

# Missing pieces: a modeler's perspective

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CRC, May 2009

# Climate model projections

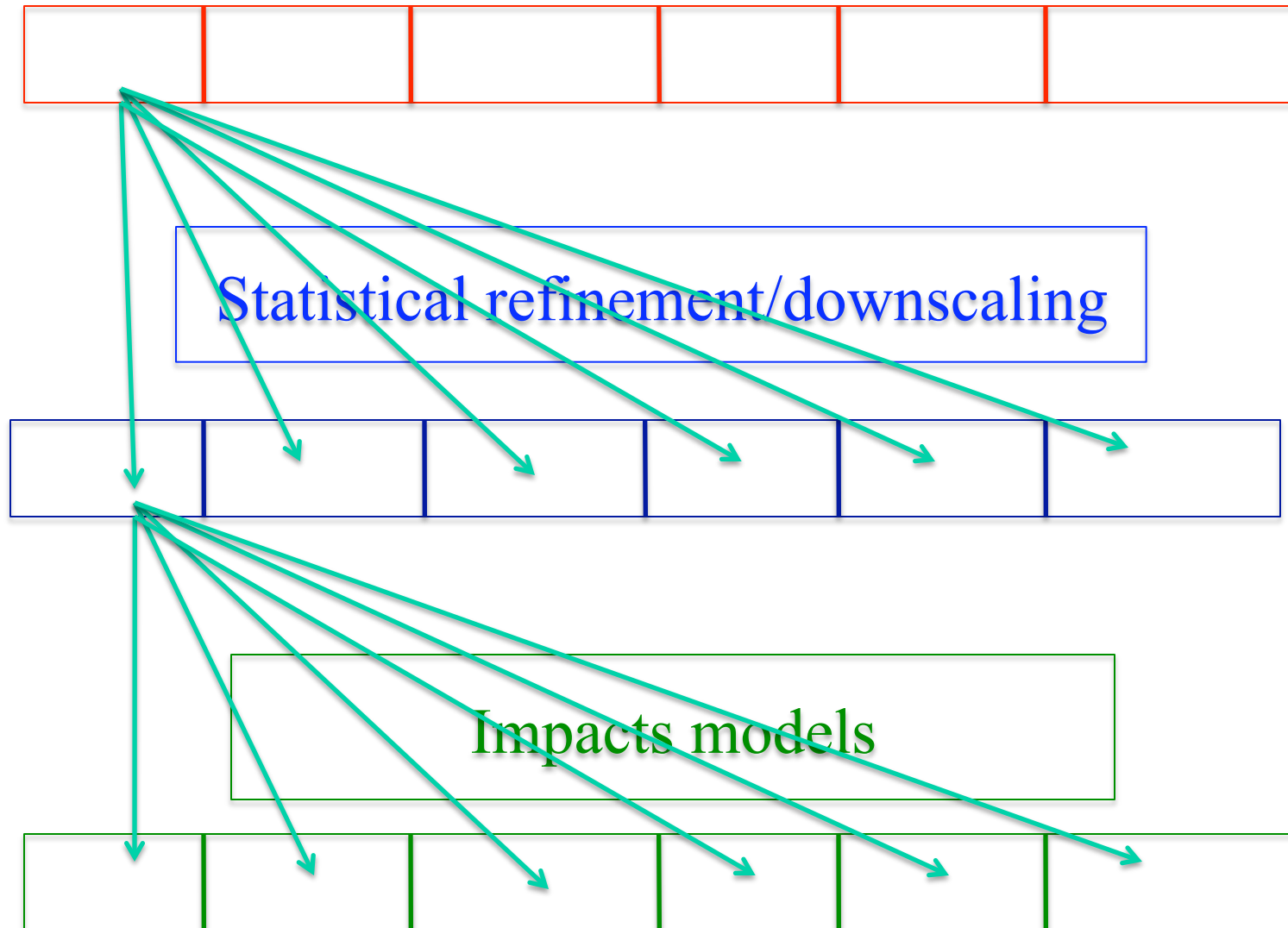


Fig. 11.3 in Ch. 11 of IPCC/WG1/2007  
JJA precipitation change in 6 CMIP3 models,  
downscaled to station data  
by Hewitson and Crane, 2006

Excerpt from Fig. 11.2:  
% change in JJA precip  
averaged over  
CMIP3 models

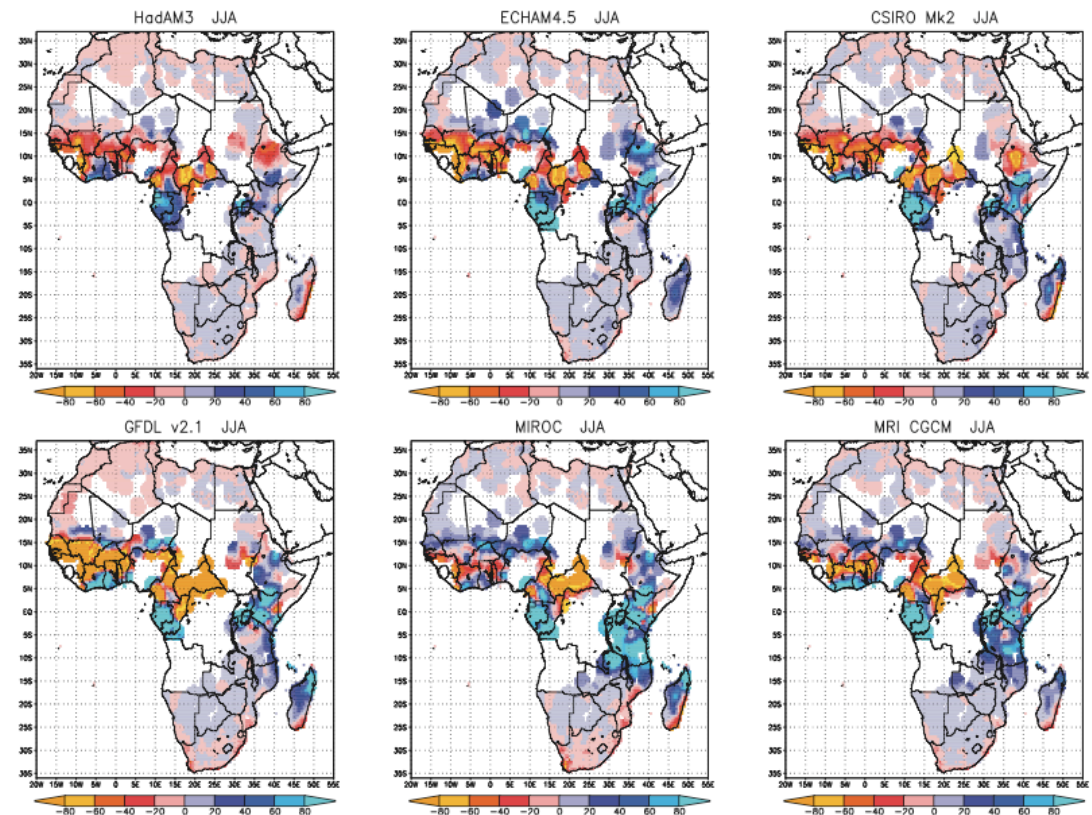
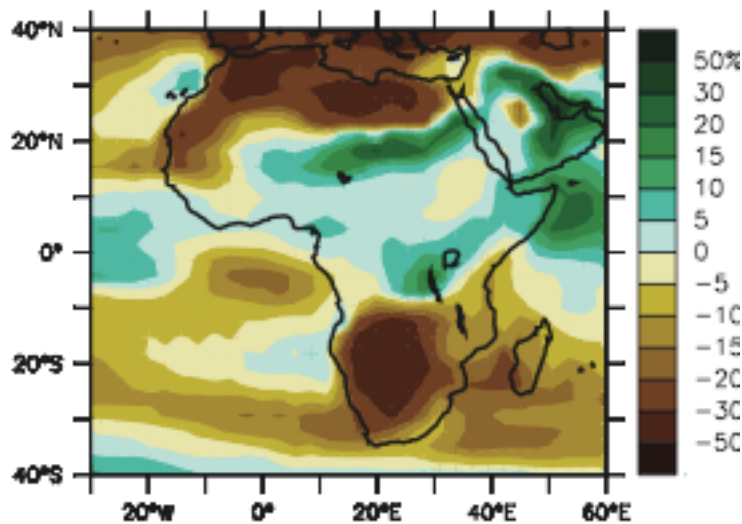


Figure 11.3. Anomaly of mean monthly precipitation (mm) using daily data empirically downscaled from six GCMs (ECHAM4.5, Hadley Centre Atmospheric Model (HadAM3), CSIRO Mk2, GFDL 2.1, MRI, MIROC; see Table 8.1 for descriptions of most of these models) to 858 station locations. The GCMs were forced by the SRES A2 scenario. Anomalies are for the future period (2070 to 2099 for the first three models, and 2080 to 2099 for the latter three models) minus a control 30-year period (from Hewitson and Crane, 2006).

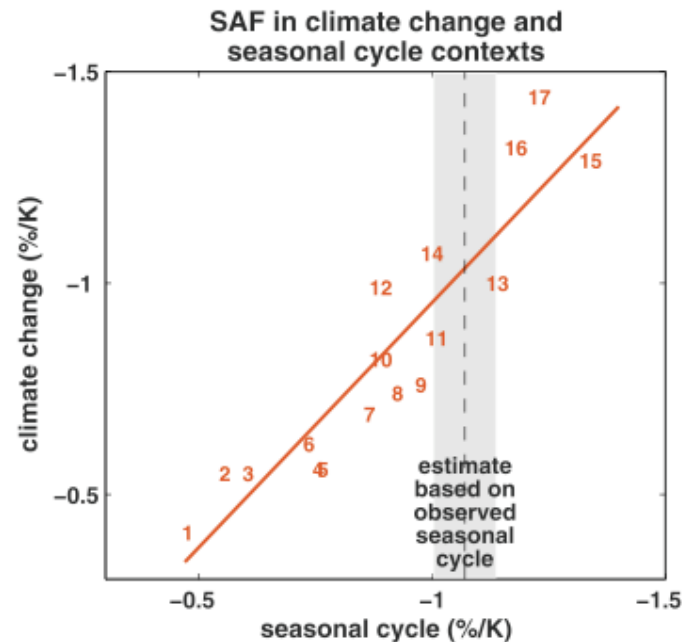
Fundamentally different over Sahel, S. Africa – but how do you assess the value  
of this kind of statistical downscaling

## Utilizing the multi-model database:

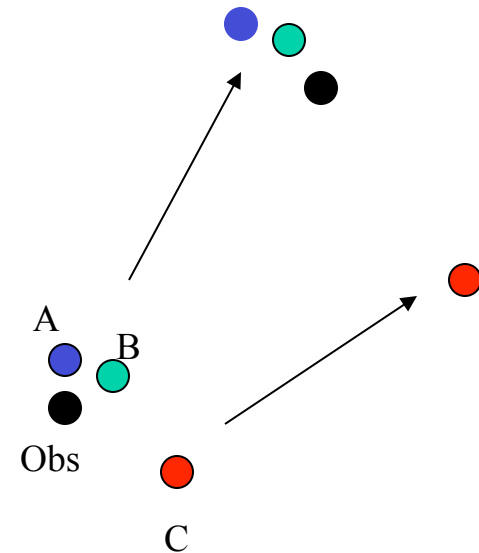
### What are the most relevant metrics?

Excellent simple example of useful metric: Hall and Qu (2006), Hall, Qu, Neelin (2008)

Seasonal cycle of snow cover good predictor  
of snow cover response to greenhouse gas increase  
=> comparing control simulation of snowcover to obs is very relevant



Hall and Qu



Key is the ability to “predict the future of models”

*The plan for CMIP5 (for the IPCC's AR5)  
includes a “time-slice” component  
(for simulations of regional climate change  
weather extremes, air quality, cloud feedbacks)  
with high resolution atmosphere/land models*

*How important are time-slices for reducing uncertainty in  
regional climate change projections ?*

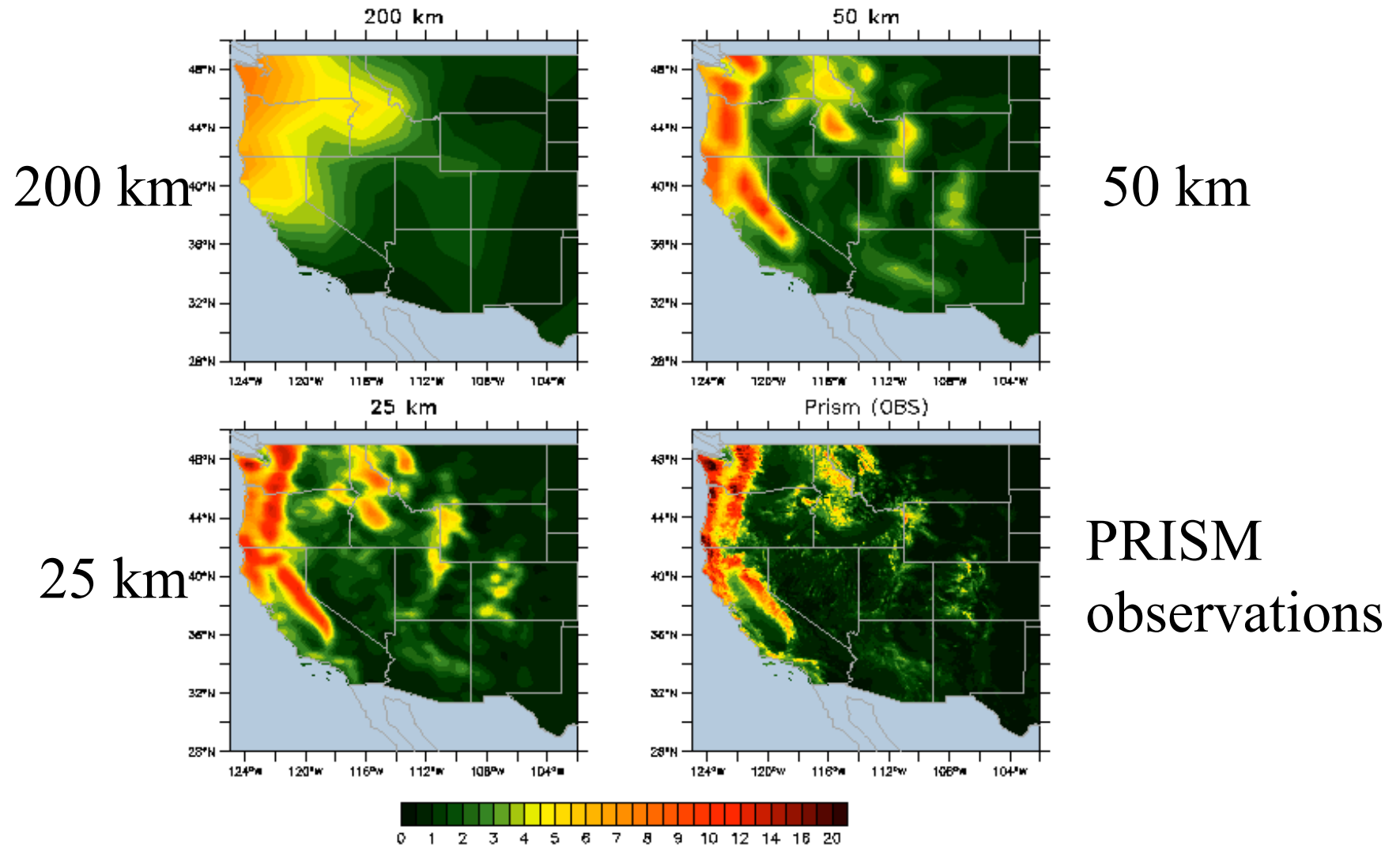
*GFDL will address this component  
in collaboration with DOE,  
which is offering substantial computer resources*

*A horizontal resolution of 25km is our target  
given the size of these resources*

# *Winter mean precipitation in Western U.S*

## *25 yr simulations.*

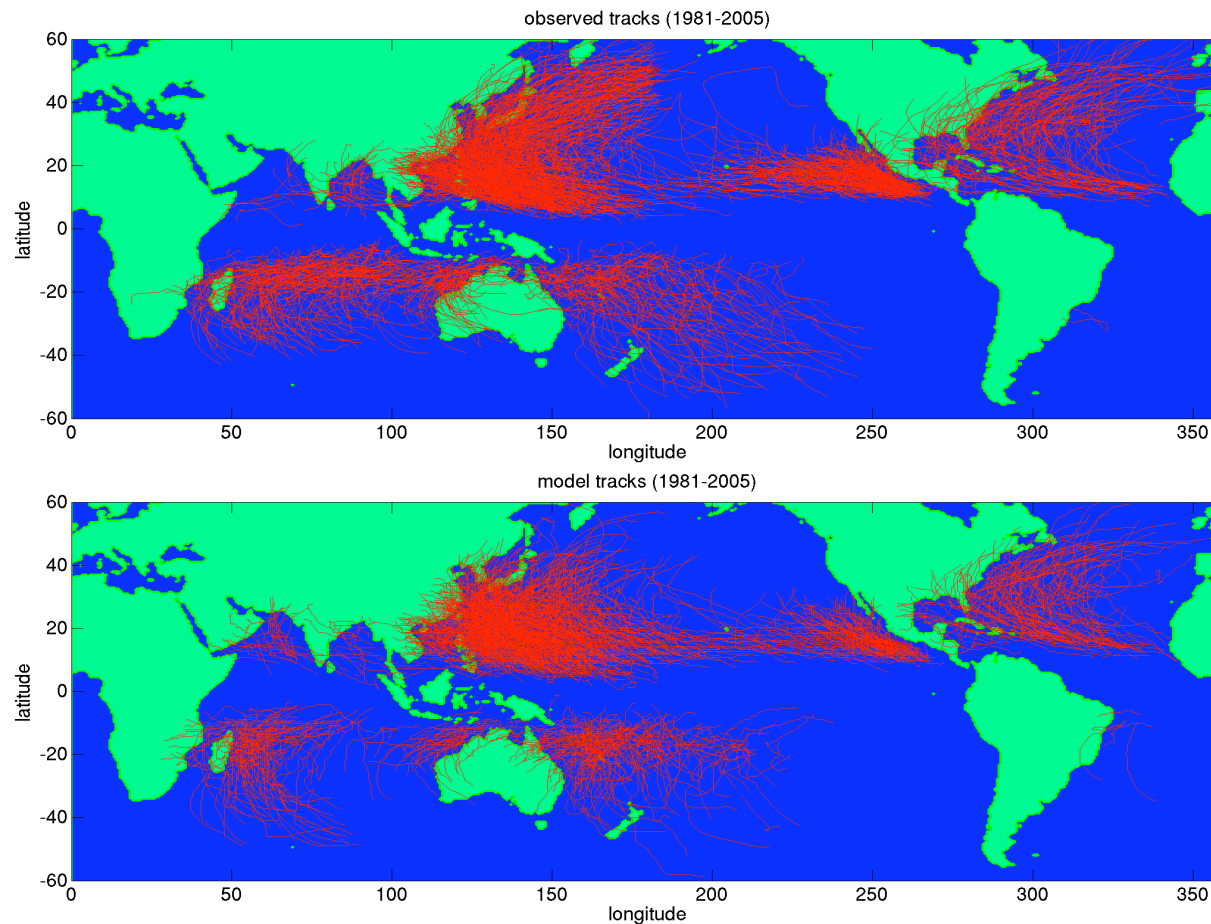
DJF Precip ( $\text{mm dy}^{-1}$ )



# Simulation of global hurricane climatology, inter-annual variability and response to global warming

Ming Zhao, Isaac Held, Shian-Jian Lin, Gabe Vecchi

**Hurricane tracks (1981-2005) upper: OBS, lower: C180 HiRAM**





# Inter-annual variability and decadal trends

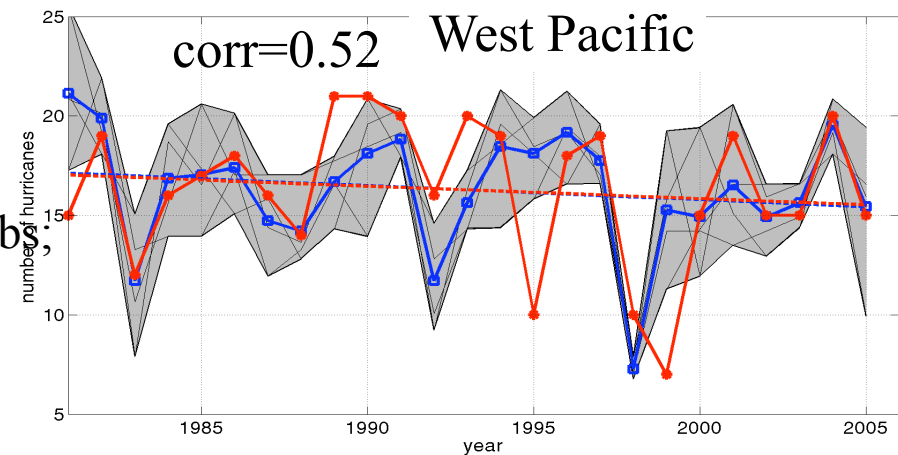
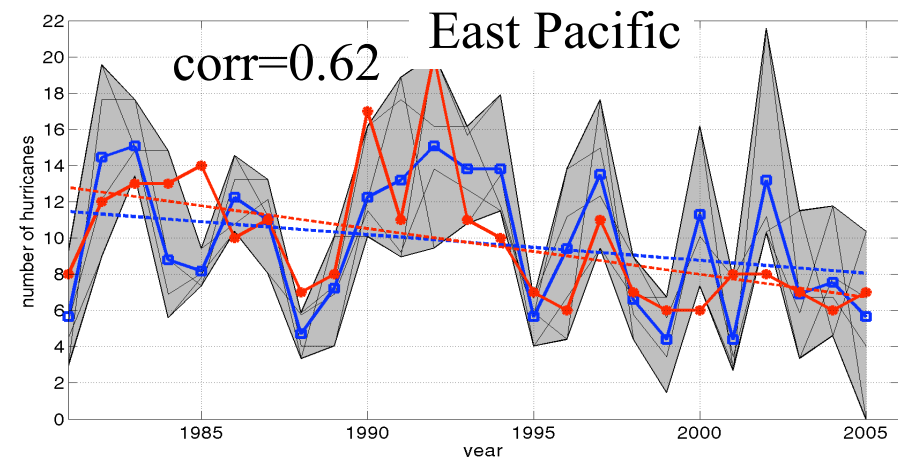
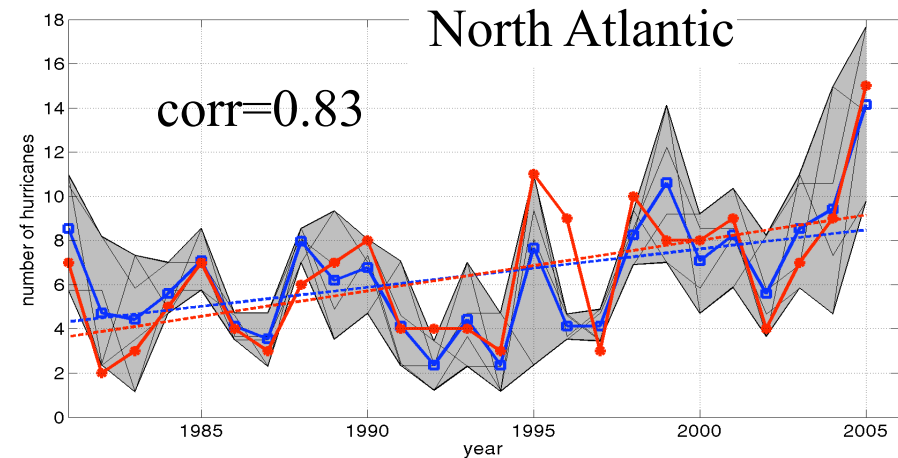
red: observations

blue: ensemble mean

shading: (4 member) spread

Hurricane counts for each basin  
are normalized by a  
time-independent  
multiplicative factor

Atmos-only time-slices have the advantage  
that they can be tested in this way against obs;  
But obviously does not work for fully  
coupled phenomenon such as ENSO





## Relative importance of time-slices and (coupled) seamless prediction?

Is relative success at regional seasonal/interannual prediction a good metric for judging the relative quality of models for regional climate change predictions/projections?

An open (important) question, in my opinion.

Is there USEFUL information on regional impacts that depends on predictions of internal variability – as opposed to understanding the forced response at regional scales? (Or is it naïve to separate the two?)

Also an open (important) question, in my opinion.

Coherent, transparent, open end-to-end archive  
(including algorithms rather than output for  
statistical refinement and impacts layers as far as possible)

Natural resource/goal of National Climate Service

Would allow immediate feedback on which new models  
developments are most relevant for impacts



**Climate model projections**  
(global, dynamical regional downscaling, timeslices)

**Statistical refinement/downscaling algorithms**

**Impacts algorithms**