THE C20C+ DETECTION AND ATTRIBUTION PROJECT

CASCADE

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A CLIMATE PRODUCT FOR UNDERSTANDING EXTREMES

Current status of "event attribution" research

While there is a growing research effort to assess the degree to which recent extreme weather events relate to historical anthropogenic emissions, understanding of the sensitivity of results to aspects of the experimental setup and the characterisation of the event remain poorly understood, in part due to a lack of an adequate data product.

Threshold
p_{All}=29.2%
p_{Nat}=9.4%
$RR=p_{All}/p_{Nat}$=0.31
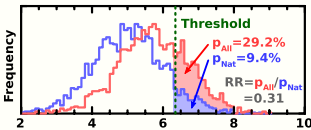
The International CLIVAR C20C+ Detection and Attribution Project

Goal is to conduct modelling in support of research and analysis of the detection and attribution of changes in weather extremes.

In particular, in aims to support:

• Characterisation of historical trends and variability in the probabilities of damaging weather events, including the differences across climate models

• Estimation of the fraction of the historical, present, and future chance of damaging weather events that is attributable to anthropogenic emissions, and characterisation of underlying uncertainties in these estimates

Undertaken as a collaboration within the International CLIVAR C20C+ Project, managed by LBNL with data portal services provided by NERSC.

LARGE ENSEMBLE MODELLING TO SAMPLE RARE EVENTS

Each atmospheric climate model will be run under two scenarios:

• an "All-Hist" scenario designed to describe the climate over recent decades

• a "Nat-Hist" scenario designed to describe what the climate might have been like over recent decades had anthropogenic emissions never occurred
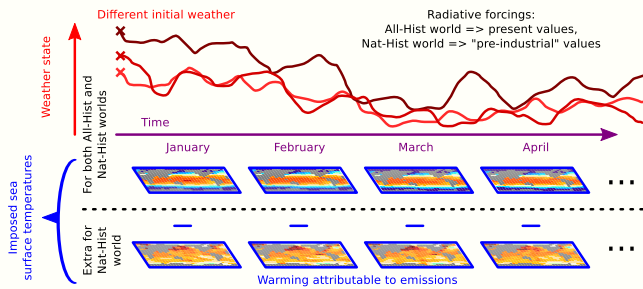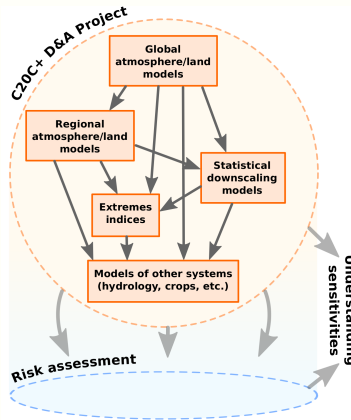

Different initial weather

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

Scenario	Description	Radiative and surface boundary conditions	Simulations
All-Hist/est1	"real world" baseline and reference, performed with all models	All: *varying as observed*	≥50 covering ~1996-present, with ≥10 starting in 1960
Nat-Hist/CMIP5-est1	"natural world" benchmark estimate, performed with all models	Anthropogenic radiative: *pre-industrial levels*; Natural radiative: *varying as observed* Ocean temperatures: *varying as observed minus estimate of attributable anthropogenic warming from CMIP5 simulations* Sea ice: *adjusted in line with temperatures* Land cover: *varying as observed*	≥50 covering ~1996-present
Nat-Hist/?	A second "natural world" estimate, different for each model	Ocean conditions: *as for Nat-Hist/CMIP5-est1 but using a different estimate of attributable warming* Others: *as for Nat-Hist/CMIP5-est1*	≥50 covering ~1996-present
Nat-Hist/?	A third "natural world" estimate, different for each model	Ocean conditions: *as for Nat-Hist/CMIP5-est1 but using a different estimate of attributable warming* Others: *as for Nat-Hist/CMIP5-est1*	≥50 covering ~1996-present

MULTIPLE MODELS IN SUPPORT OF UNDERSTANDING AND ASSESSMENT

C20C+ D&A Project
Global atmosphere/land models
Regional atmosphere/land models
Statistical downscaling models
Extremes indices
Models of other systems (hydrology, crops, etc.)
Risk assessment
Understanding sensitivities

Participating models

Simulations with at least a dozen models are being run or are scheduled to start running during 2014:

• global atmosphere/land
• regional dynamical atmosphere/land
• statistical downscaling
• river basin

Pilot study: Okavango Delta flooding, Botswana, 2009-2011
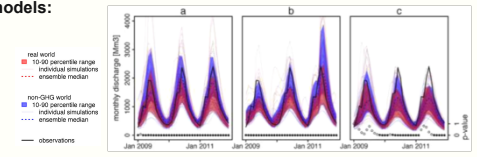
Global atmosphere/land models:
a) HadAM3P-N96
b,c) CAM5.1-2degree

Statistical downscaling:
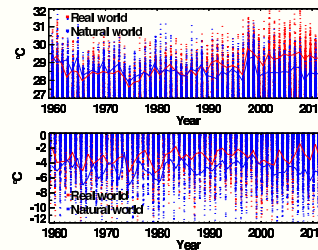*b) SOM-D*

River basin model:
a,b,c) Pitman model

UNDERSTANDING EXTREMES IN A CHANGING CLIMATE

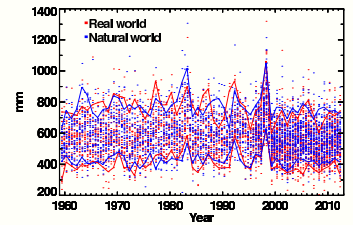### First results from CAM5.1-1degree simulations

California daily temperature
Dots: daily values, Lines: 1-in-1-year event

California hydrological-year precipitation
Dots: annual values, Lines: 1-in-10-year event

INFORMATION, DATA, AND COLLABORATION

Data distribution

• Diagnostic output available on the ESGF (http://esg.nersc.gov) under project "c20c".

• Output needed for dynamical downscaling archived on tape

FOR MORE INFORMATION: http://portal.nersc.gov/c20c

CONTRIBUTIONS OF DATA, ANALYSES, ETC. ARE INVITED AND WELCOME!