Courtesy xkcd.com

I CAN'T BELIEVE SCHOOLS ARE STILL TEACHING KIDS ABOUT THE NULL HYPOTHESIS.

I REMEMBER READING A BIG STUDY THAT CONCLUSIVELY DISPROVED IT *YEARS* AGO.

First contributions to the C20C Detection and Attribution Project

with contributions from

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Dáithí Stone (dstone@lbl.gov)
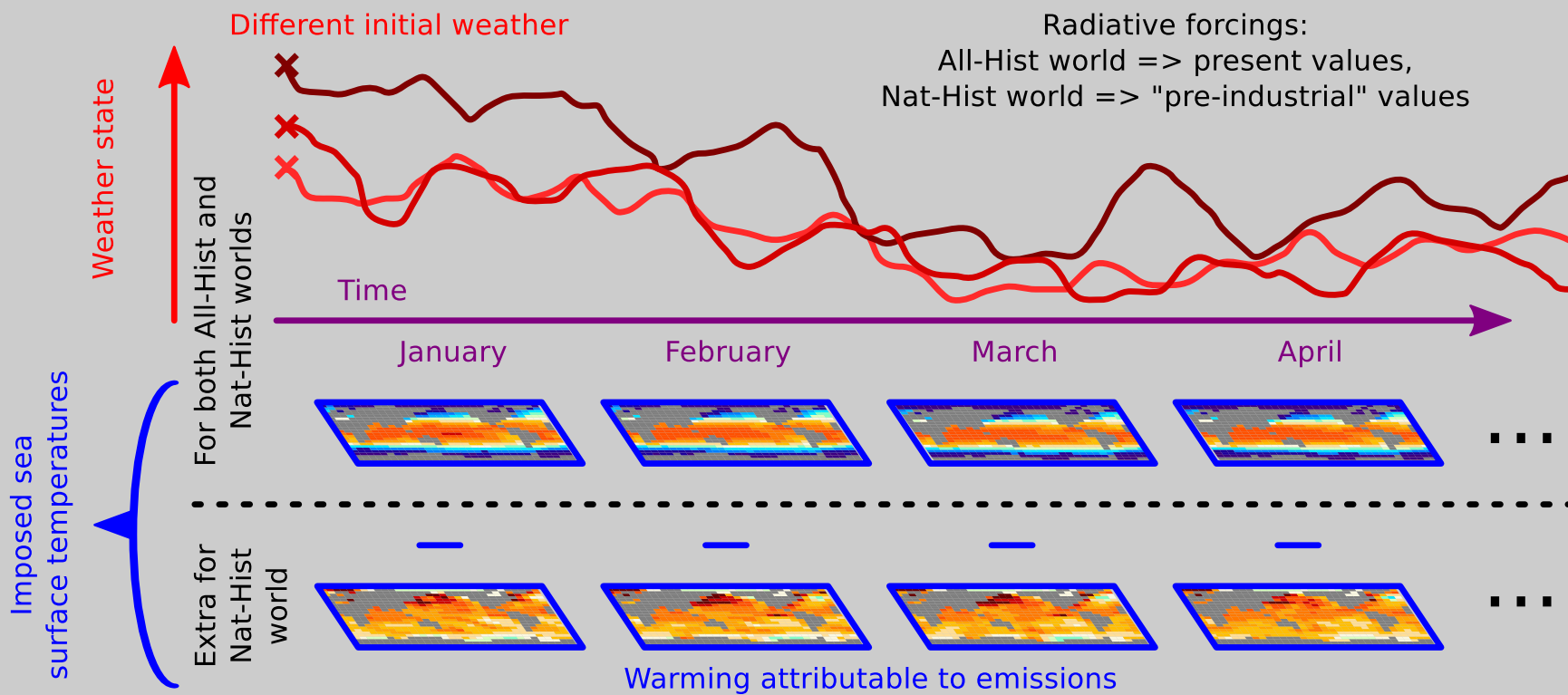
Previously available datasets

- Observations with LOTS of assumptions (statistical, forcing, response)

  (e.g. Rahmstorf and Coumou, 2011; Hansen et alii, 2012)

- CMIP5 attribution simulations, plus private predecessors (poor resolution of space and probability)

  (e.g. Stott et alii, 2004)

- Ad hoc data generated for single study

  (e.g. Pall et alii, 2011)

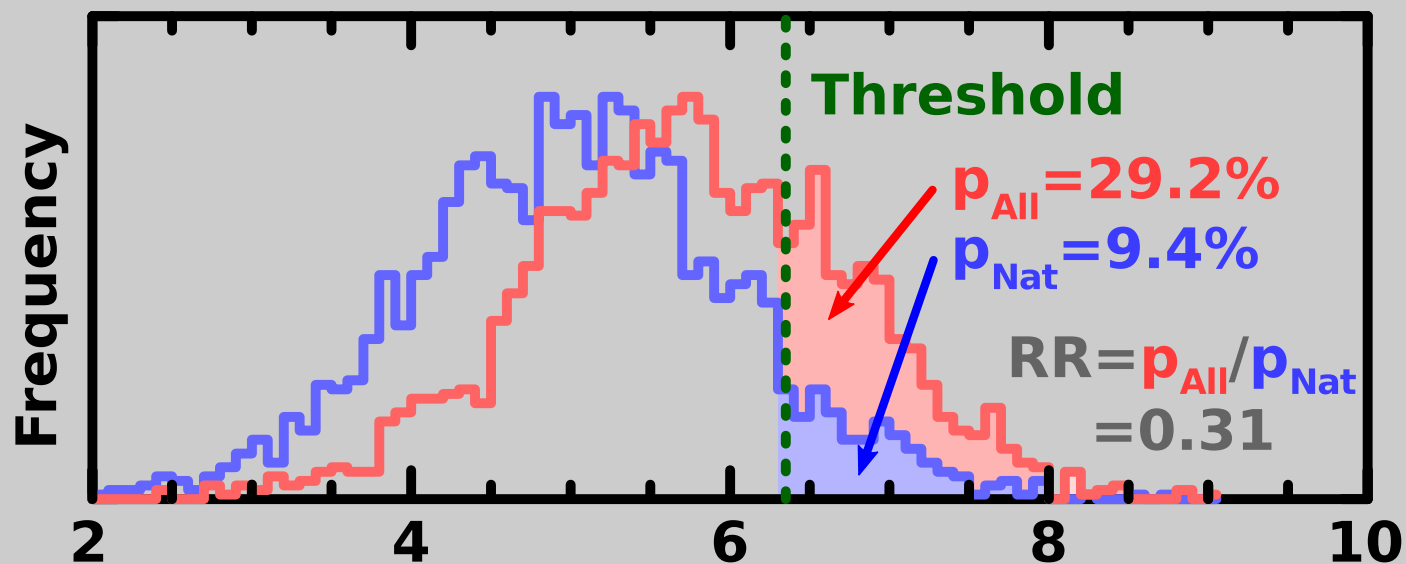## The C20C Detection and Attribution Project

- Scientific aims:

  – to characterise historical trends and variability in the probabilities of damaging weather events, including the differences across climate models;

  – to estimate the fraction of the historical, present, and future probabilities of damaging weather events that is attributable to anthropogenic emissions, and to characterise underlying uncertainties in these estimates.

- Or in other words:

  – to get O(30) modelling groups around the world to run >O(30) atmospheric models in a semi-coordinated weather-risk-attribution framework.

Experiment design

Different initial weather

Radiative forcings:
All-Hist world => present values,
Nat-Hist world => "pre-industrial" values

Weather state

For both All-Hist and Nat-Hist worlds

Time

January   February   March   April

Imposed sea surface temperatures

Extra for Nat-Hist world

. . .

Warming attributable to emissions

. . .

Example attribution analysis

Threshold

p_{All}=29.2%
p_{Nat}=9.4%

RR=p_{All}/p_{Nat}
=0.31

The "core" project

Scenario	Description	SST and SIC	Period
All-Hist/est1	Including changes in "all" known external forcings (anthropogenic and natural)	Observed	1960-2012
Nat-Hist/CMIP5-est1	Including changes in natural external forcings only	Observed minus CMIP5 estimate of anthropogenic signal	2000-2012
Nat-Hist/?	Including changes in natural external forcings only	Observed minus another estimate of anthropogenic signal	2000-2012
Nat-Hist/?	Including changes in natural external forcings only	Observed minus another estimate of anthropogenic signal	2000-2012

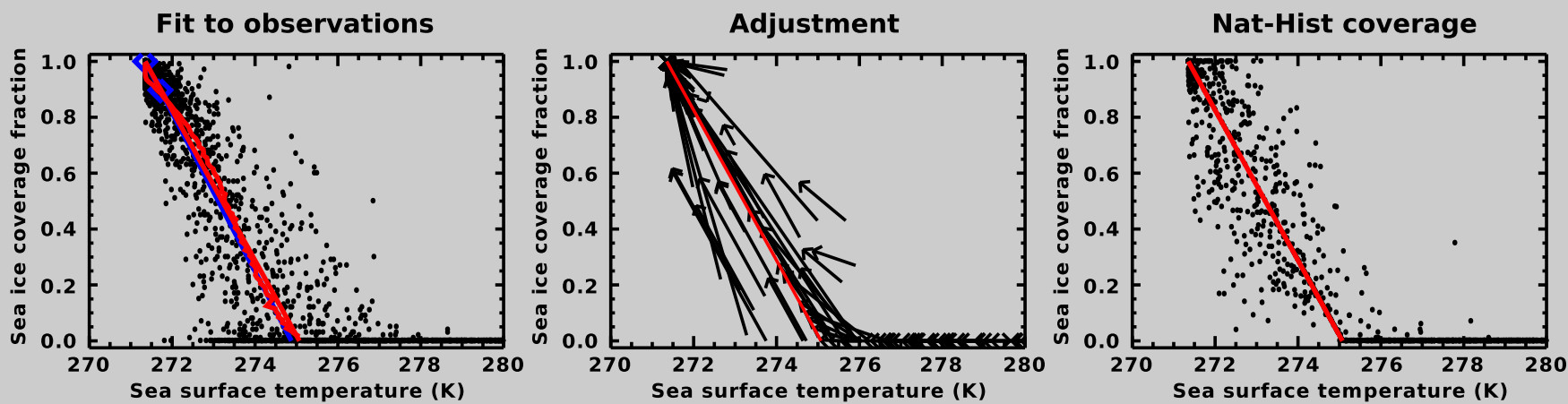## Estimation of Nat-Hist/CMIP5-est1 SSTs

Anthropogenic-historical at time January 2006
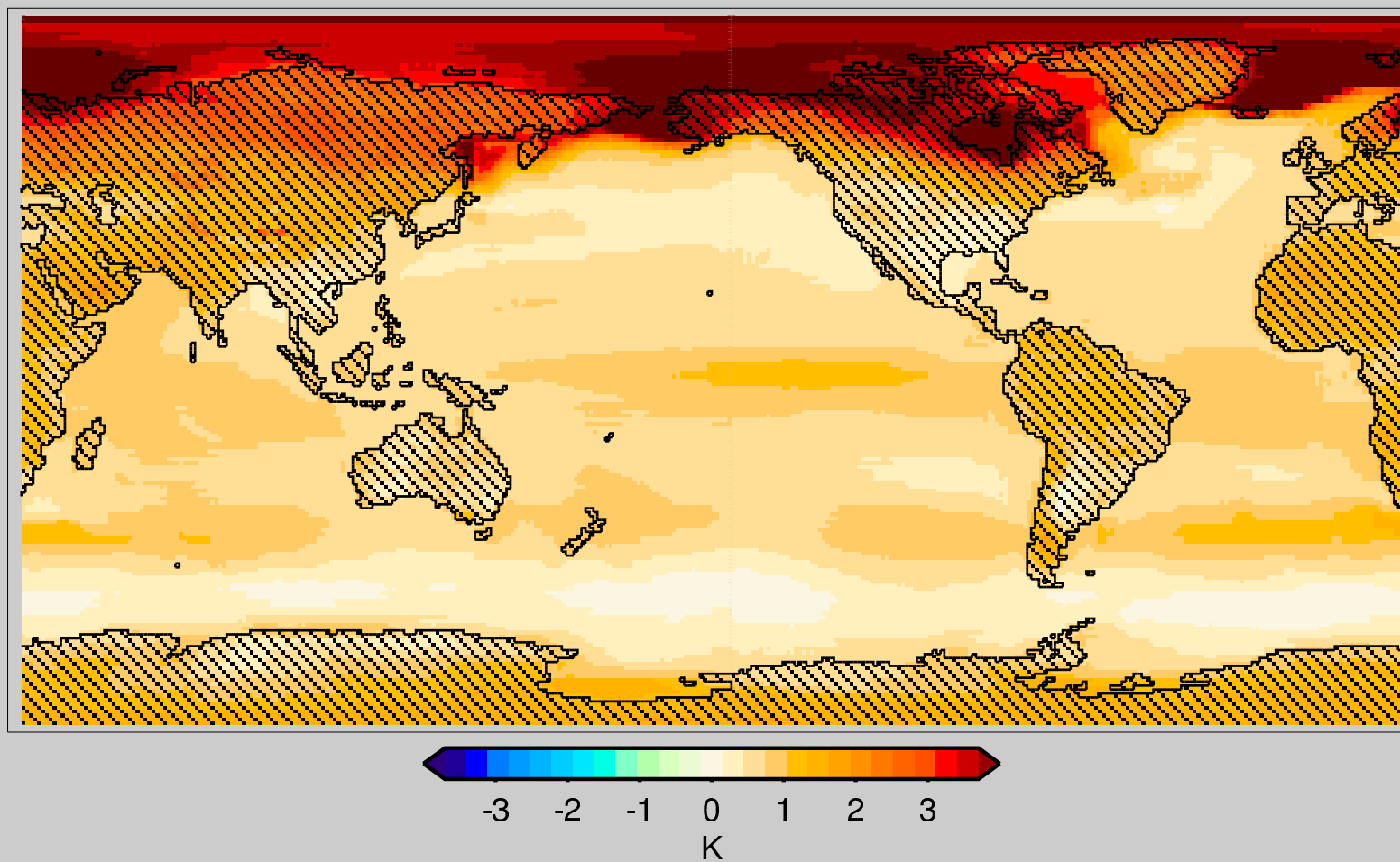
Estimation of Nat-Hist/CMIP5-est1 sea ice

Northern Hemisphere, 2001-2010, NOAA OI.v2

Other Nat-Hist estimates

- Differ across models

- Choice of the modelling group

- I can help with generating these if based on coupled models and regression scaling

C20C data distribution

- Atmospheric modelling output is available on the NERSC Earth System Grid portal (http://esg.nersc.gov).

- Plan for derivative output to be put on the ESG portal too.

- Currently limited to allocated disk space, but soon should have ESG access to tape archive.

A pilot experiment (LBNL and UCT)

|	CAM5.1-1degree	CAM5.1-2degree	HadAM3P-N96	HadAM3-N48
All-Hist/est1				
No. of sims	50 (1959-2008)	49 (1959-2007) 56 (2008-2012)	10 (1960-2008) 60 (2009-2011)	10 (1960-2008) 50 (2009-2011)
GHG-forcing	As observed	As observed	As observed	As observed
Aer forcing	Not included	Not included	Not included	Not included
Vol, Sol forcing	As observed	As observed	Not included	Not included
SSTs	As observed	As observed	As observed	As observed
Sea ice	As observed	As observed	Climatology	Climatology
nonGHG-Hist/HadCM3-p50-est1				
No. of sims		56 (2008-2012)	60 (2009-2011)	50 (2009-2011)
GHG-forcing		Pre-industrial value	Pre-industrial value	Pre-industrial value
Aer forcing		Not included	Not included	Not included
Vol, Sol forcing		As observed	Not included	Not included
SSTs		As observed minus GHG warming	As observed minus GHG warming	As observed minus GHG warming
Sea ice		As observed minus GHG retreat	Climatology	Climatology

Conditionality
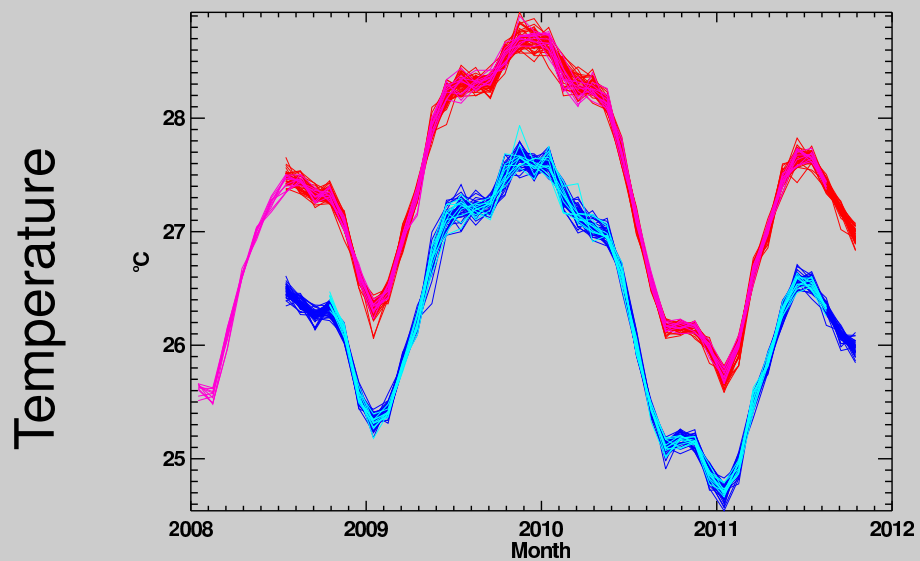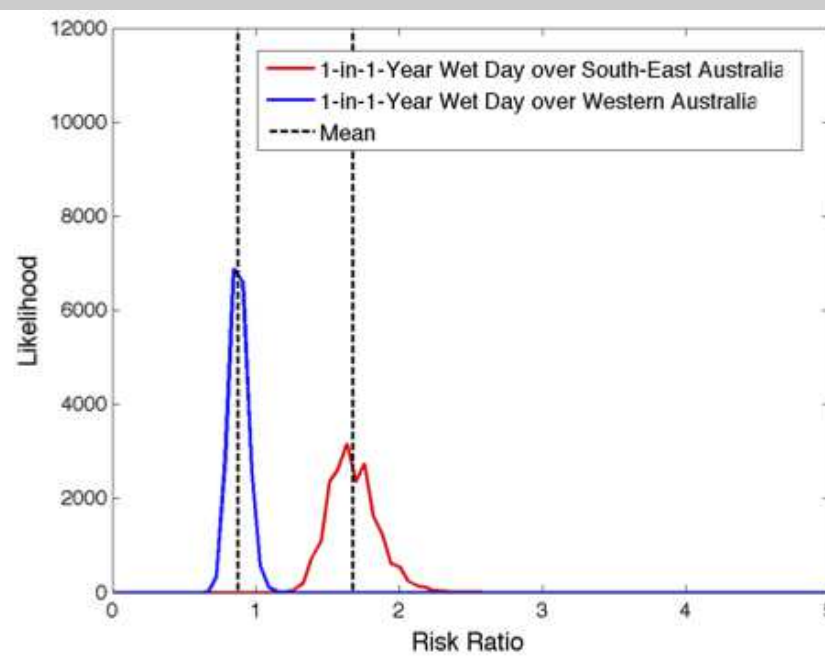

Niño 3.4   Kimberley (South Africa)
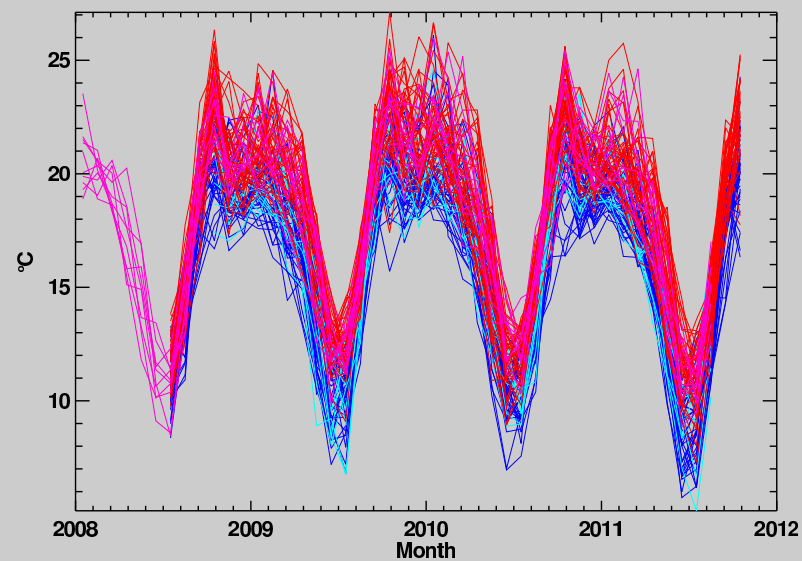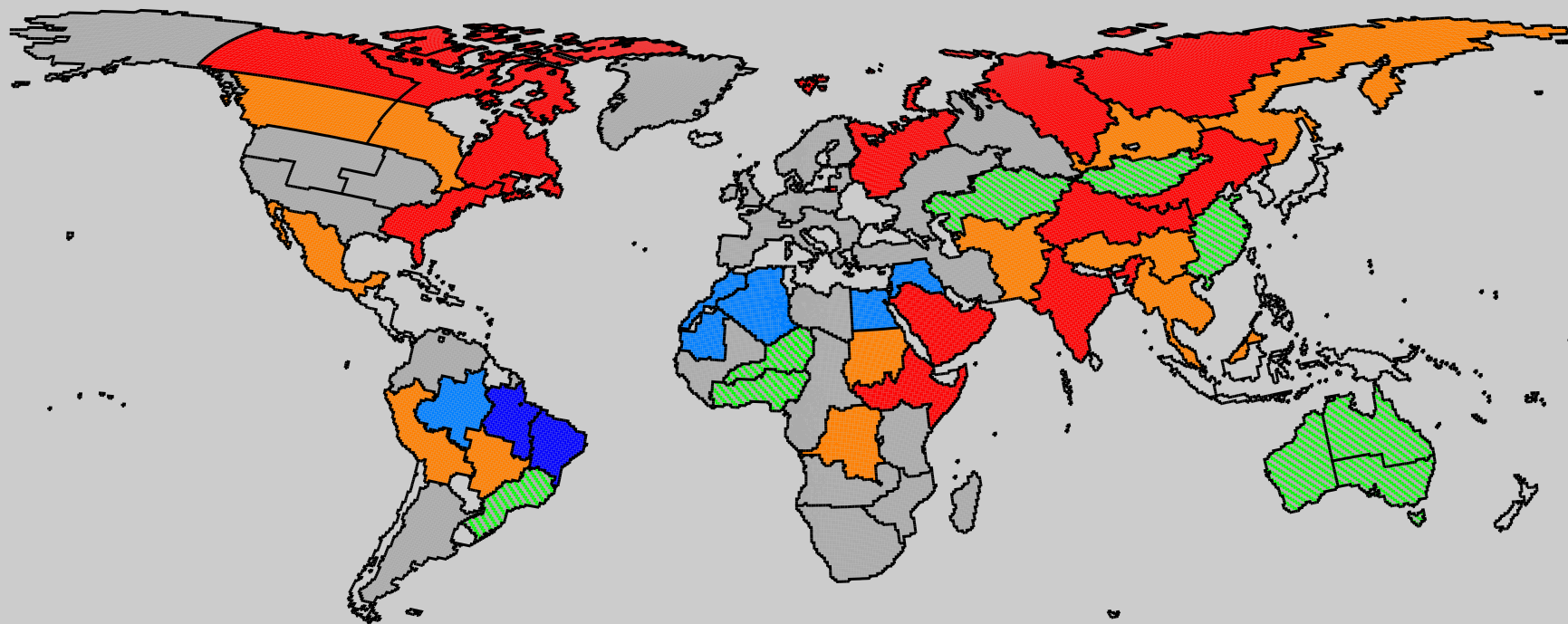
What can we do with O(50) simulations?
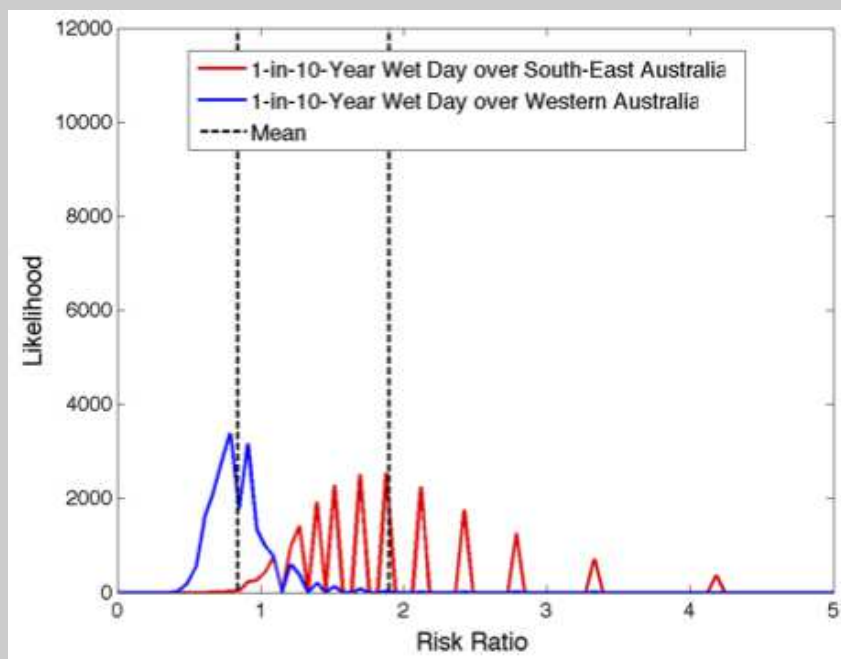
1-in-10-year　　　　　　　　**1-in-1-year**

Courtesy Oliver Angélil
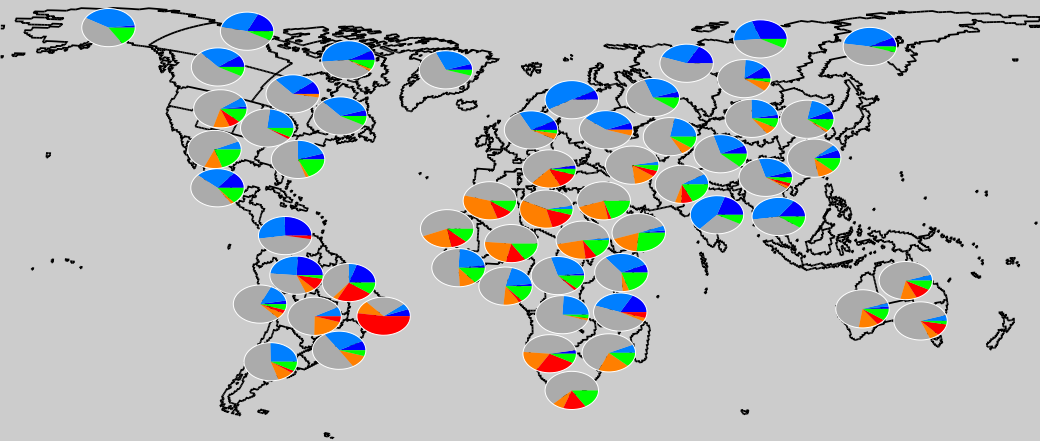
Unusually wet November 2010, with CAM5.1-2degree

- **Chance is at least halved** (dark blue)
- **Chance is at least smaller** (light blue)
- **No detectable difference** (grey)
- **Chance is at least larger** (orange)
- **Chance is at least doubled** (red)
- **Chance is less than halved or doubled** (green)

Model comparison

HadAM3P-N96   CAM5.1-2degree
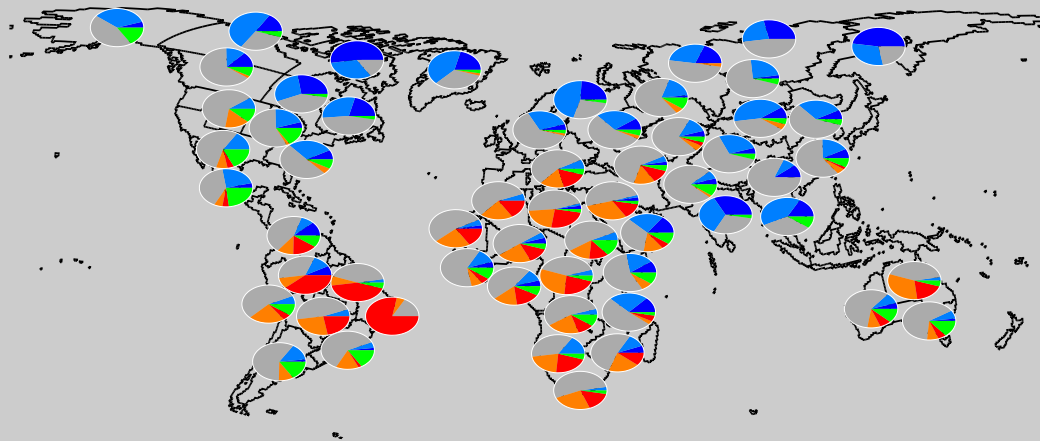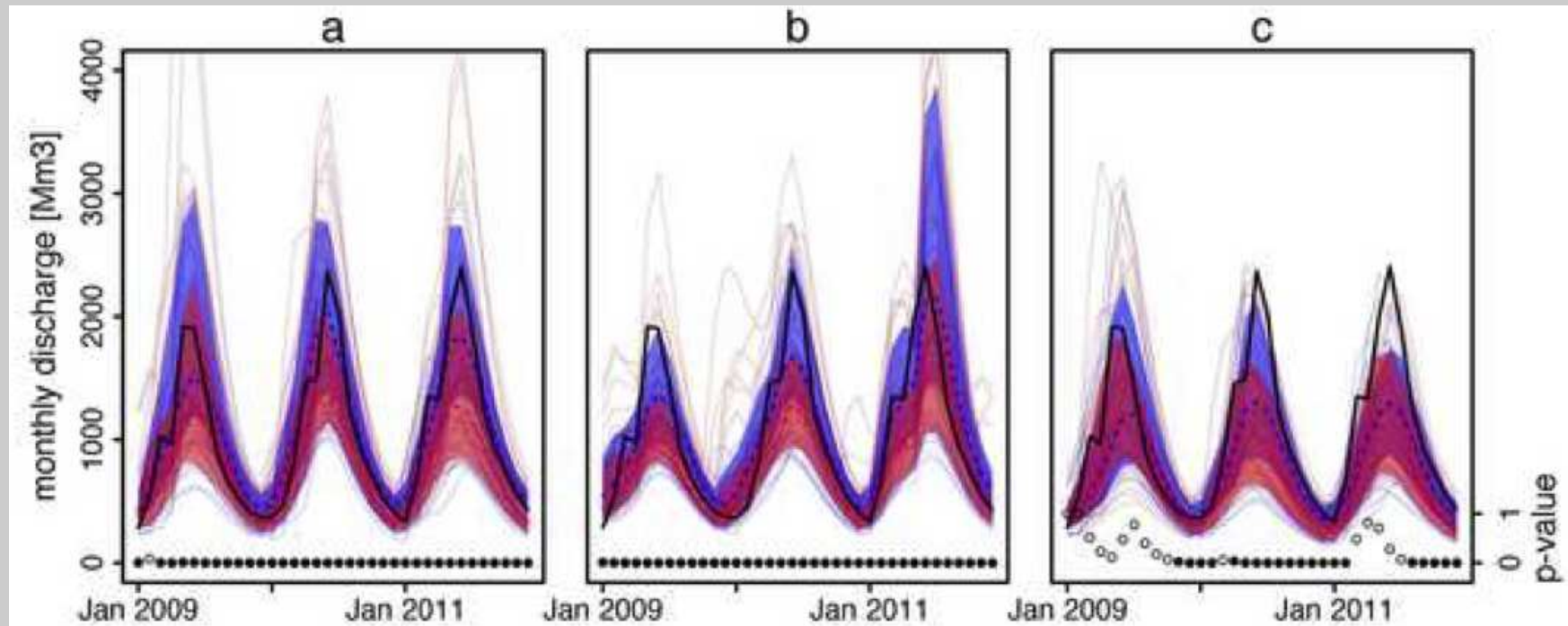
A case study of Okavango flooding

HadAM3P-N96   Downscaled HadAM3P-N96   CAM5.1-2degree

c/o Piotr Wolski

Starting "core" simulations

Institution	Model
LBNL (USA)	CAM5.1-2degree, CAM5.1-1degree, CAM5.1-0.25degree
MOHC (UK)	HadGEM-3A-N96, (HadGEM-3A-N216?)
NIES (Japan)	MIROC5-T85
UCT (South Africa)	HadAM3-N48, HadAM3P-N96
UC Davis (USA)	WRF/CAM5.1-1degree
UOx-cpdn (UK)	HadAM3P-N96/HadRM3P

Goals for the meeting

- Renew mandate for project from C20C membership

- Discuss experimental design (constraints, possibilities)

- Formulate timetable