Introduction to Climate Services & Handling Climate Risk

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Early 2000s: The Seamless Prediction Problem

Past: Weather | Climate

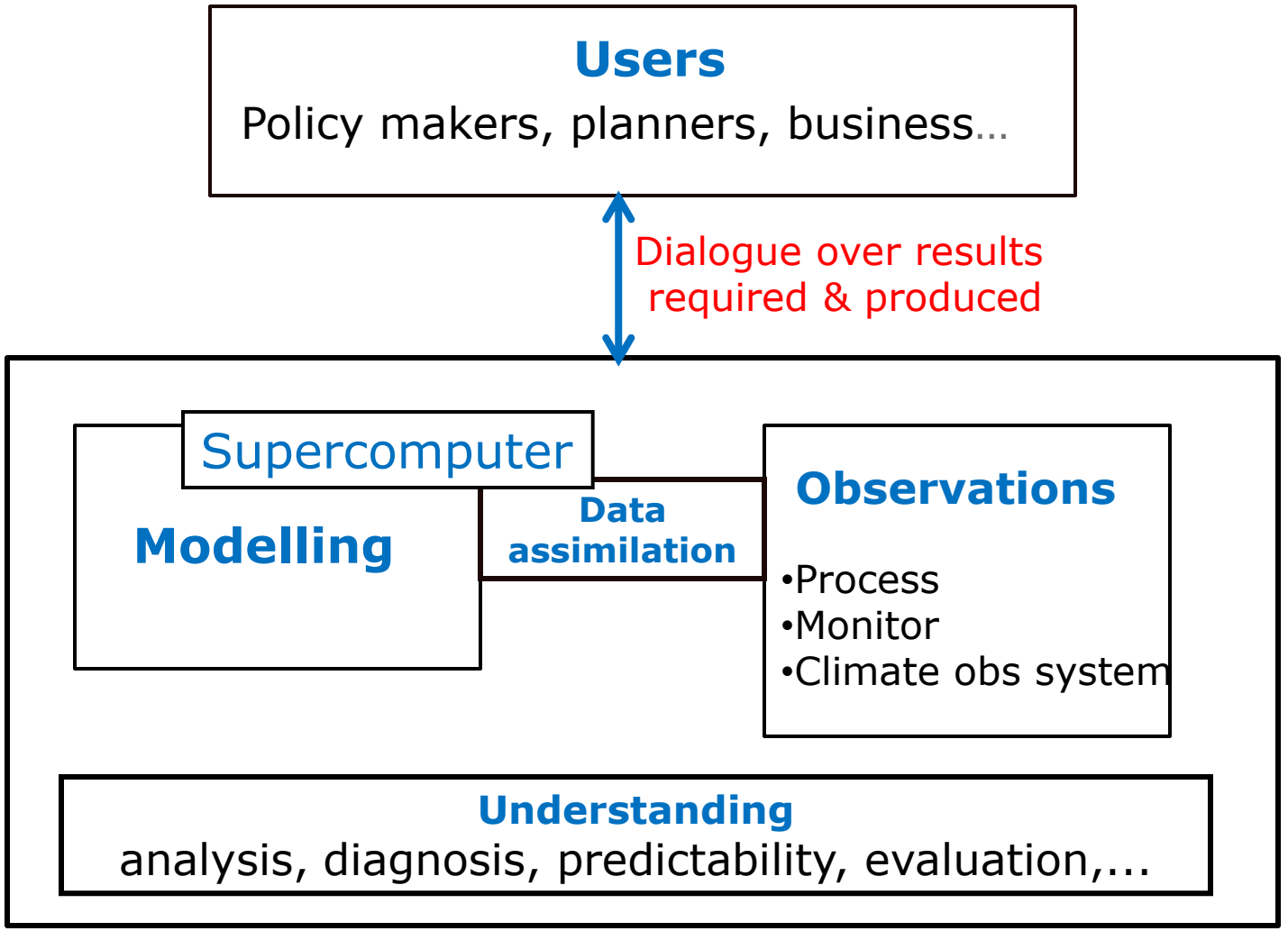
Future:

day..week..month..season..year..decade..century..

block MJO NAO ENSO PDO THC

1. Climate in a region = ensemble of weather
2. Longer time-scales ↔ Weather
3. Initial Value problem + Scenarios + Solar/Volcano
4. Longer time-scales: Impact through Weather
5. Problem Seamless; Approach "Unified"

The Future Climate Prediction System



WMO Global Framework for Climate Services (GFCS)

Developed following World Climate Conference-3 in 2009

WMO with UNESCO, UNEP, FAO, ICSU etc

Components

User interface platform

Climate services information system

Observations & monitoring

Research, modelling & prediction

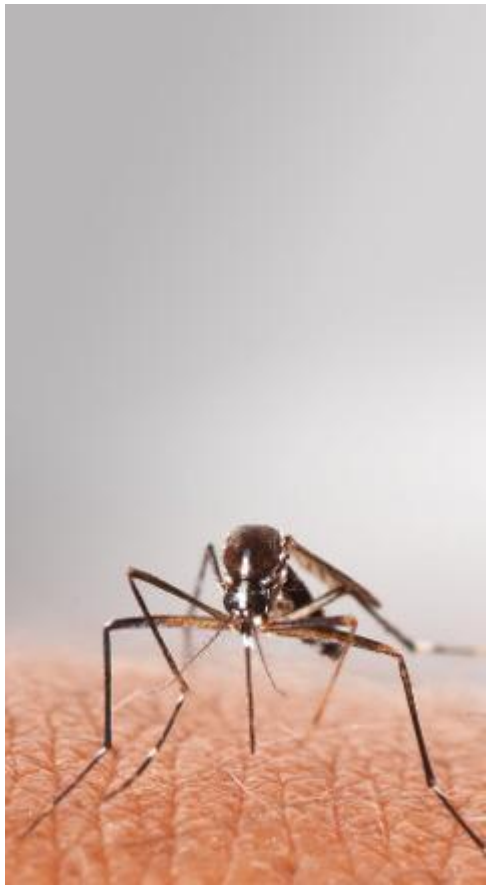
Capacity development

GCFS Priority Areas

Ag & food security

Disaster reduction

Energy



Health

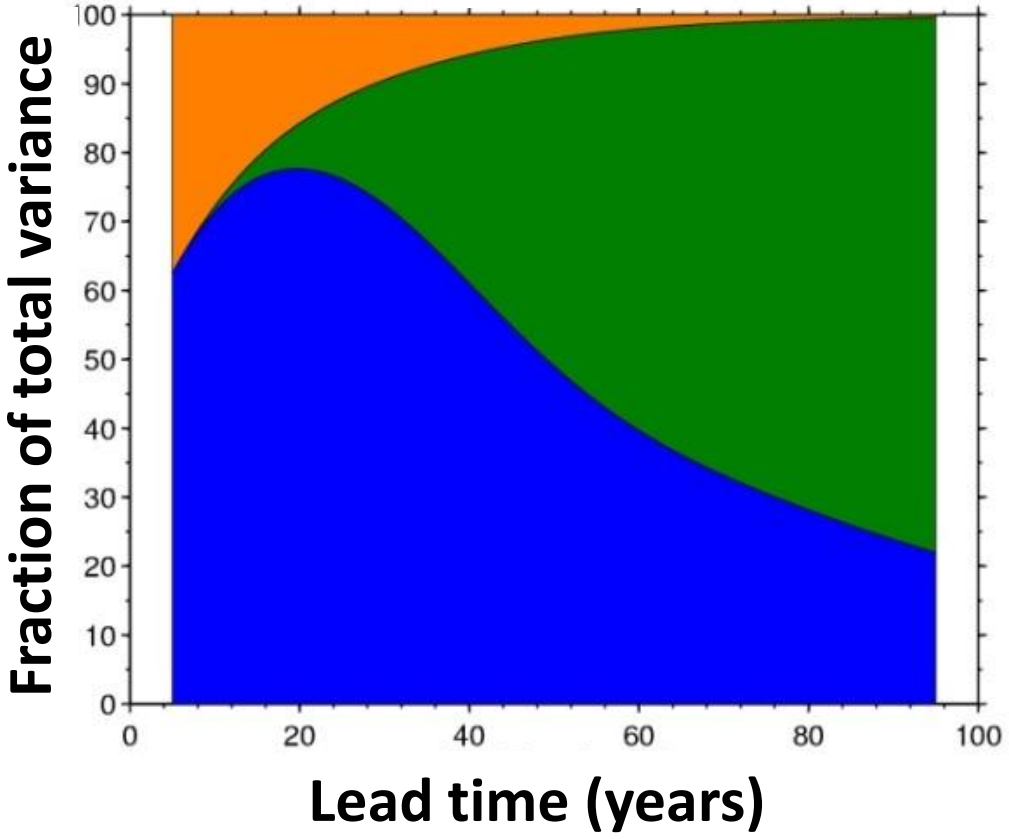
Water

Hawkins & Sutton (2008)

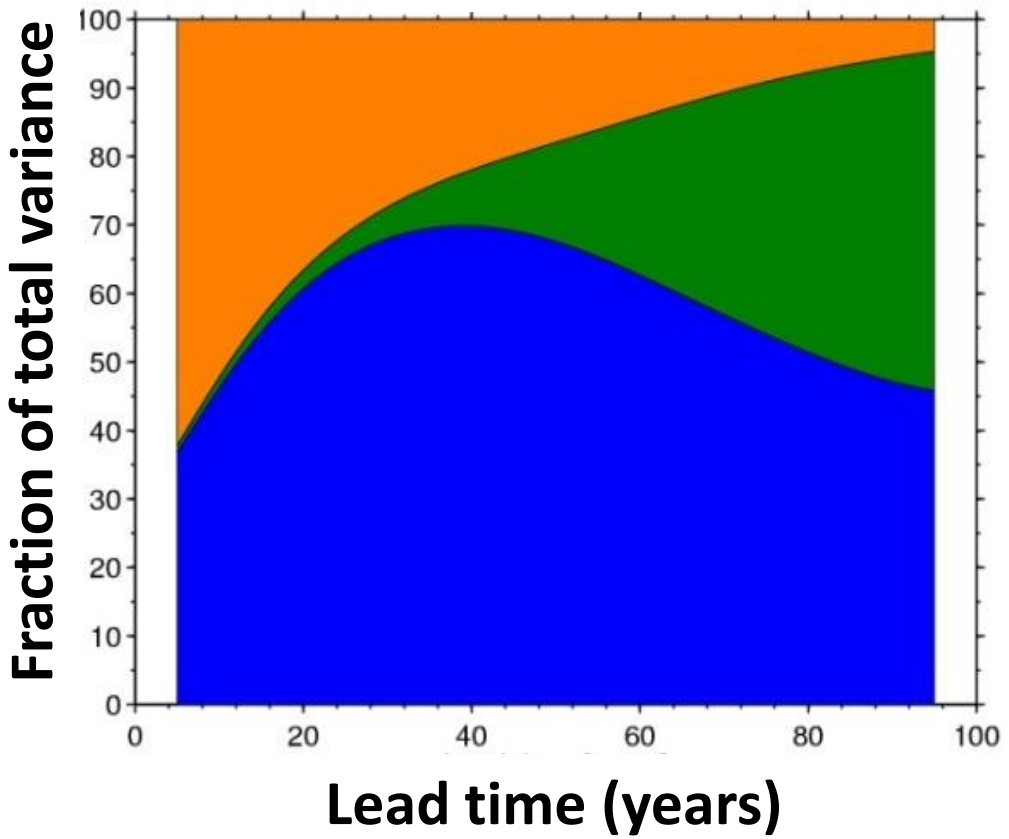
Contribution to uncertainty in decadal mean T

Internal variability
Model uncertainty
Scenario uncertainty

Global



British Isles



Source of Uncertainty	Method of handling
Internal variability	Large ensembles of runs
Model uncertainty	Use a range of models &/or parametrisations
Human activity uncertainty	Use a range of scenarios

Choice of Global Model

- Resolution
- Complexity of physical parametrizations
- More interactive components of the Earth System,

  e.g. vegetation, chemistry & carbon cycle

Tension between these and with the need for many model runs

Evaluation of performance of global model

How good does it have to be?
With what accuracy should it reproduce e.g.

- 20^{th} century global T
- Seasonal cycle
- Patterns of variability:

blocking, MJO, ENSO, NAO, PDO, … glacial cycles..

What do we do about the model imperfections?

Embedded Regional Climate Models (RCMs)

Purpose: provide local detail & weather

- RCMs cannot correct larger scale errors in the global model
- They can provided detail such as that due to orography,

  partition rainfall into convective and non-convective

The realism of the detail in an RCM should not obscure the dependence of its results on the global model and any errors in it

Use of model data in climate projection data for users

1. Provide the broad context,

   e.g. increase local/regional T by amount suggested by models

2. Combine with physical understanding to produce bounds on changes

3. Combine data from different models & model runs

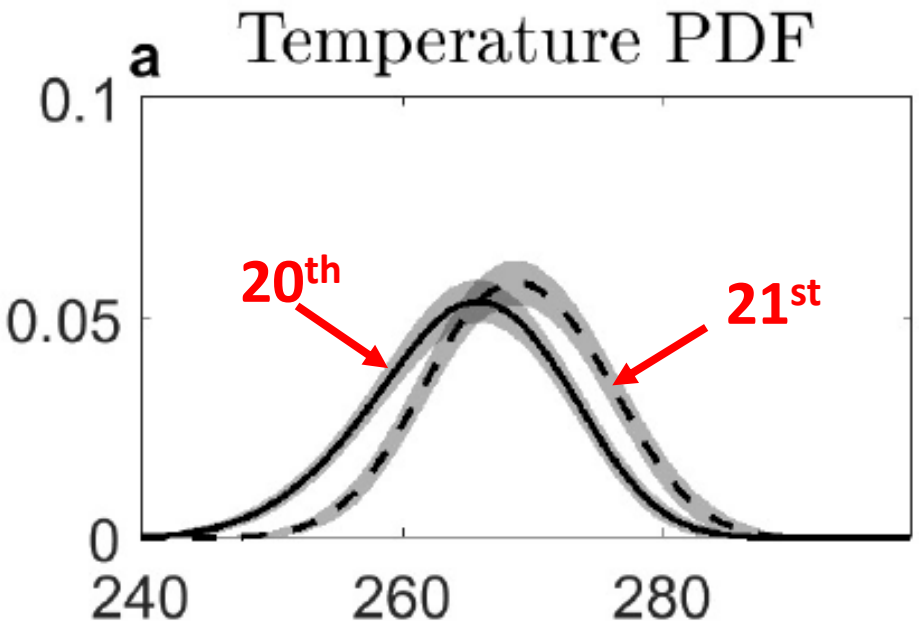
   to produce “pdfs” of variables of interest

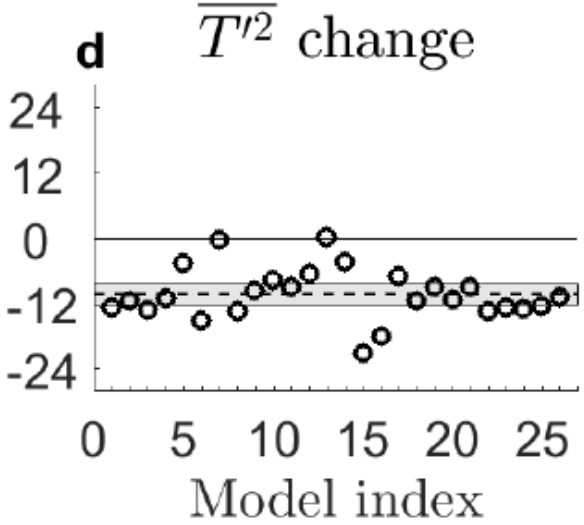
4. Provide the local/regional daily data from a number of runs of “good” models

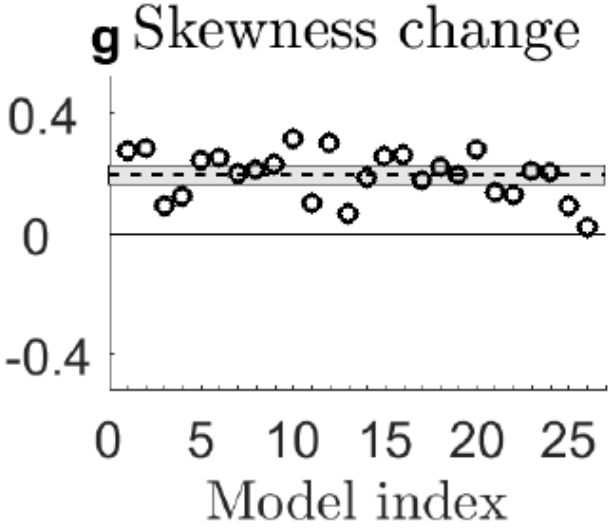
   – storylines

Winter T850 probabilities at end of 20th and 21st Centuries for Mid-West USA based on all CMIP5 models

Tamarin-Brodsky et al, submitted







Concluding comments

Climate services for use on all time-scales;

today focus decades in 21st century

Some issues raised:

- 2-way interaction with users
- handling uncertainty
- choice of global model
- evaluation of model performance
- embedded regional model
- use of model data in climate projections
- pdfs, meaning & shape