SOUTHEAST ASIA CLIMATE ANALYSIS & MODELLING (SEACAM)

Raizan Rahmat (CCRS)

David Hein (UKMO)

SEACLID Workshop

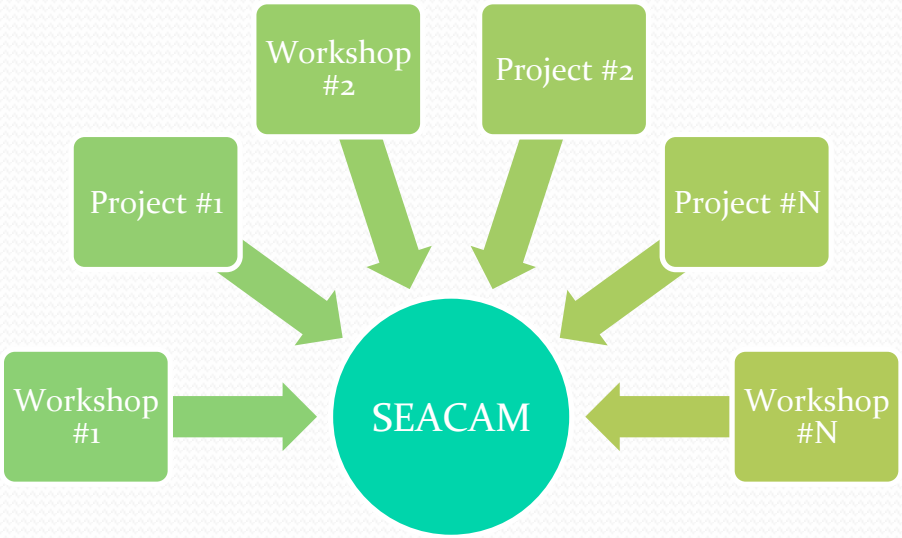
18 Nov 2013

Outline

- Background/objectives
- Workshops
- Preliminary work/report
- Exploring coordination

Objectives of SEACAM

- **Framework to:**
  - Increase **scientific capacity** of the National Met. and Hydro. Services (NMHS) in SE Asia region for **climate analyses and modelling**
  - Enhance regional **scientific cooperation** among SE Asia's NMHS



Workshops

1st

- Kick-started the MOU between CCRS and UKMO
- "Regional Climate Workshop on Modelling Climate Change and Variability in SE Asia" (**10 -12 May '11, Singapore**)

Generate climate indices…

2nd

- "SE Asia Climate Analysis and Modelling Study" (**19 – 20 Jun '12, Singapore**)
- "Observed and Modelled Temperature and Precipitation Extremes over SE Asia from 1972 – 2010" Cheong et al. (in review)

Run climate simulations…

3rd

- "Durian Experiments"
- Climate Projections for SE Asia (**26 – 30 Aug '13, Phnom Penh**)

Technical report writing…

4th

- Coming soon (planned for **Feb 25-27 '14**)
- Discuss "Durian Experiments"/Finalise report

Understanding of past climate trends in the region

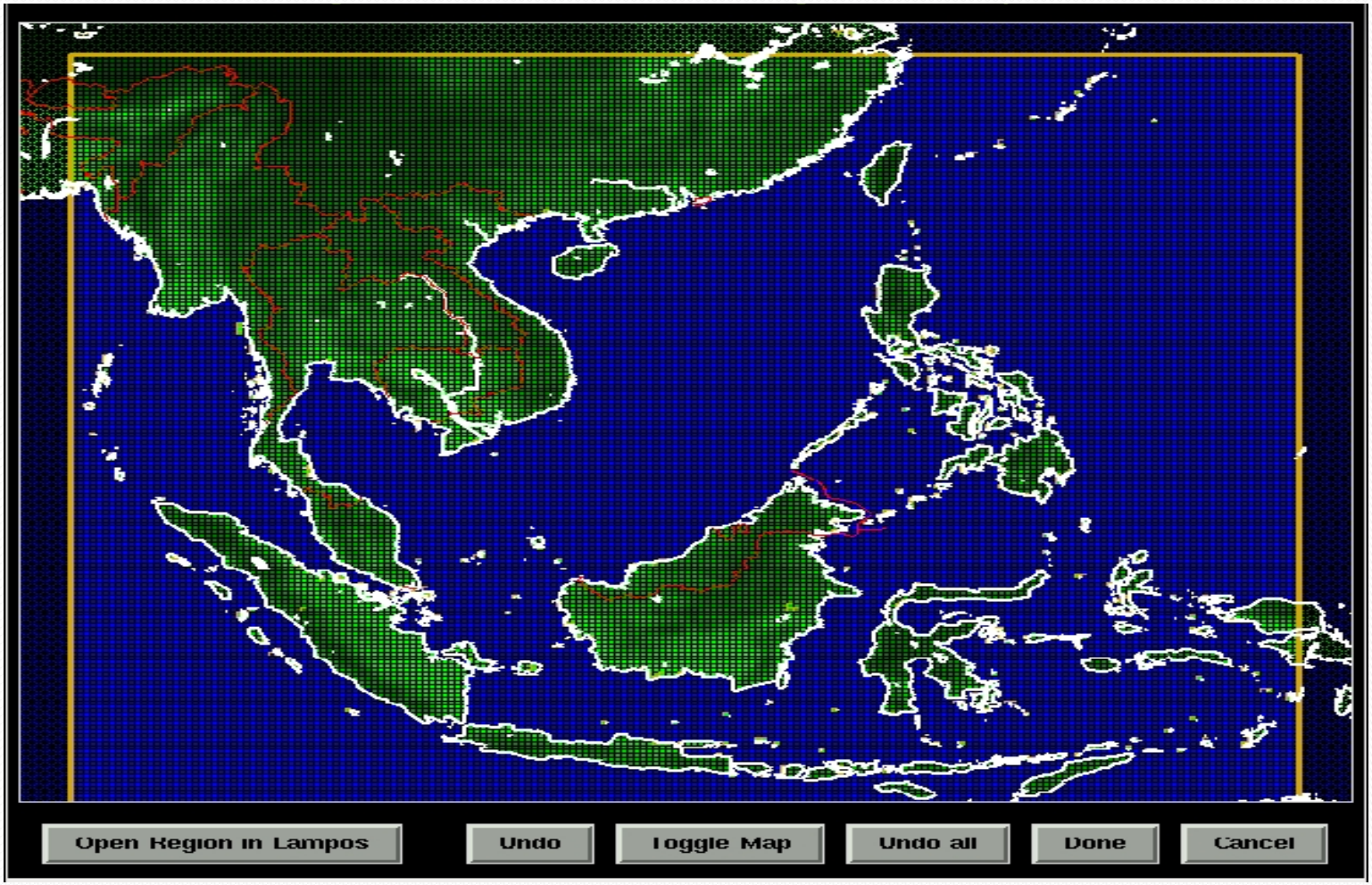
Climate predictability & projections

Durian Experiments (Workshop #3 & #4)

- Climate projections for SE Asia
  - 25 km resolution PRECIS (RCM) downscaling
  - 150 years (A1B), baseline: 1960 - 2000
  - Co-funded by UK Foreign Commonwealth Office & CCRS
- 6 GCMs
  - 5 QUMP members of HadCMQ0, Q3, Q10, Q11, Q13 (out of 17 members)
  - QUMP: perturbed-physics ensemble
    - Plausible values in poorly-constrained parameters in model
  - 1 ECHAM5 + ERA-40 driven reanalysis run

Evaluate against present day observation → Analyse changes between present day-future climate → Technical report for users (April 2014)

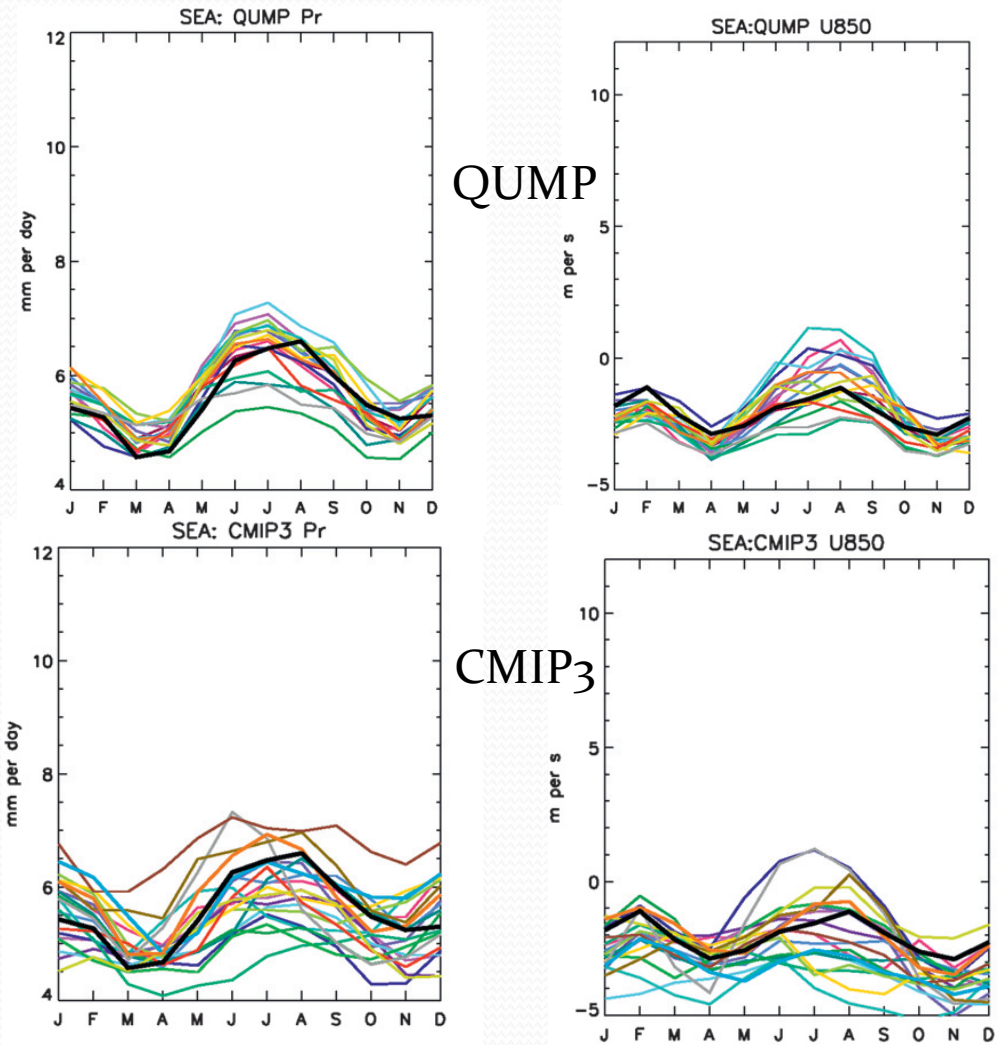
SEACAM's Domain



Initial PRECIS RCM Assessments

- Period: 1970-2000
- PRECIS RCM driven by:
  - ERA-40
  - ECHAM5
  - HadCM3Q0 – standard (unperturbed)
  - HadCM3Q3 – low sensitivity
  - HadCm3Q13 – high sensitivity
  - HadCM3Q10 – simulates rainfall decreases
  - HadCM3Q11 – simulates rainfall increases
- Evaluated against APHRODITE, CRU, etc data
- "Work Packages":
  - Annual cycle*
  - Spatial dist. seasonal precipitation and temperature*
  - Monsoons characteristics (JJAS & DJF)
  - Extreme precipitation and temperature

QUMP and CMIP3 "performance"



Annual Cycle
(obs: CMAP rainfall and ERA40 winds)

McSweeney et al, 2012, J. Clim.

ECHAM5
HadCM3Q13
HadCM3Q11
HadCM3Q10
HadCM3Q3
HadCM3Q0
ERA-40
APHRO_MA

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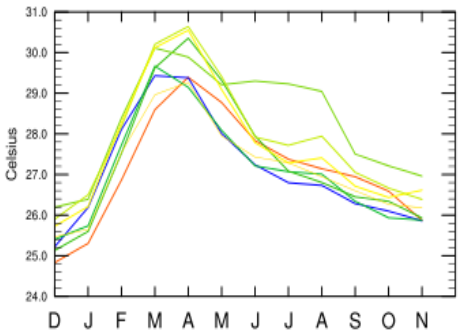
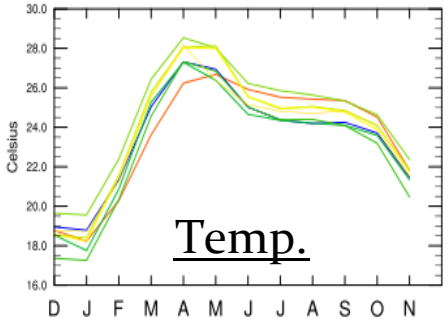
Downscaled simulations (e.g.)

Mean annual surface air temperature cycle for Cambodia

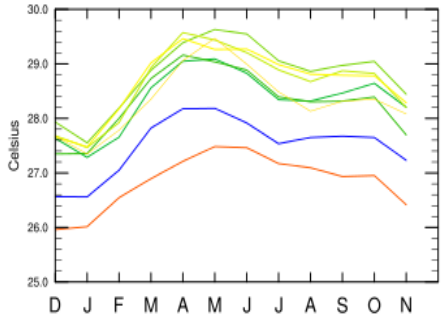


Mean annual surface air temperature cycle for Myanmar

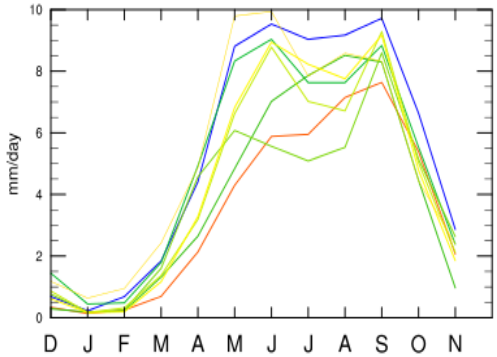


Temp.

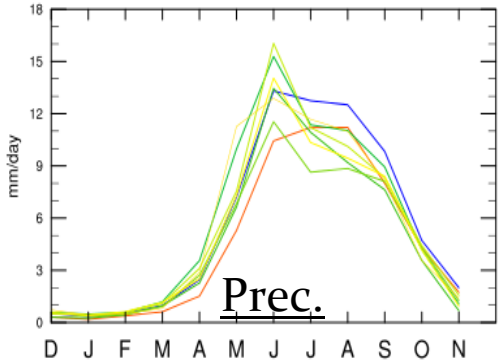
Mean annual surface air temperature cycle for Singapore



Mean annual precipitation cycle for Cambodia

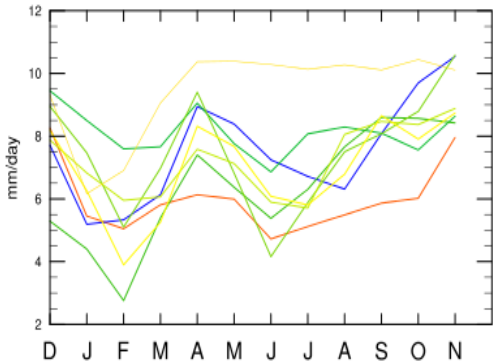


Mean annual precipitation cycle for Myanmar

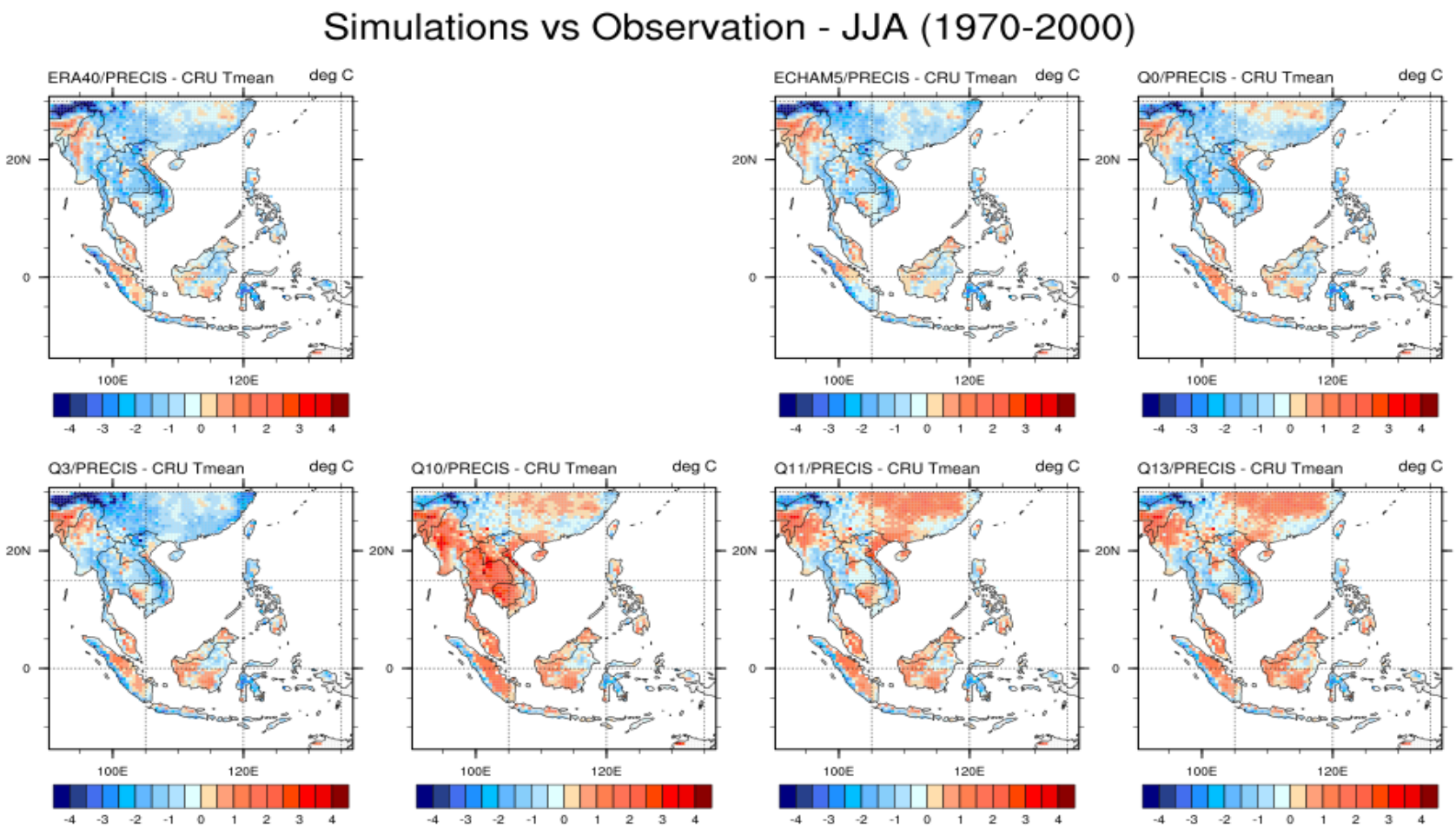


Prec.

Mean annual precipitation cycle for Singapore



Downscaled simulations (e.g.)



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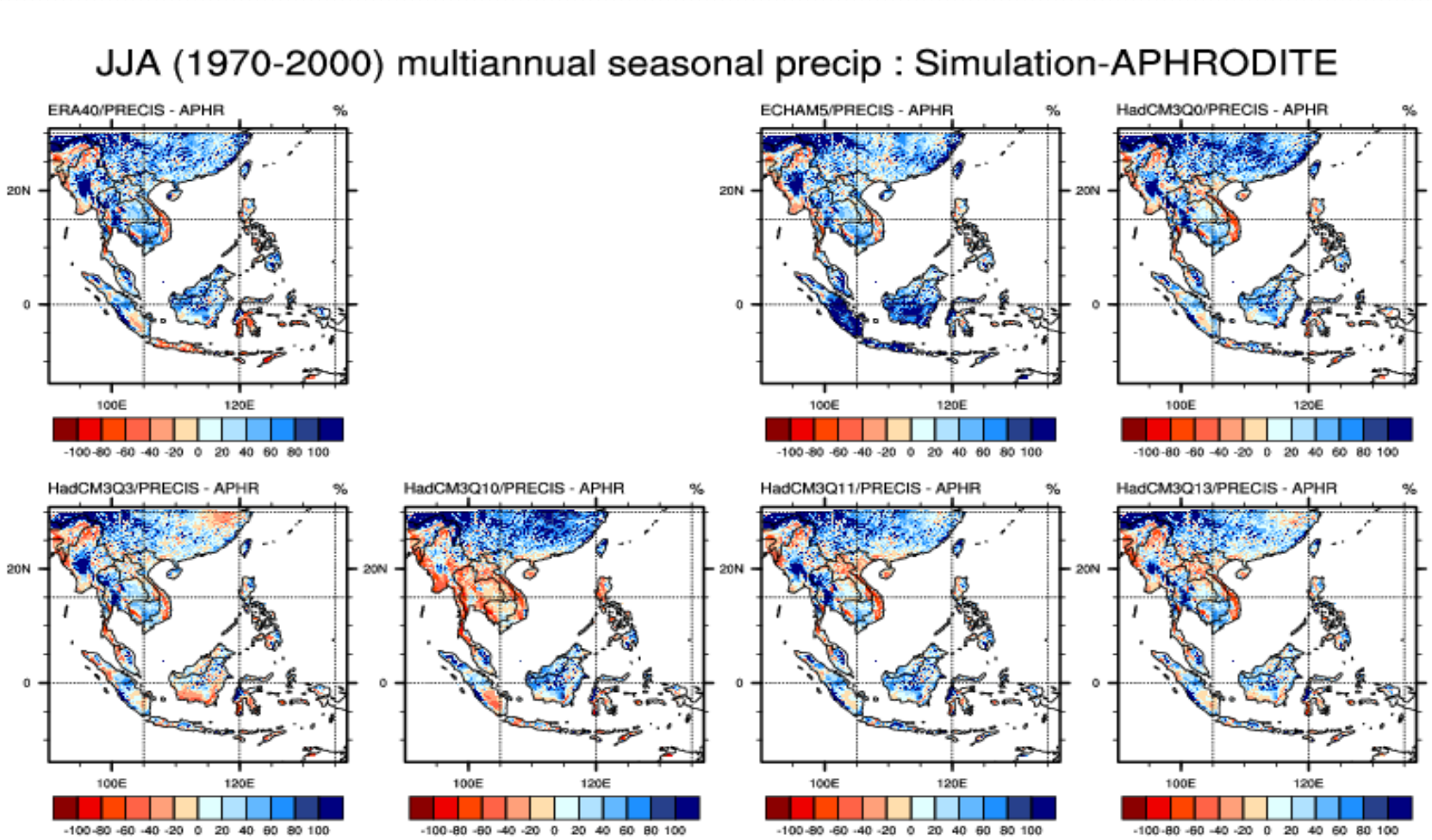


Making SEACLID/Southeast Asia CORDEX complement SEACAM

- David Hein, MSc (University of Reading, 2008)

  Regional Modelling and PRECIS coordinator
  International Development team

- UK Met Office, 2002-present

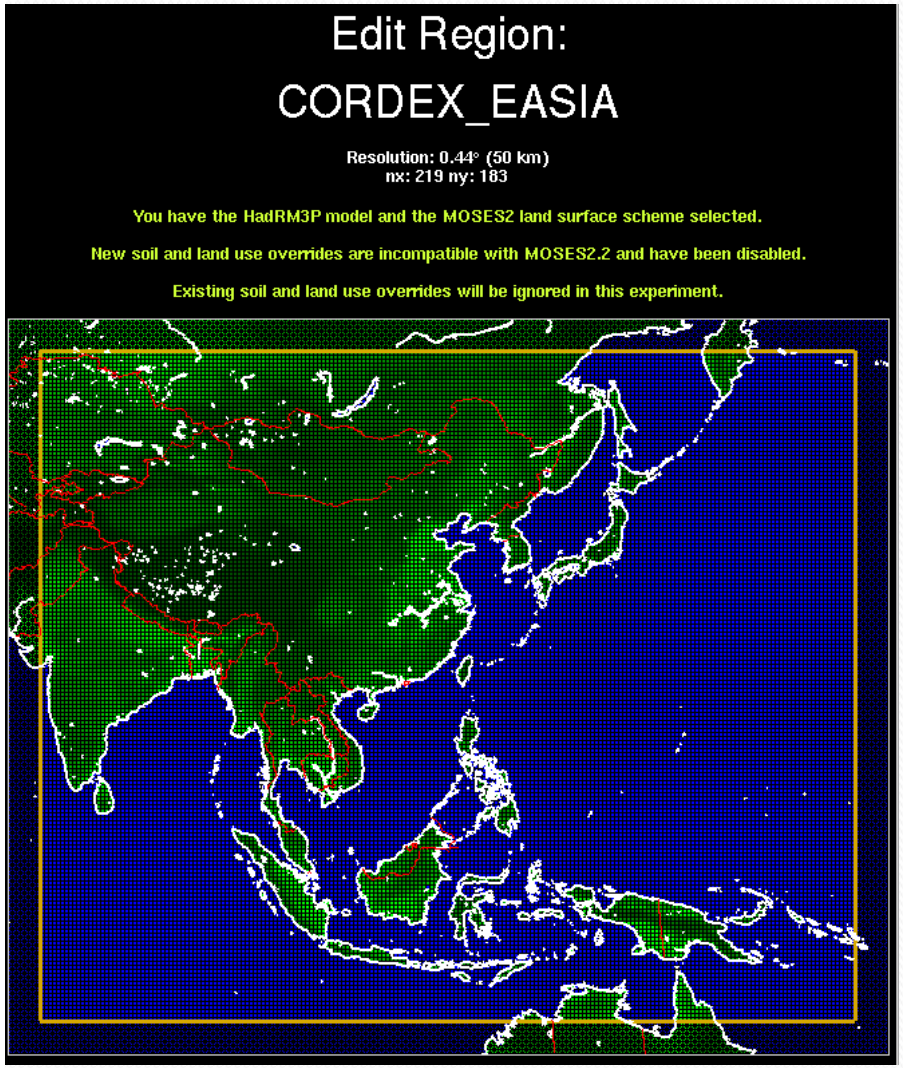
SEACLID/Southeast Asia CORDEX and SEACAM

- Mission Statement:
- CORDEX aims to coordinate international efforts in regional climate downscaling.

UK Met Office involvement in CORDEX

- Dr. Richard Jones from the International Development team at the Met Office was one of the original designers of CORDEX.
- Dr. Wilfran Moufouma-Okia designed the original 11 CORDEX domains using the PRECIS user interface.
- http://wcrp-cordex.ipsl.jussieu.fr/images/pdf/cordex_regions.pdf

CORDEX East Asia domain



A) For rotated polar RCMs (in rotated coordinates):

RotPole (295.22; 77.61)
TLC (319.08; 46.20)
Nx=203
Ny=167

B) For non-rotated polar RCMs (in actual coordinates):

TLC (63.36; 54.80)
CNB (119.89; 58.56)
TRC (175.13; 53.55)
CWB (72.18; 18.91)
CPD (118.96; 22.04)
CEB (165.48; 17.81)
BLC (77.49; -17.24)
CSB (118.46; -14.47)
BRC (159.46; -18.22)

CORDEX history and progress at the UK Met Office

- The original CORDEX domains were designed to reflect realities in computational expense while still providing added value in downscaling
- The resolution was 0.44 degrees * 0.44 degrees
- The Met Office has downscaled the ECMWF ERA-Interim reanalysis over each of the 11 original domains using both HadRM3P (PRECIS) and HadGEM3-RA for model performance evaluation
- Ready to deliver the first set of results to the British Atmospheric Data Centre

Met Office plans for CORDEX

- The Met Office are committed to downscaling a selection of GCMs over the European and African CORDEX domains
- The CMIP5 GCMs to be downscaled will be chosen using the model sub-selection methodology developed by Dr. Carol McSweeney and Dr. Richard Jones
- *McSweeney, Carol F., Richard G. Jones, Ben B. B. Booth, 2012: Selecting Ensemble Members to Provide Regional Climate Change Information. J. Climate,* ***25****, 7100–7121.*

Met Office partnerships in the region

- The Met Office have a track record of working on in both weather and climate capacities with National Meteorological Services and research institutes in Southeast Asia, e.g. CCRS (Singapore), BMKG, the Thai Met Department, the Malaysian Meteorological Department, the Institute of Meteorology and Hydrology of Vietnam, and many more
- Extensive work has been carried out using the PRECIS regional climate modelling system

SEACLID/Southeast Asia CORDEX and SEACAM: Why?

- SEACAM was formed as a multi-nation regional downscaling effort of ASEAN member countries, sort of a proto-type / predecessor to SEACLID
- We have learned a few things along the way. ☺
- SEACAM is on target to publish a report on foundational analysis (temperature, precipitation, extremes and circulation/monsoon) by Q1 2014
- SEACAM includes participants both from National Met Services *and* research institutes (universities)

Complementing Southeast Asia CORDEX: Question 1

- RESOLUTION
- The resolution of SEACAM at 0.22 by 0.22 degrees required about 1.5 years for the six model experiments to complete, even when split between participating institutes
- Running 150 year experiments of the SEACAM domain at 0.11 by 0.11 resolution would require nearly a year even on the Met Office's IBM supercomputer!
- 0.22 by 0.22 is one of the new "standards" for CORDEX experiments, even though *some* experiments have been run at 0.11 by 0.11
- Finally, 0.22 resolution would benefit existing PRECIS users in the region, as the ability to downscale PRECIS at 0.11 is not possible. This is important from a capacity building point of view.

Complementing Southeast Asia CORDEX: Question 2

- DOMAIN
- The SEACAM experiments were run on a rotated pole grid (which PRECIS uses)
- The RCMs selected for SEA CORDEX do not (as far as I know) have the same grid representation, but could they be aligned as closely as possible to the SEACAM domain?
- E.g. Could the SEACLID domain be tweaked to be as co-incident as possible with the SEACAM domain?
- This is one way of increasing the comparability of SEACAM and SEACLID

Complementing Southeast Asia CORDEX: Question 3

- CHOICE OF REGIONAL MODEL
- HadRM3P is now being interfaced with CMIP5 GCMs both for CORDEX and for development of "PRECIS 2.0"
- Why not add HadRM3P, a tried-and-tested regional climate model, to the SEACLID RCMs to be downscaled? Model diversity is one of the most important elements of CORDEX
- The Met Office would offer technical support for this and (possibly) computational time (e.g. HadRM3P downscaled on Met Office systems)

Complementing Southeast Asia CORDEX: Question 4

- CHOICE OF GLOBAL MODELS
- The Met Office can offer the HadGEM2-ES GCM, its own CMIP5 model, for downscaling with HadRM3P
- Furthermore, HadGEM2-ES is *already* being downscaled by RegCM4 in the MENA CORDEX region
- HadGEM2-ES could be a useful GCM to include in the Southeast Asia CORDEX GCMs
- CORDEX Southeast Asia model sub-selection assistance/review??

Complementing Southeast Asia CORDEX: Question 5

- INTERCOMPARISON
- The Met Office CMIP3 models (HadCM3Q – QUMP) downscaled by HadRM3P can also be downscaled by RegCM4
- It would be an interesting “bridge” between SEACLID and SEACAM to compare the results from at least one GCM from SEACAM with a model being used by SEACLID

Complementing Southeast Asia CORDEX: Question 6

- DATA SHARING
- At this point SEACAM is pursuing options on sharing the data on internet web portals
- Could the SEACAM-Durian experiments be hosted on the Southeast Asia CORDEX data portal?

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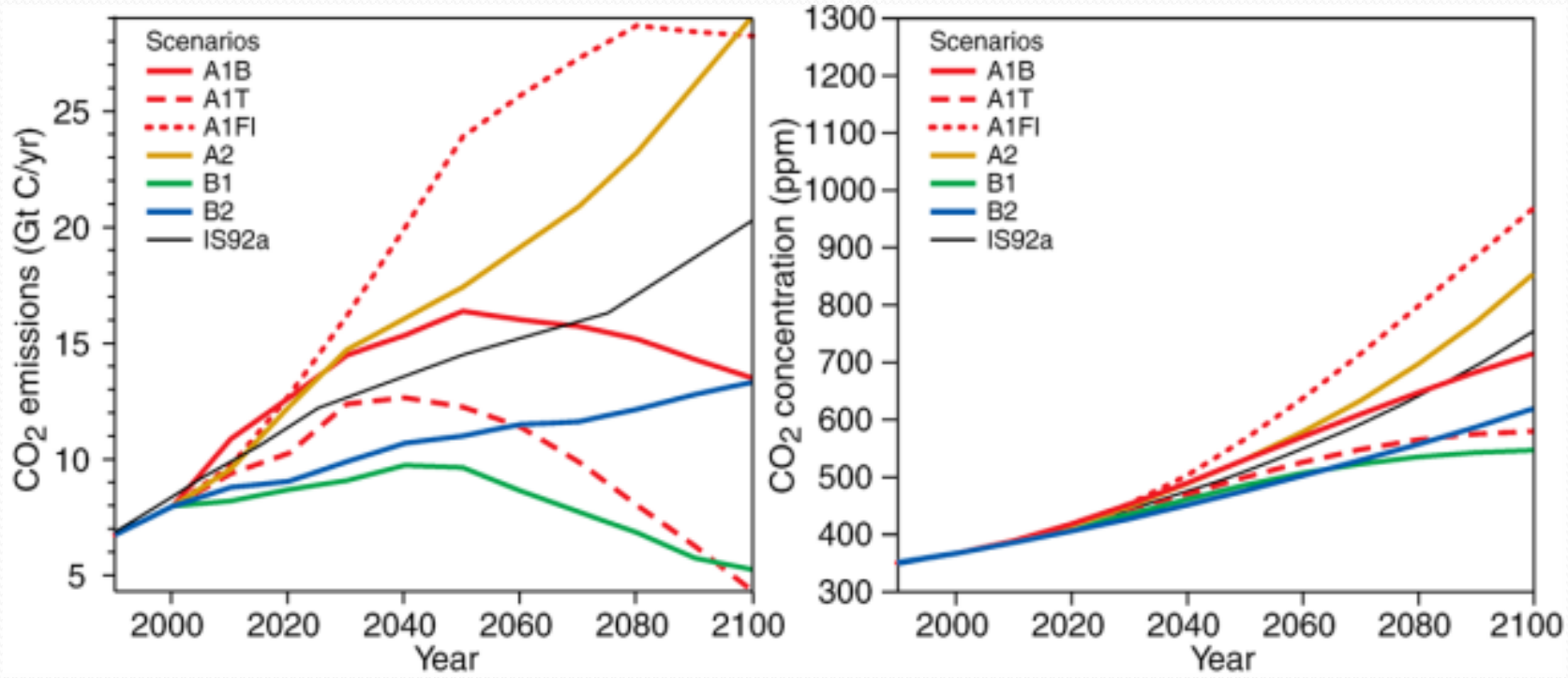
THANK YOU

SUPPLEMENTARY INFORMATION

Scenarios


Scenarios
A1B
A1T
A1FI
A2
B1
B2
IS92a
CO_2 emissions (Gt C/yr)
25
20
15
10
5
2000
2020
2040
2060
2080
2100
Year
CO_2 concentration (ppm)
1300
1200
1100
1000
900
800
700
600
500
400
300

RCPs vs Scenarios

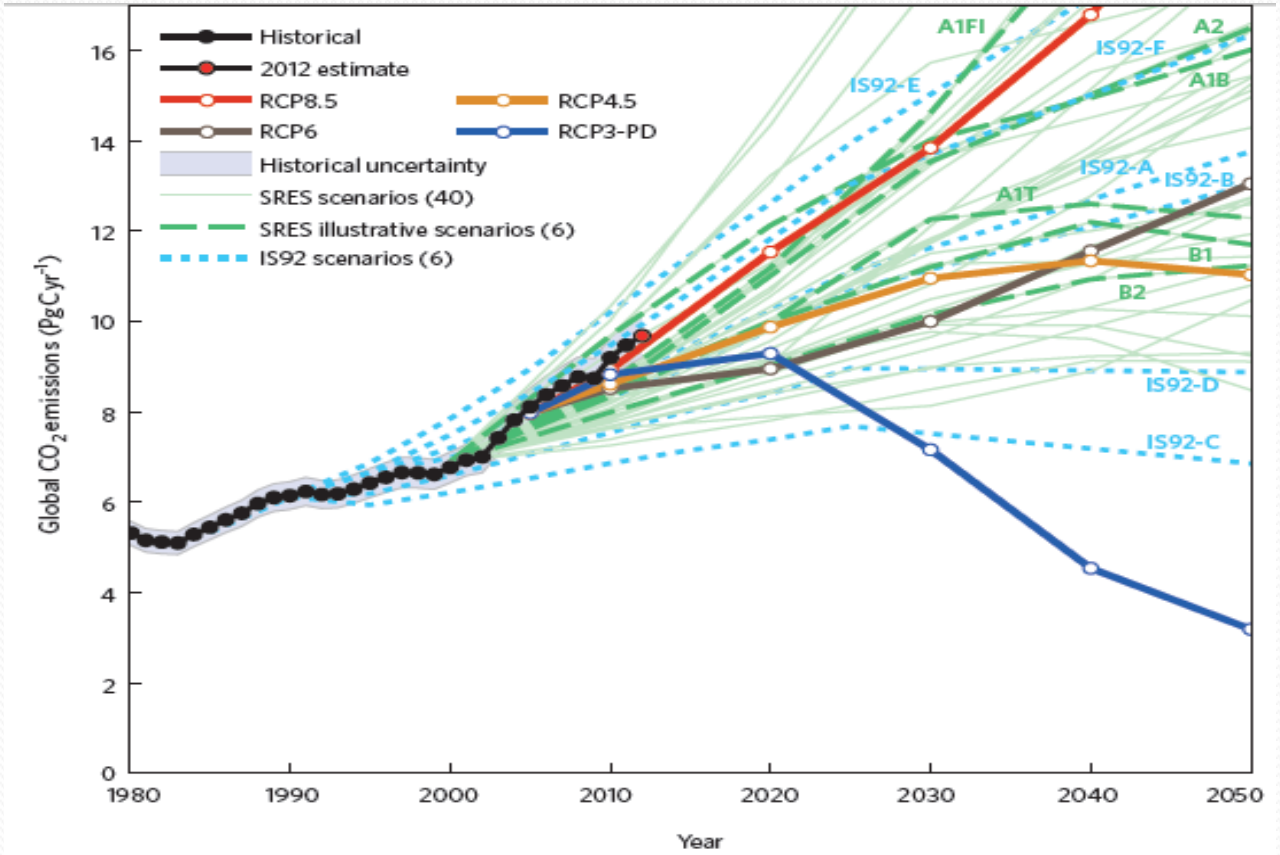


Figure 1 | Estimated CO_2 emissions over the past three decades compared with the IS92, SRES and the RCPs. The SA90 data are not shown, but the most relevant (SA90-A) is similar to IS92-A and IS92-F. The uncertainty in historical emissions is ±5% (one standard deviation). Scenario data is generally reported at decadal intervals and we use linear interpolation for intermediate years.

V2

- 5-10 CMIP5 GCMs
- 2 RCPs (4.5/8.5)
- PRECIS3
- ~12km approx.