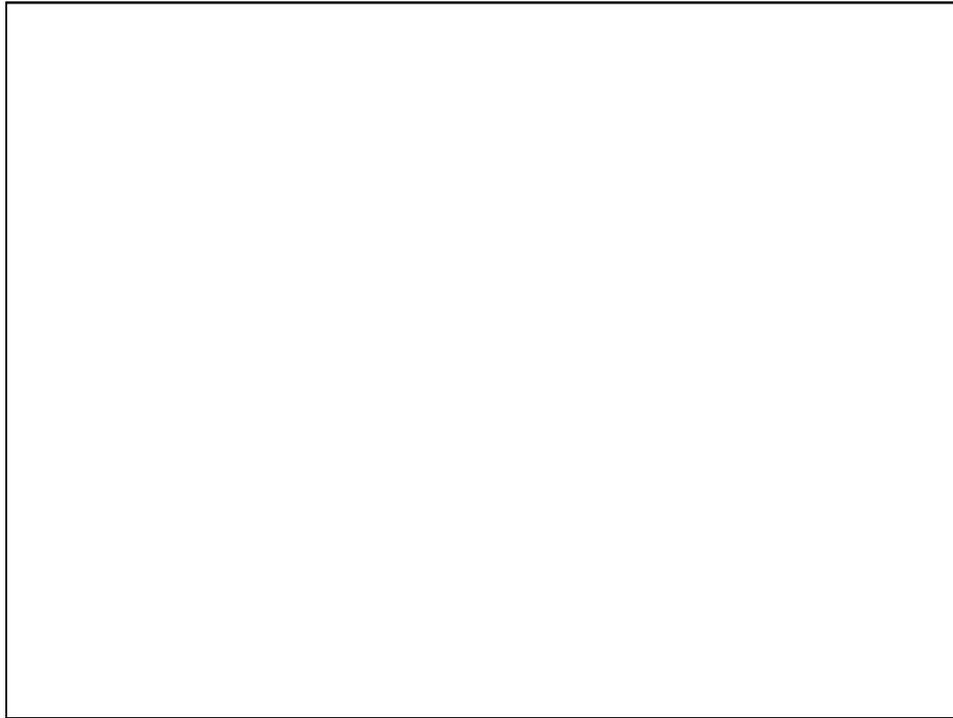
Dynamical Downscaling

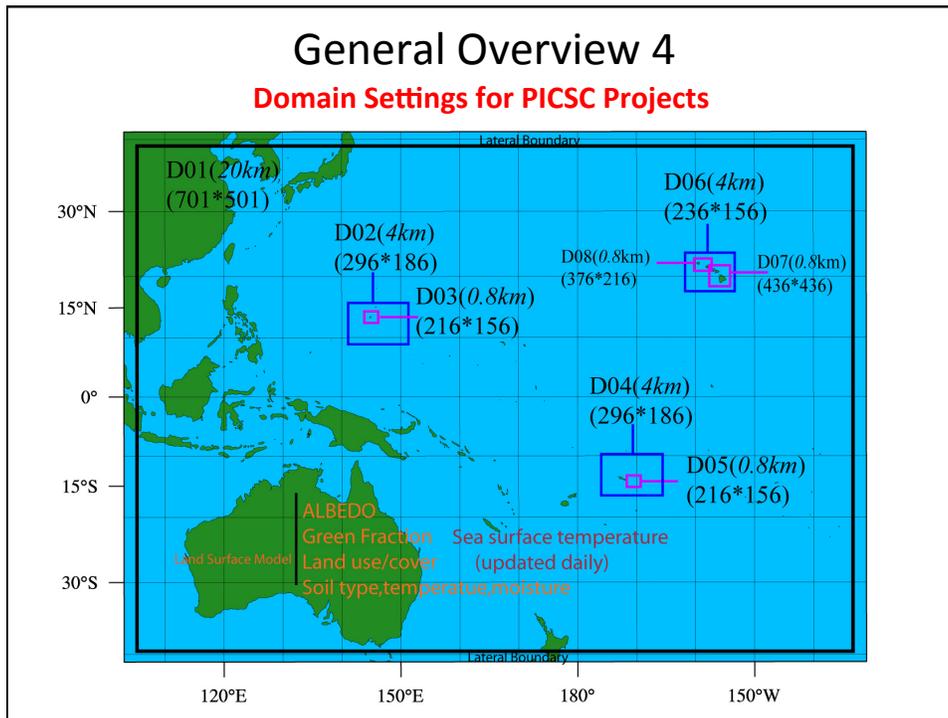
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East-West Center
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Overview of calibration or tuning process used during model development

Physics schemes	Annotation
New Tiedtke Cumulus Scheme (domain 1 only) (there are two versions, the first version was released in WRFV3.3 (Zhang et al, 2011), and applied to Pacific RISA Project, the second version was released in WRFV3.7, and applied to PICSC projects.	These schemes can have good simulation on convections and precipitation. Second version further improved the tropical precipitation.
YSU Boundary layer Scheme	
MM5 Monin-Obukhov surface layer scheme	
WSM6 microphysics scheme (Zhang et al, 2012a)	New warm rain process, which reduces the precipitation efficiency
RRTMG short/long wave radiation scheme	1)time-varying green-house gases 2)use CAM ozone data and Tegen climatological aerosol
Noah land surface scheme	New land surface data, slightly improve surface temperature, wind, etc.
Updating SST every day	Including the diurnal variations

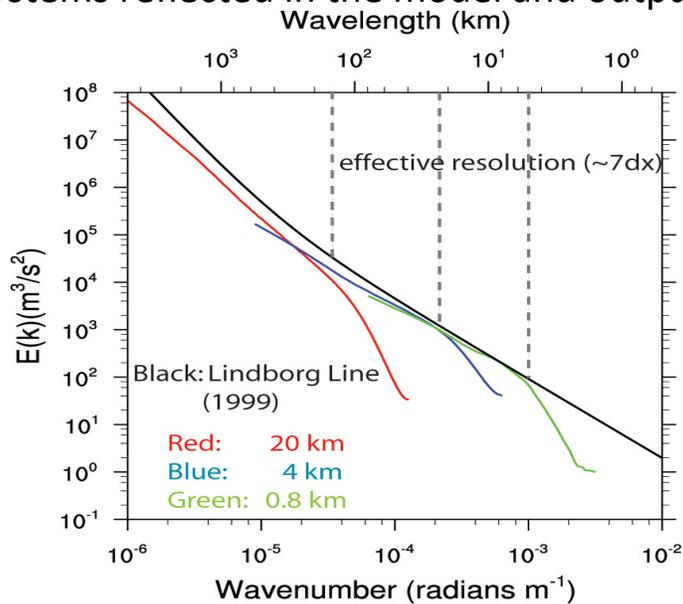
How are ENSO/PDO and other oceanic processes incorporated?

- Current state-of-the-art CGCMs have large bias in simulating ENSO/PDO and other oceanic processes.
- Systematic cold bias in the tropical eastern Pacific and warm bias in the eastern Pacific off the equator.
- ENSO/PDO and other oceanic processes are kept as the current climate except for the SST with global warming increments added.

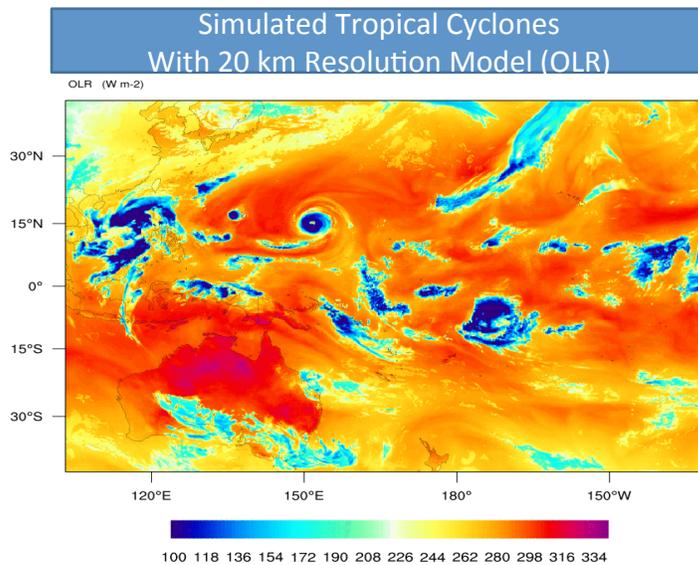
Do you make assumptions of stationary? If yes, in what way(s)?

- ENSO/PDO and other variabilities in the atmosphere outside the outmost domain are kept the same as in the current climate.
- The use of large model domain allows considerable freedom for the model to develop its own internal variability, particularly, at small-scale and synoptic scales.

How well are these synoptic and smaller scale systems reflected in the model and output?

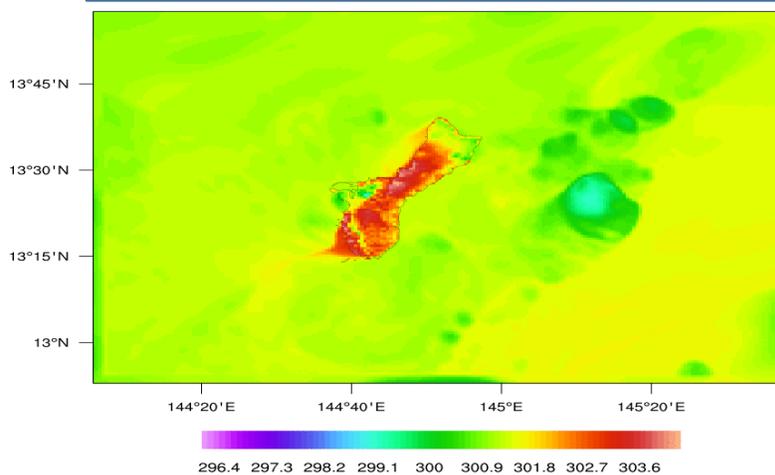


How well are these synoptic and smaller scale systems reflected in the model and output?



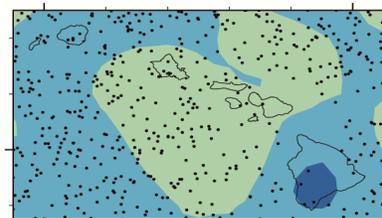
How well are these synoptic and smaller scale systems reflected in the model and output?

Simulated Diurnal surface Temperature (K)
With 0.8 km Resolution Model

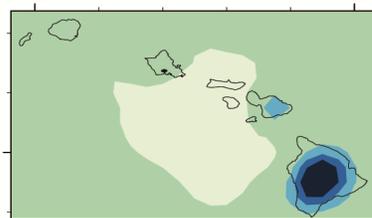


How well are these synoptic and smaller scale systems reflected in the model and output?

(a) COSMIC - TWIBH



(b) HRCM - TWIBH



20N

160W

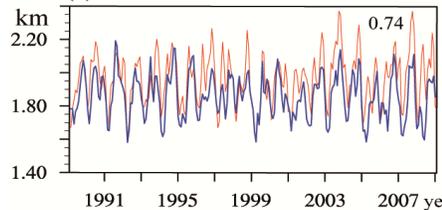
155W

160W

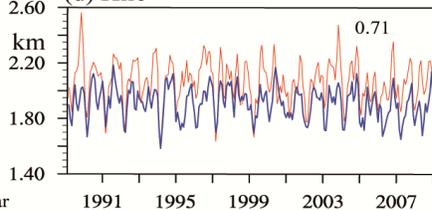
155W

1.6 1.8 2 2.2 2.4 km

(c) Lihue



(d) Hilo

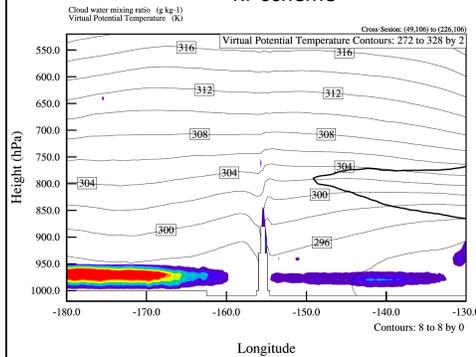


Identification of parameter sensitivities

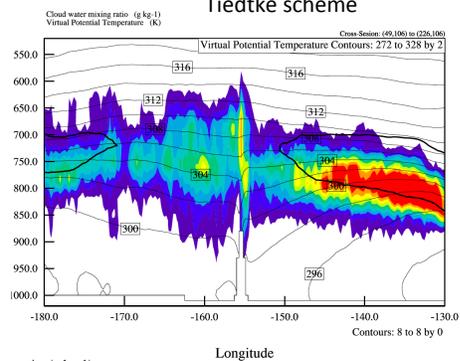
Sensitivity to Cumulus Parameterization Scheme



KF scheme



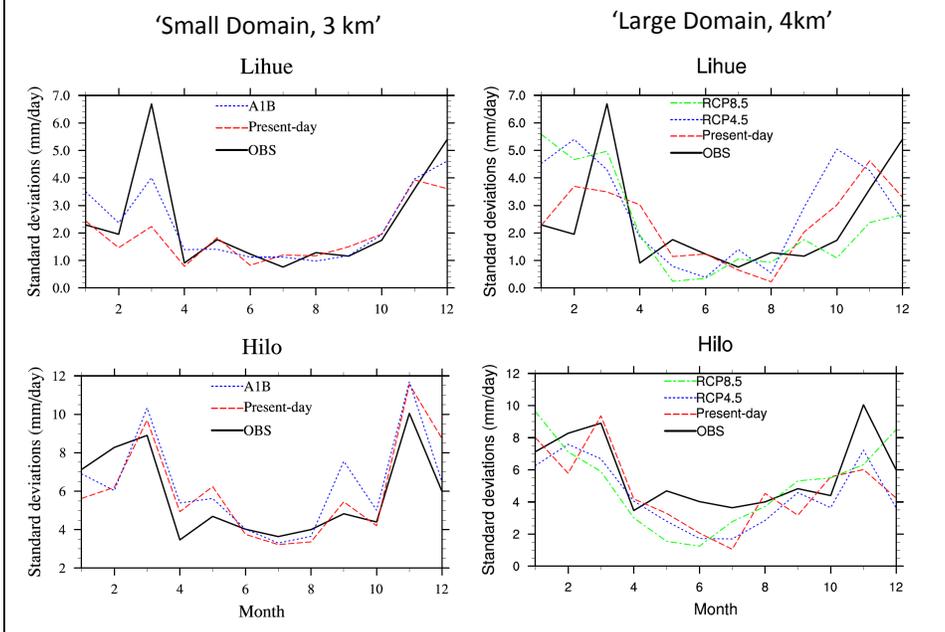
Tiedtke scheme



Primary sources of error

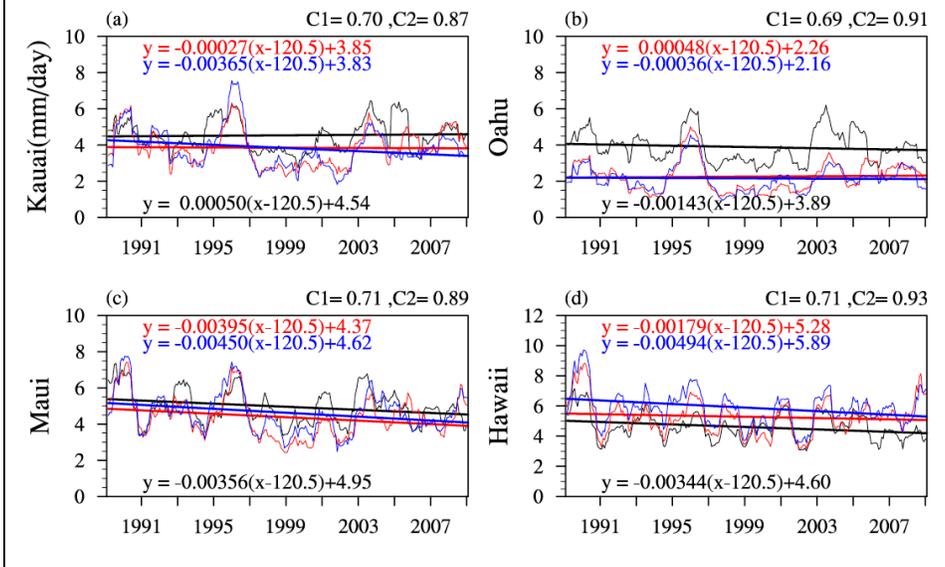
- The assumed unchanged decadal and interannual variabilities in SST;
- The assumed unchanged variabilities in atmospheric forcing through lateral boundaries;
- The unresolved subgrid scale topography and other uncertainties in land surface properties;
- Model domain size may affect internal variability;
- The representation of some model physics and the accuracy and stability of the numerical solver.

Example for the Primary Source of Errors: Domain size



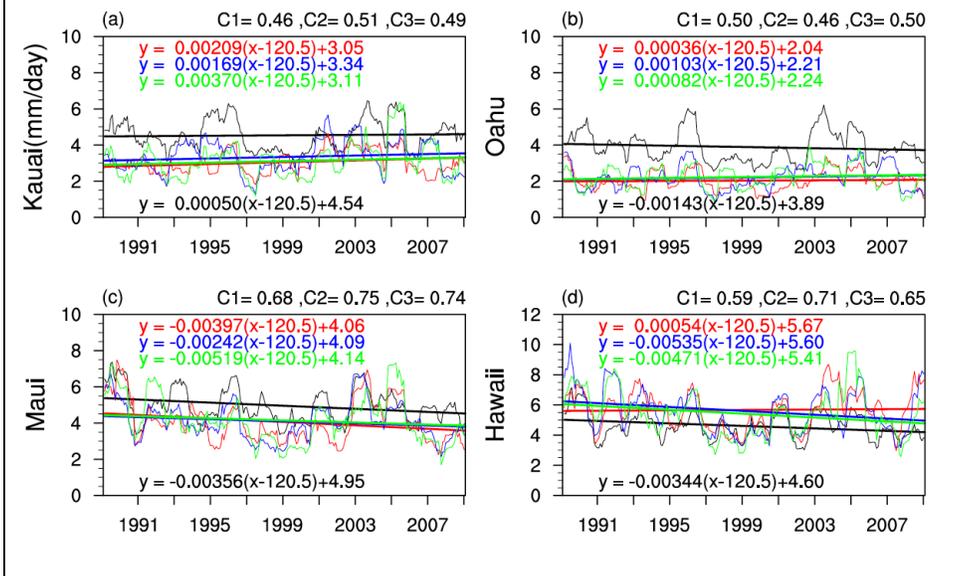
Example for the Primary Source of Errors: Domain size

interannual variation

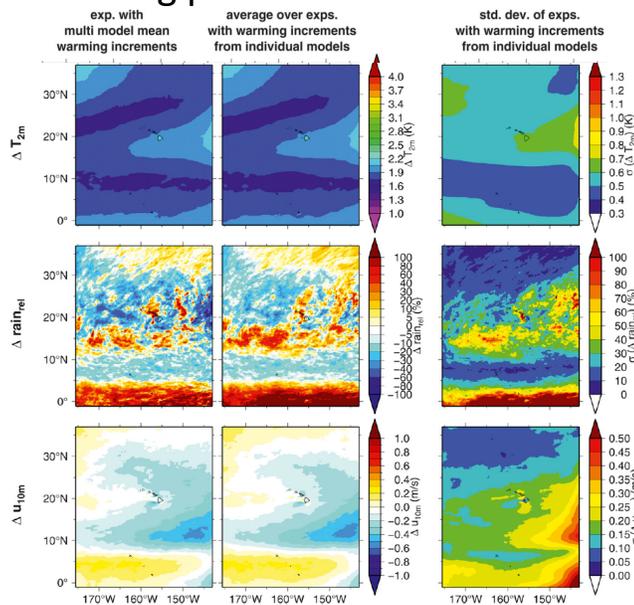


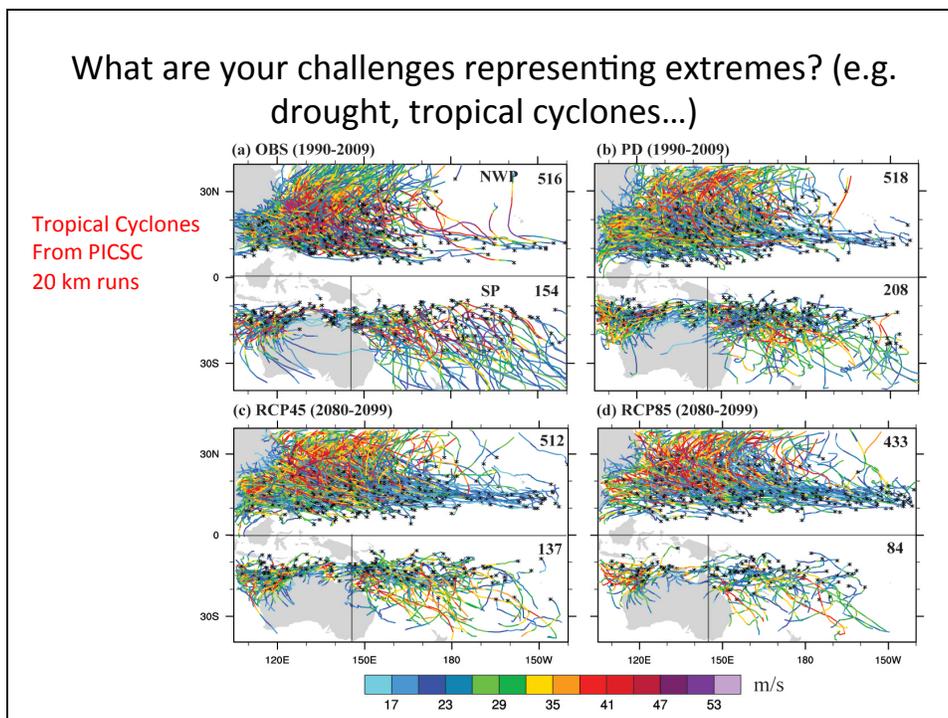
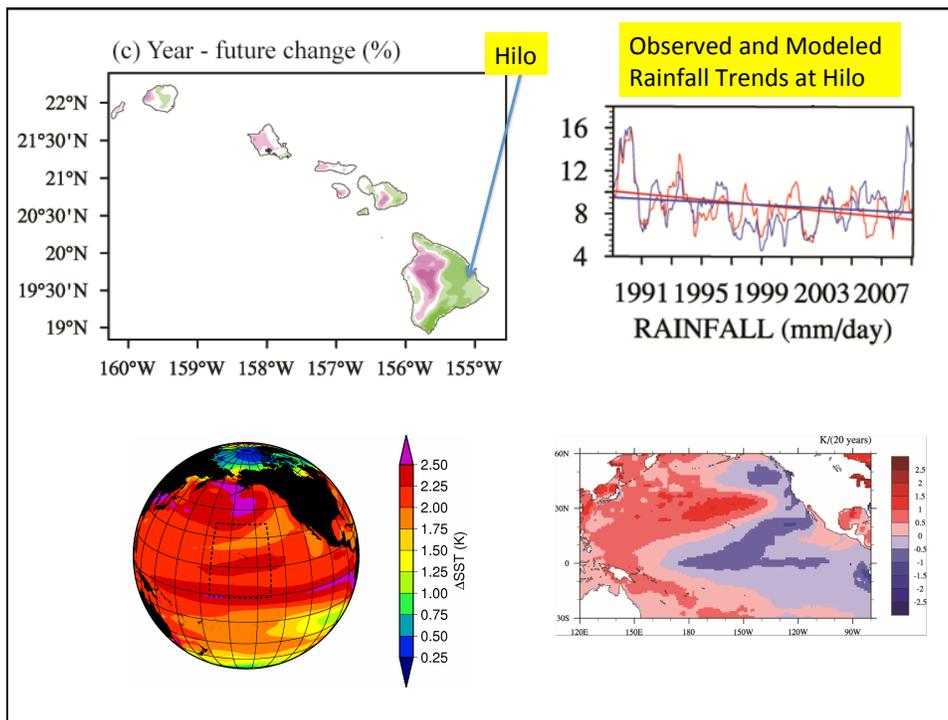
Example for the Primary Source of Errors: Domain size

interannual variation



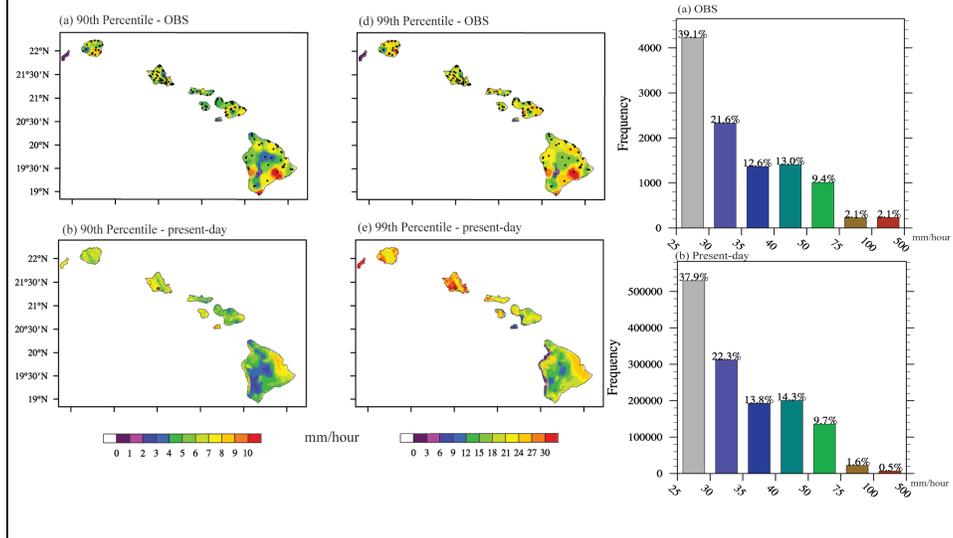
Effects of ensemble averages or lumping in representing potential future conditions





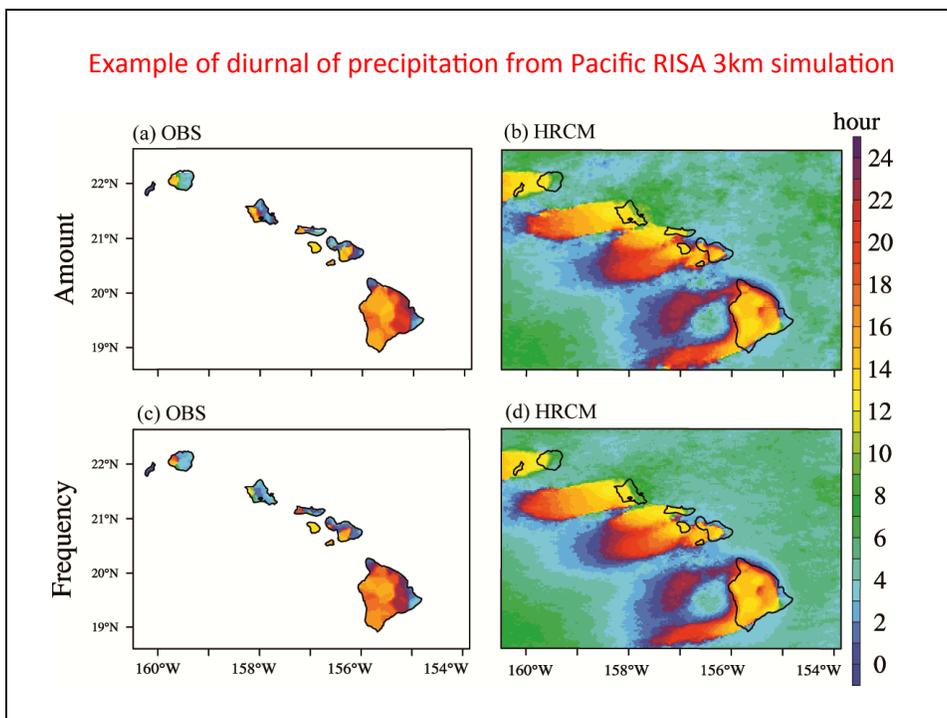
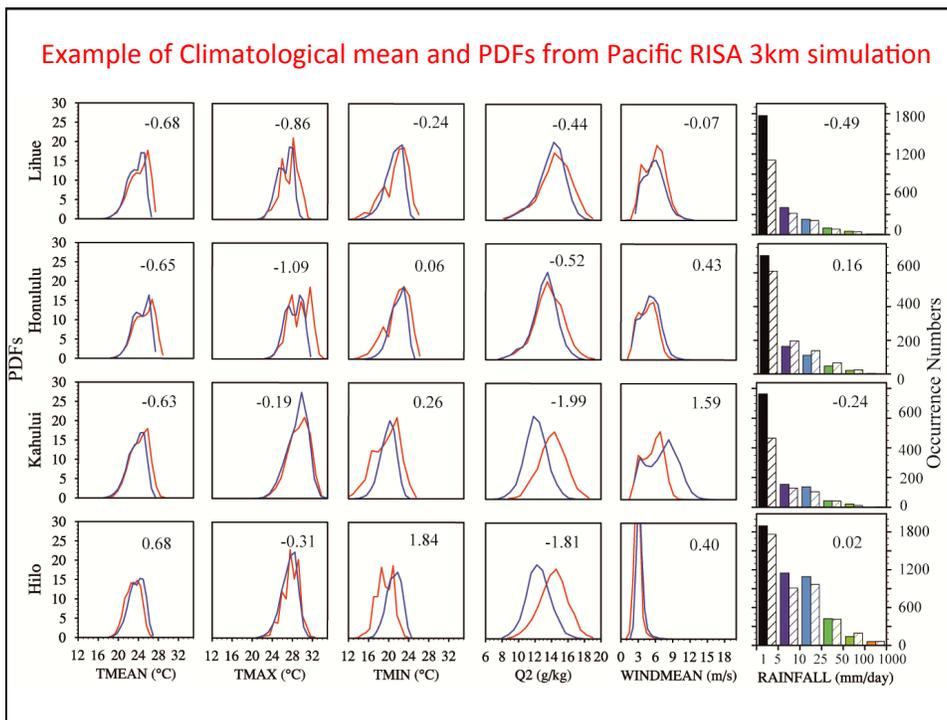
What are your challenges representing extremes? (e.g. drought, tropical cyclones...)

Hourly Rainfall Extremes from observations and Pacific RISA 3 km runs



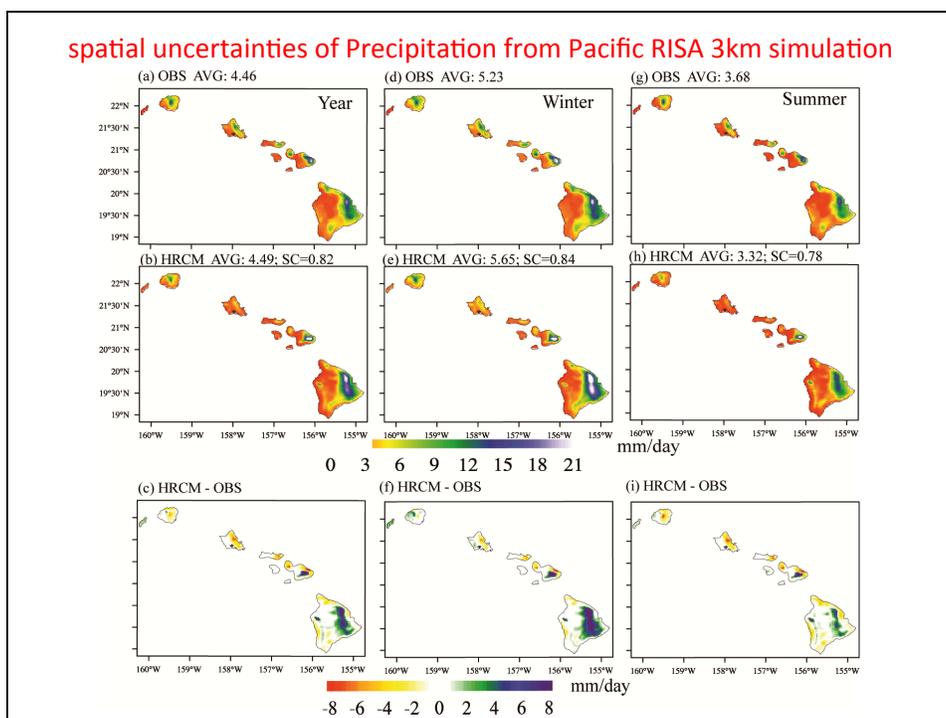
Which aspects of the model are the most confident?

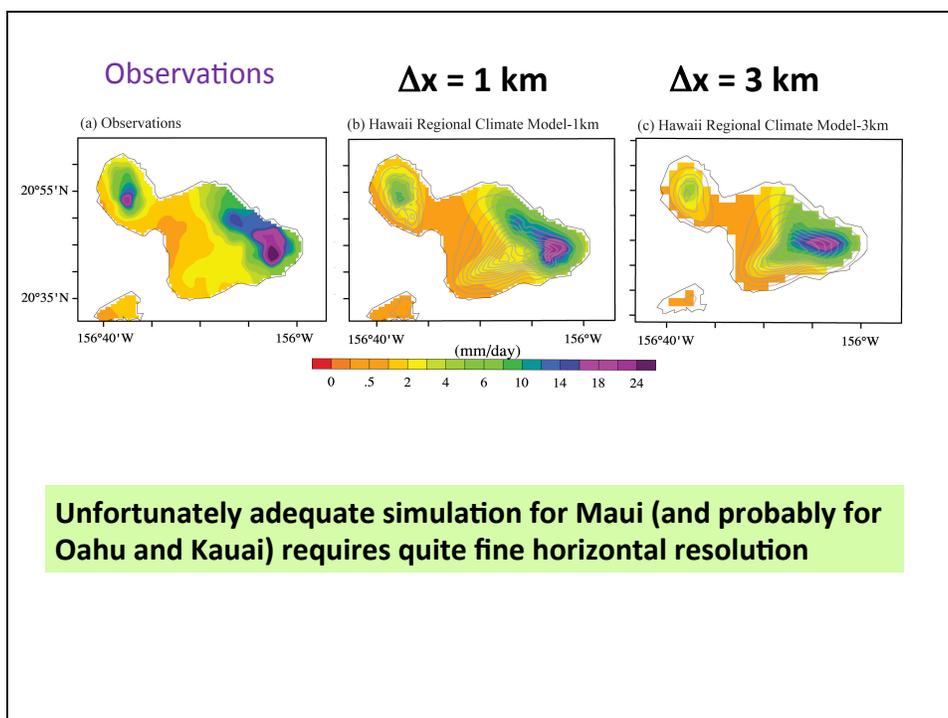
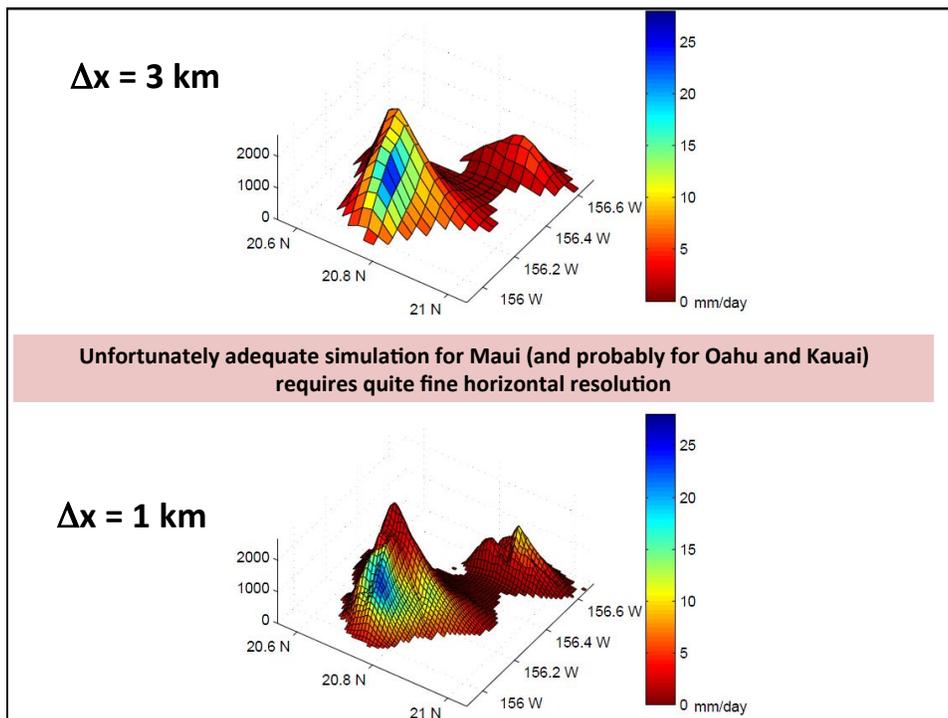
- Timescales?
 - Climatological mean, monthly mean, seasonal mean, diurnal cycle.
- Spatial scale/location?
 - Island and sub-island scale.
- Variables?
 - Long term (~20 year) mean values (from most to least confident) surface air temperature, absolute humidity, evapotranspiration, vertical temperature sounding, precipitation, surface wind, cloudiness, radiations.
 - Statistics of extremes.



Which aspects of the model are the most uncertain?

- Timescales?
 - Interannual and decadal variabilities.
- Spatial scale/location?
 - Subgrid scale phenomena.
- Variables?
 - No explicit prediction for changes in vegetation
 - No explicit prediction for ground water storage





Other issues, concerns, or ideas

- Is a linear interpolation is good to make projections for mid-century conditions based on our projected late 21st century results?
- If so, what variables are likely reliable (a) mean values, and (b) statistics of extremes (e.g. tropical cyclones)?
- Could we develop any algorithms to make bias correction before the results are used for other applications?
- The limitations of the PWG approach could be evaluated within a “perfect global coupled model” context.