Update on Cordex-AustralAsia domain

J. Katzfey (CSIRO)
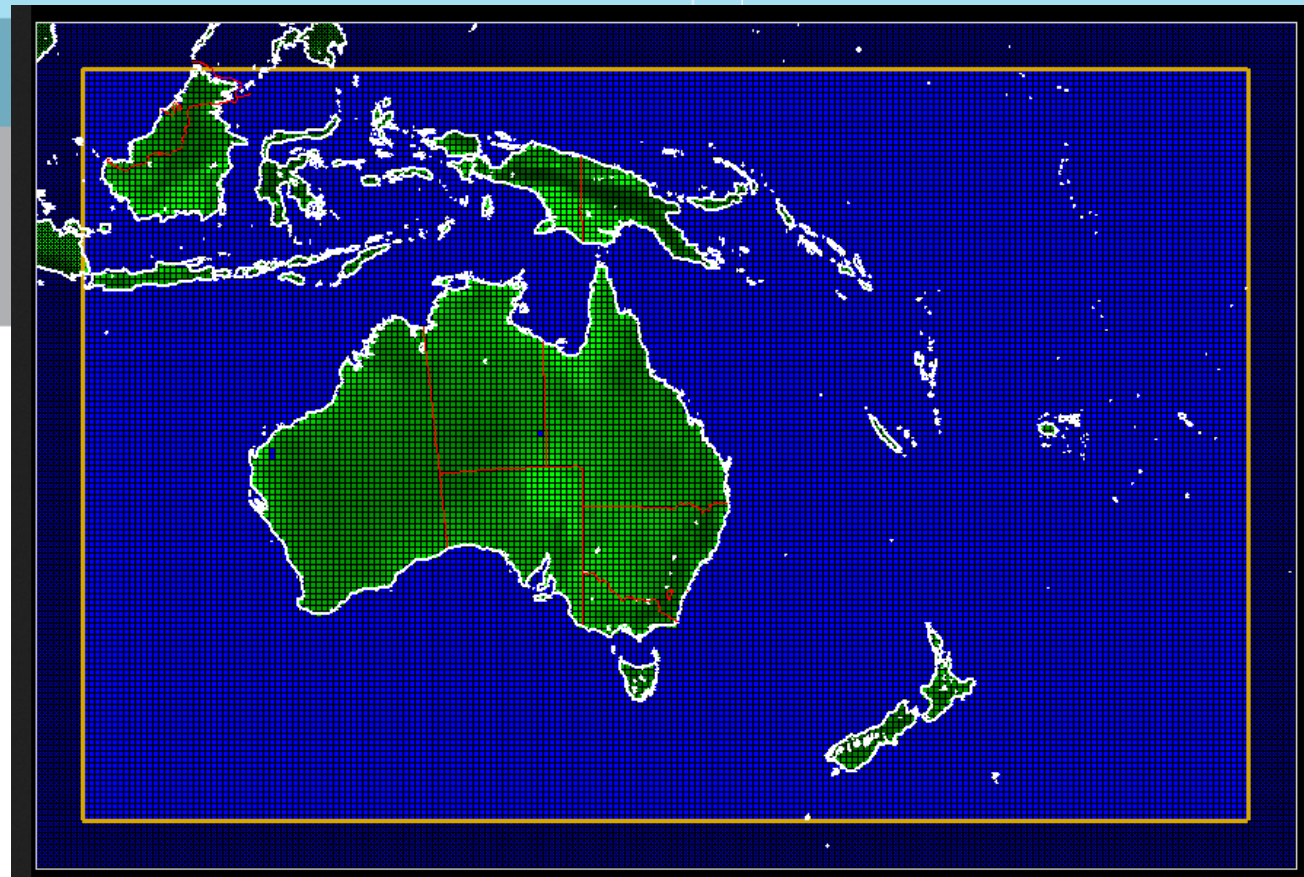
Australia

with contributions from

J. Evans (UNSW)

Bertrand Timbal (BoM)

and others

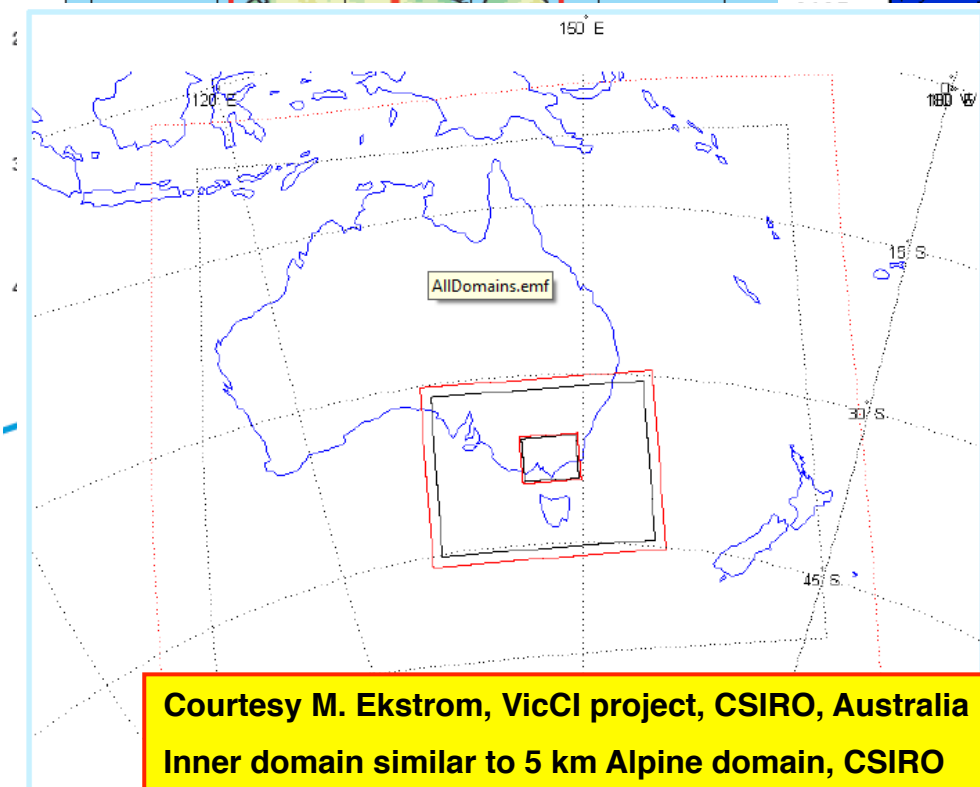Australian Government
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CORDEX-Oz   update

	RCM (group)			
GCM	COSMO-CLM (Institute of Coastal Research HZG, Germany)	CCAM (CSIRO, Australia) [& Queensland government]	WRF (3-member multi-physics ensemble) (Uni. of New South Wales, Australia) Currently doing NARCLIM runs (CMIP3)	BoM-SDM (Bureau of Met., Australia) Statistical technique Australian continent R, T_{max}, T_{min} only
ERA-Interim	🟦	🟦	🟩	🟦
MPI-ESM-LR	🟦	🟦		🟦
EC-Earth	🟦		🟨	🟦
HadGEM2-ES	🟦			
CNRM-CM5	🟦	🟦		🟦
ACCESS 1.0		🟦		🟦
CCSM4		🟦	🟨	🟦
NorESM1-M		🟦		🟦
GFDL-CM3		🟦		
ACCESS 1.3			🟨	🟦
An other 15 GCMs				🟦

CORDEX-Oz sub-domain

Sub-Domains

NARCLIM Domain
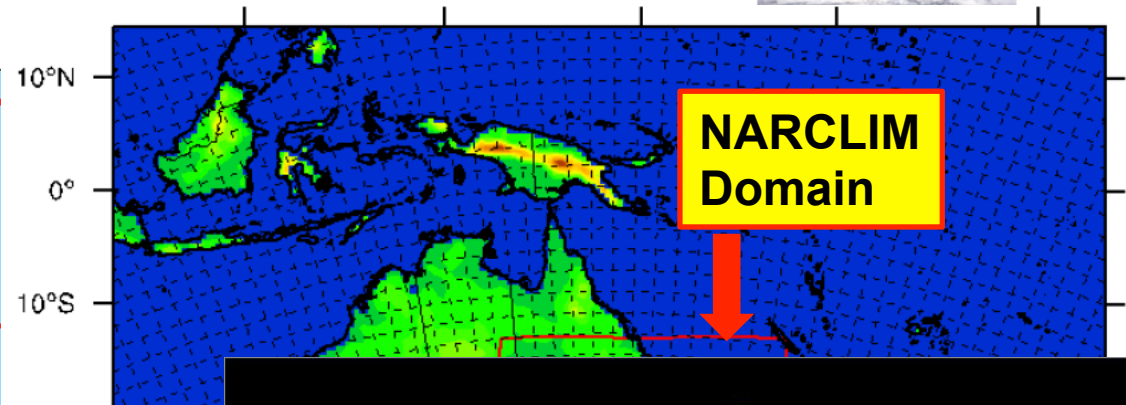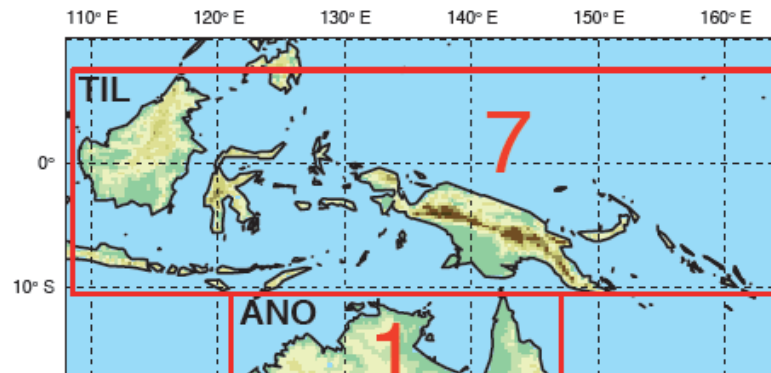
Courtesy M. Ekstrom, VicCI project, CSIRO, Australia

Inner domain similar to 5 km Alpine domain, CSIRO
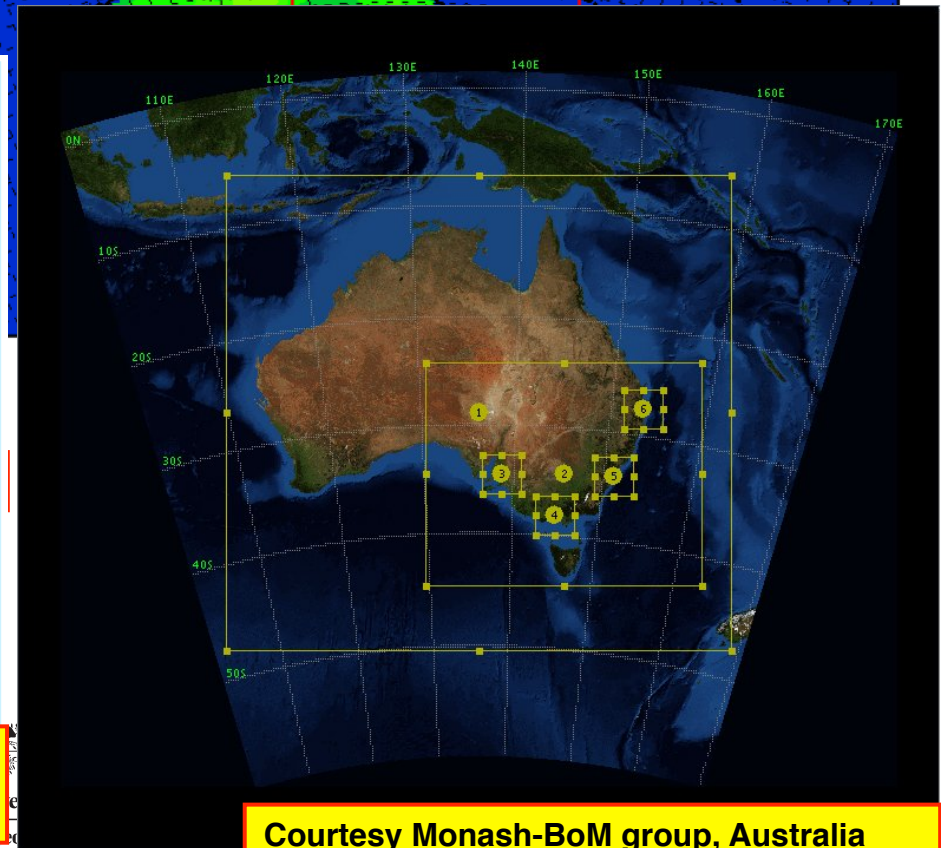
Courtesy Monash-BoM group, Australia

CORDEX-Oz   wikipage

CORDEX-AustralAsia wikipage

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Welcome to CORDEX AustralAsia wikipage

This is the RCM users wikipage that includes information about the CORDEX (COordinated Regional climate Downscaling Experiment) project over the AustralAsian region.

- Further information about the CORDEX project can be found here
- The main CORDEX data archive can be found here

If you would like to contribute RCM simulations to CORDEX-AustralAsia please contact Daniel Argueso to join this wikipage.

CORDEX Australasia has a now a mailing list. If you want to join it, please click the link below:
https://groups.google.com/d/forum/cordexaustralasia

page revision: 17, last edited: 31 Jan 2013, 01:23 (469 days ago)

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Join the conversation at: http://cordex-australasia.wikidot.com/start

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The Centre for Australian Weather and Climate Research
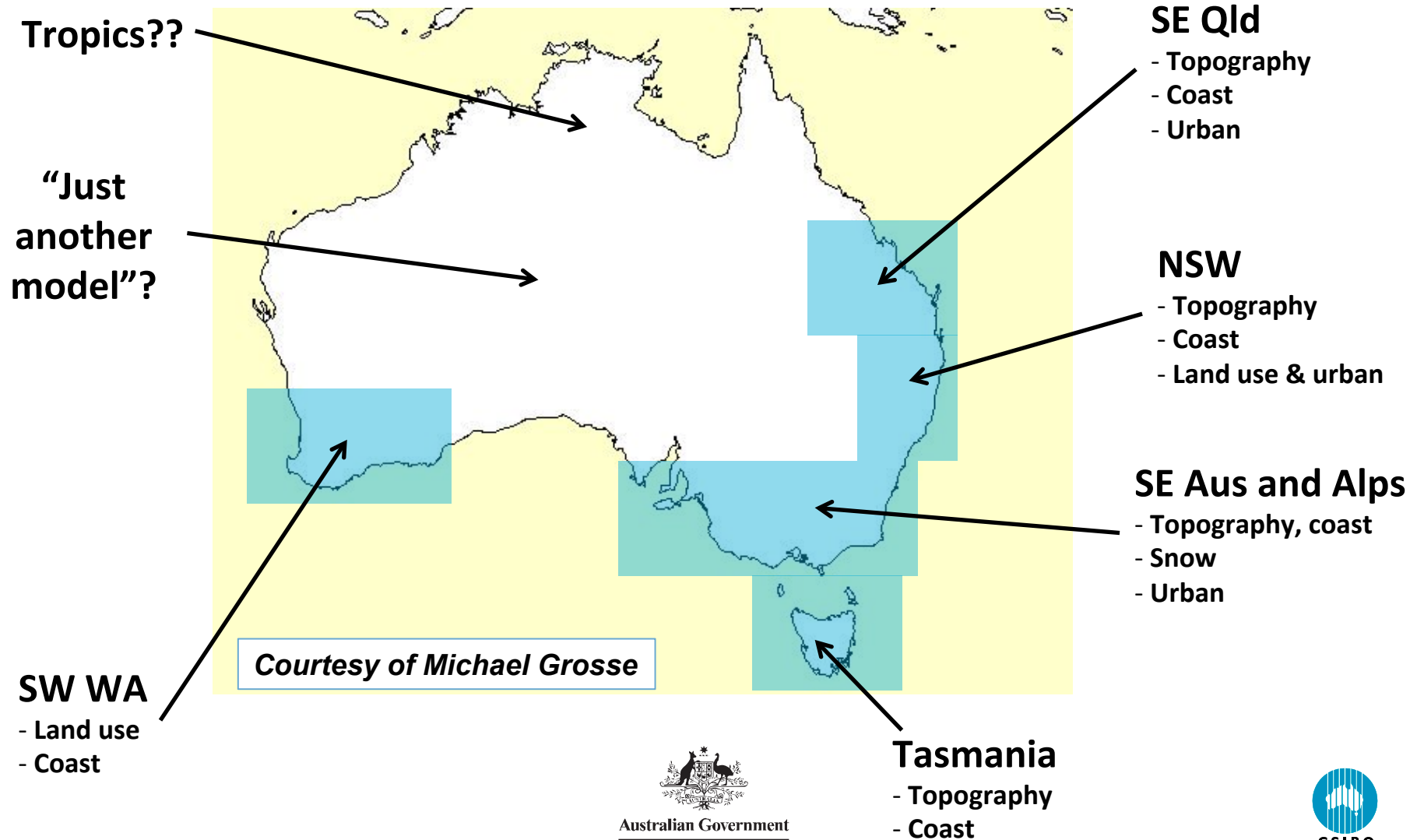A partnership between CSIRO and the Bureau of Meteorology

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Context for current work (funding)

- Delivery of a new set of national climate change projections across the Australian continent

- To be released in 2014 (superseding 2007 projections)

- Application ready datasets

- Downscaling is part of the mix (dynamical & statistical)

- Well defined user-needs (NRM groups)

- Planning (risk management and opportunities)

1 – Monsoonal North
2 – Wet North
3 - Rangelands
4 – Darling Basin
5 – Murray Basin
6 – East Coast
7 – Southern Slopes
8 – Southern and South-Western Flatlands

Added value of Downscaling

Tropics??

"Just another model"?

SE Qld
- Topography
- Coast
- Urban

NSW
- Topography
- Coast
- Land use & urban

SE Aus and Alps
- Topography, coast
- Snow
- Urban

SW WA
- Land use
- Coast

Tasmania
- Topography
- Coast

Courtesy of Michael Grosse

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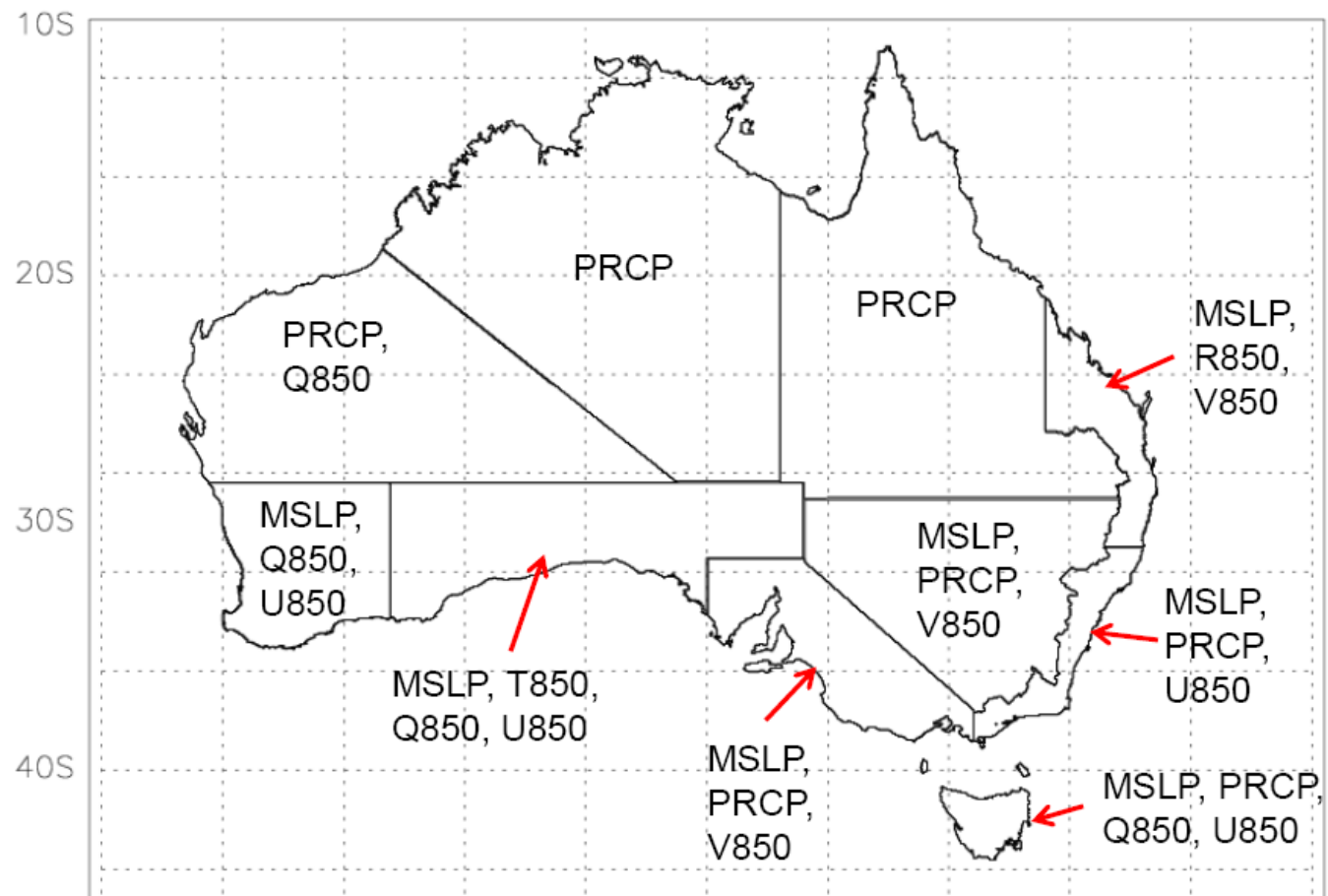
Application Australia wide of the BoM-SDM:

- Optimisation of individual SDMs

- 4 seasons *
  10 climate regions
  * 3 predictands
  =120 individual
  SDMs

- Applied using gridded predictands: Rainfall, Tmax, Tmin

Map of Australia with climate regions labelled:

PRCP

PRCP

PRCP, Q850

MSLP, R850, V850

MSLP, Q850, U850

MSLP, PRCP, V850

MSLP, T850, Q850, U850

MSLP, PRCP, U850

MSLP, PRCP, V850

MSLP, PRCP, Q850, U850

E.g. Combination of optimum predictor: Winter Rainfall

Conformal Cubic Atmospheric Model

- **Based upon projection onto cube**

- **Semi-Lagrangian, Semi-Implicit**

- **Range of physics options**

- **Bias and variance corrected SST projections from GCMs (warming ΔT is preserved)**
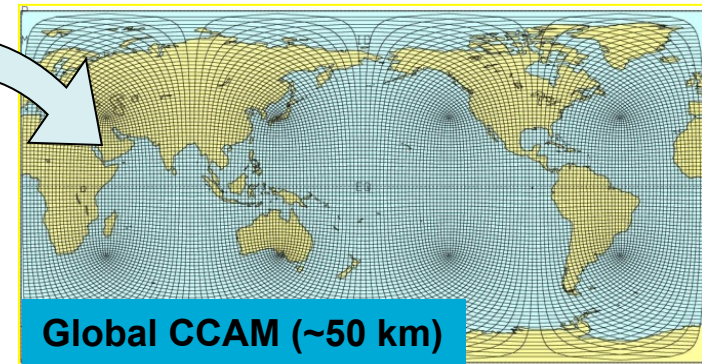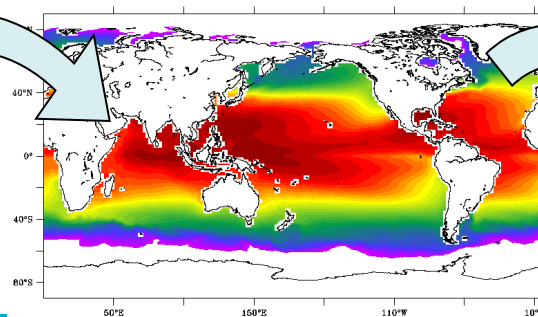
New features
- **Chemistry transport modelling for aerosols**
- **New GFDL radiation code**
- **Urban model**
- **Updated convection scheme**
- **Updated land surface scheme**
- **Parallel IO and improved scaling**

Corrected SSTs

Global Climate Model (~200 km)

Global CCAM (~50 km)

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GCM Selection Requirements
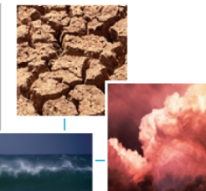
Rank	GCM	Average Score
1	CNRM-CM5	0.31
2	CCSM4	0.34
3	ACCESS1.3	0.35
4	NorESM1-M	0.35
5	ACCESS1.0	0.39
6	MPI-ESM-LR	0.41
7	GFDL-CM3	0.42
8	HadGEM2-CC	0.44
9	MIROC4h	0.46
10	MIROC5	0.47
11	GFDL-ESM2M	0.48
12	MRI-CGCM3	0.51
13	HadCM3	0.53
14	IPSL-CM5A-MR	0.53
15	HadGEM2-ES	0.54
16	FGOALS-g2	0.57
17	CSIRO-Mk3.6.0	0.57
18	inmcm4	0.61
19	CanESM2	0.61
20	MIROC-ESM-CHEM	0.69
21	GISS-ES-H	0.70
22	IPSL-CM5A-LR	0.71
23	FGOALS-s2	0.80
24	MIROC-ESM	0.84

- **Good performance in present climate**
  - Simulation of rainfall, air temperature etc.
  - Reproduce observed trends

- **Good SSTs**
  - ENSO pattern/frequency
  - SST distribution

- **Range of climate change signals**
  - Different SST changes

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CSIRO contributions to CORDEX Australasia

CCAM 50 km global even grid

- Bias and variance correct SSTs from selected GCMs
- Six GCMs downscaled 1970-2100
  - CNRM-CM5, ACCESS1.0, CCSM4, MPI-ESM-LR, NorESM1-M, CFDL-CM3
- Two RCPs: 4.5 and 8.5
- More runs planned (TBD) with CSIRO, QLD and South Africa

QCCEE (QLD)

- 20 km stretched grid over Australia
- 4 CSIRO Mk3.6 ensemble members
  - 1st set with no SST correction and with atmospheric forcing (filter)
  - 2nd set with SST bias correction and without atmospheric forcing
- Two RCPs: 4.5 and 8.5
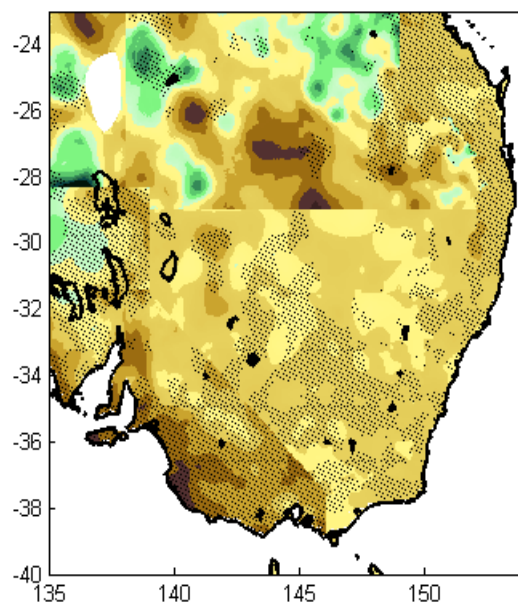
SE Australia 5 km CCAM simulations

- Six GCMs, RCP8.5
- Time slices: 1961-2010 and 2070-2100
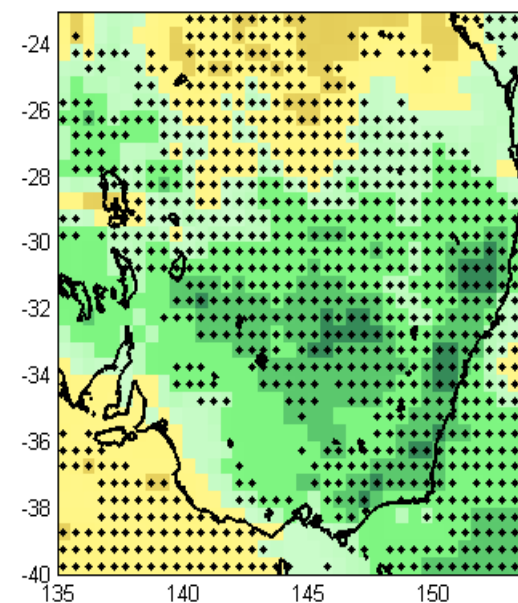- Input to NERP project for Alps

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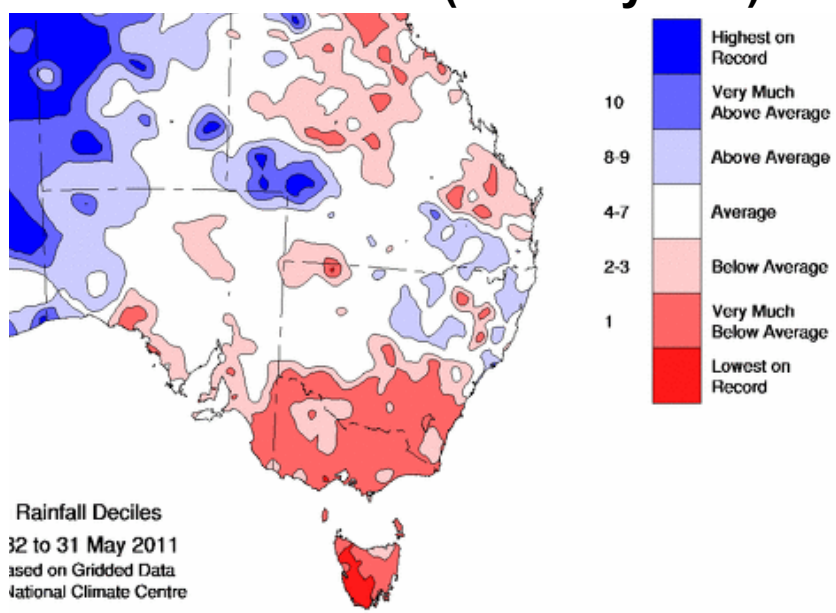
CSIRO

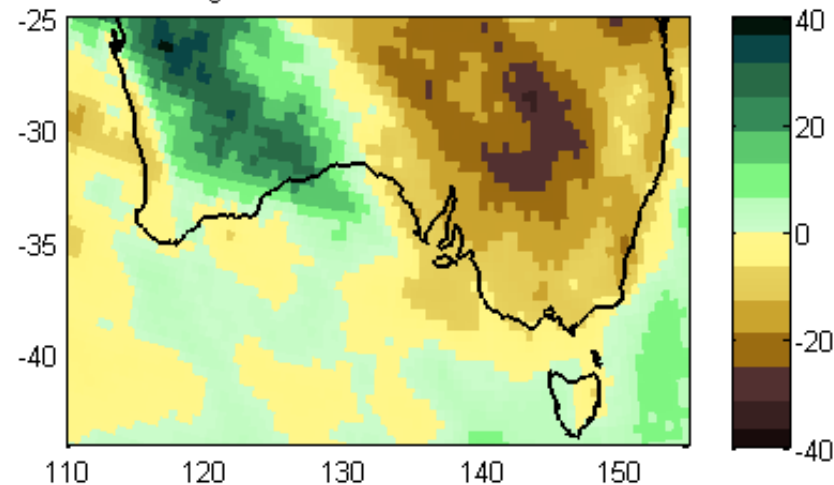b. Autumn rainfall change (%), RCP8.5 to 2090

5 x GCMs
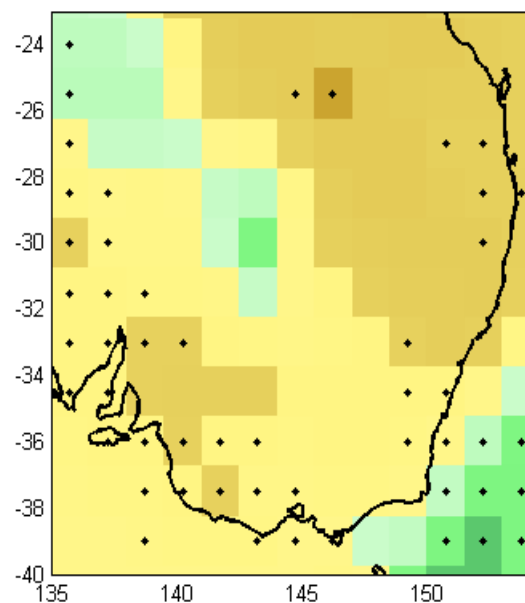
5 x SDM

5 x CCAM

Observed decline (last 30 years)

COSMO-CLM autumn change RCP8.5 1986-2005 to 2075-2094 in % - model mea

Highest on Record

Very Much Above Average

Above Average

Average

Below Average

Very Much Below Average

Lowest on Record

Rainfall Deciles
32 to 31 May 2011
ased on Gridded Data
National Climate Centre

Rainfall changes mid-century (mm/day) CCAM 20 km downscaled from

	Bias corrected SST No atmospheric forcing	No bias corrected SST With atmospheric forcing
RCP 8.5		
RCP 2.6		
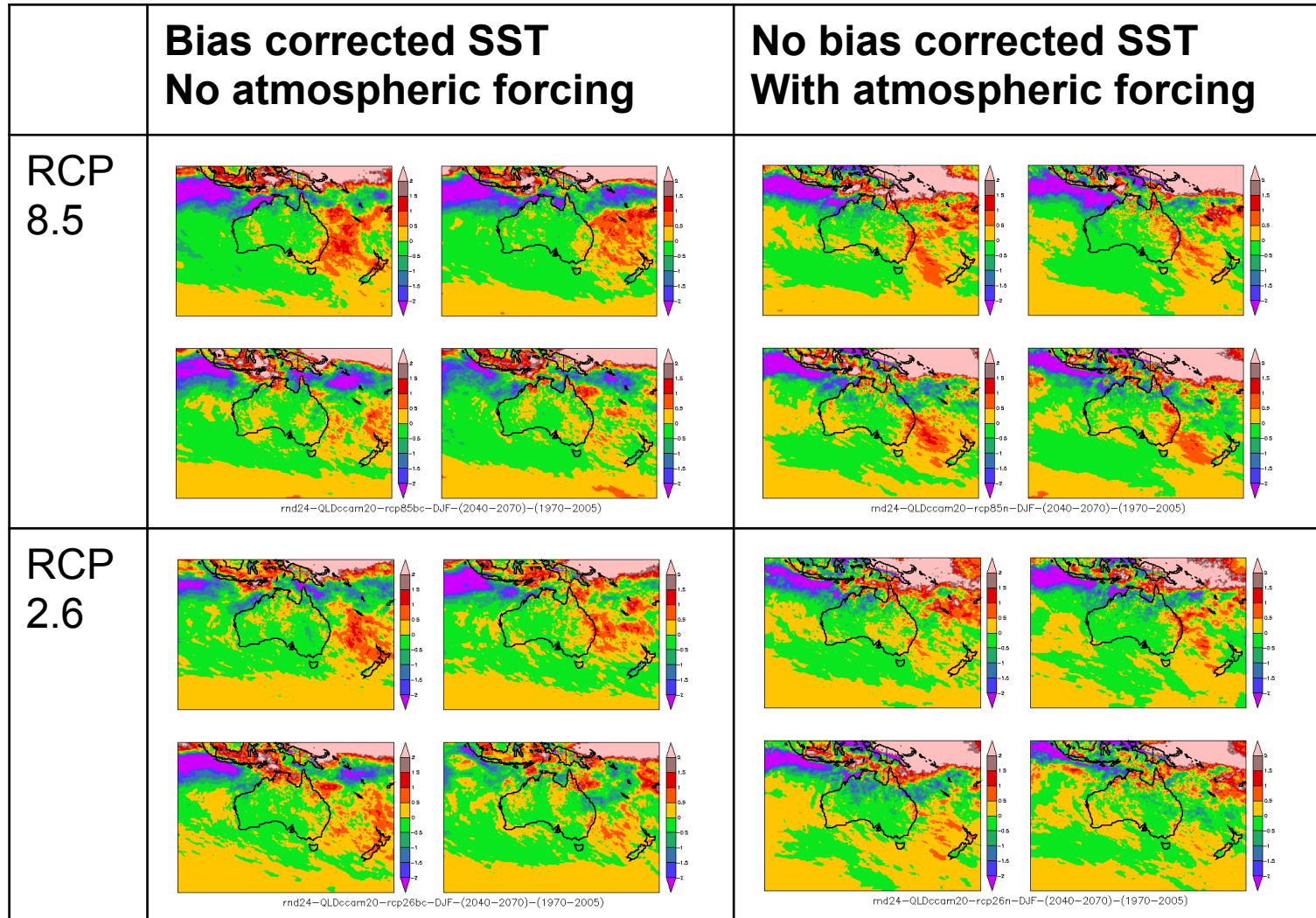
Summer (DJF) changes from each of the 4 ensemble members for each set are shown

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Delivery mechanism: Climate Futures Tool

		Annual Surface Temperature (°C)			
		Slightly Warmer < 0.50	Warmer 0.50 to 1.50	Hotter 1.50 to 3.00	Much Hotter > 3.00
Annual Rainfall (%)	Much Drier < -15.00			Likelihood: 1 of 23 GCMs (4%) No downscaling	
	Drier -15.00 to -5.00		Likelihood: 13 of 23 GCMs (56%) 14 of 18 Analogue downscaling *Link 1* 9 of 12 WRF simulations-NARCLIM *Link 2* 5 of 6 CCAM simulations-CFT *Link 3*	Likelihood: 2 of 23 GCMs (8%) 1 of 18 Analogue downscaling *Link 1* 1 of 12 WRF simulations – NARCLIM *Link 2* 0 of 6 CCAM simulations for CFT *Link 3*	
	Little Change -5.00 to 5.00		Likelihood: 6 of 23 GCMs (26%) 2 of 18 Analogue downscaling *Link 1* 2 of 12 WRF simulations – NARCLIM *Link 2* 1 of 6 CCAM simulations for CFT *Link 3*	Likelihood: 1 of 23 GCMs (4%) No downscaling	
	Wetter 5.00 to 15.00				
	Much Wetter > 15.00				

Courtesy of Penny Whetton

- **Dialogue with end users**

  - **Simplify the information – usable, digestible**

  - **Dataset and knowledge**

  - **Already applied in Pacific, Vietnam and Australia**

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# Additional CORDEX simulations: CCAM-AP and ACCESS experiments

An alternative version of CCAM is also being used for 50 km and 10 km ERA-Interim experiments. Differences include:

- Global 50 km and 10 km stretched Australian grid
- Atmospheric behavior assimilated using 3,000 km scale-selective filter
- In-line 'R-grid', 30 level, prognostic ocean (and ice) model with digital filter to assimilate SSTs. Atmosphere-Ocean coupling every timestep
- E-ε + Mass Flux boundary layer turbulence closure, non-hydrostatic dynamics, prognostic rain, geometric multi-grid solver, 35 atm levels, etc
- Focused on 50 km ERA-Interim experiment, but includes 10 km simulations

Furthermore, ACCESS 1.3 runs will be submitted for 50 km ERA-Interim experiments

- Global 50 km experiments like CCAM
- Based on ACCESS 1.3 (UM7.3) with 38 levels
- Includes 'CCAM-style' scale-selective filter using a convolution approach
- Land-surface CABLE version is the same for both ACCESS and CCAM runs

ERAI Sea surface temperature (C)

CCAM Sea surface temperature (C)
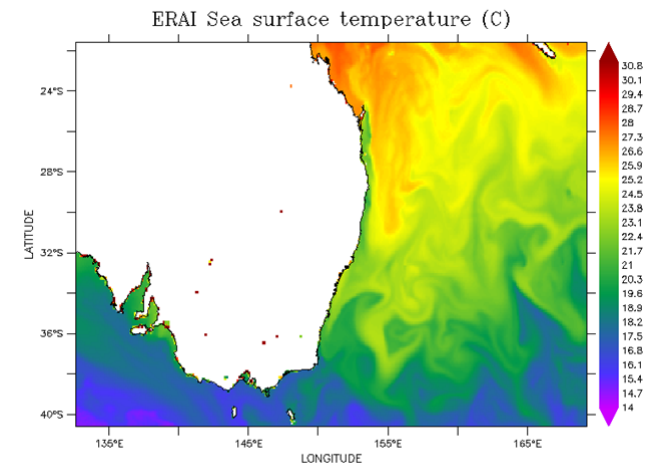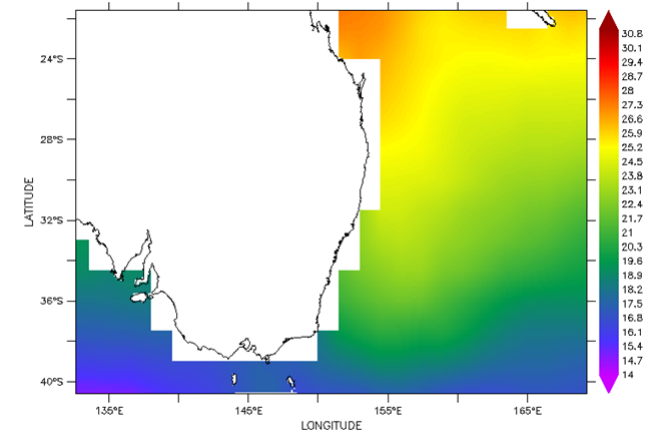
Sample of ERA-Int SST (top) and CCAM with prognostic ocean (bot)

Submissions to other CORDEX Domains

1. ## SE Asia 10 km CCAM simulations

   - Downscaled from all above 50 km simulations
   - RCP4.5 and RCP 8.5
   - 1970-2099 continuous
   - Providing input to Vietnam 2015 National Projections
   - CCAM and RegCM4.2
   - http://vnclimate.vn
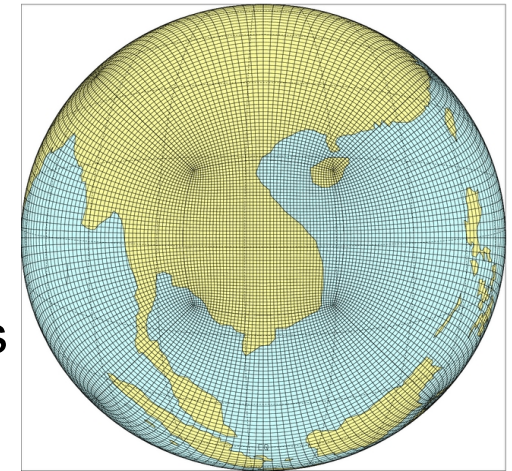
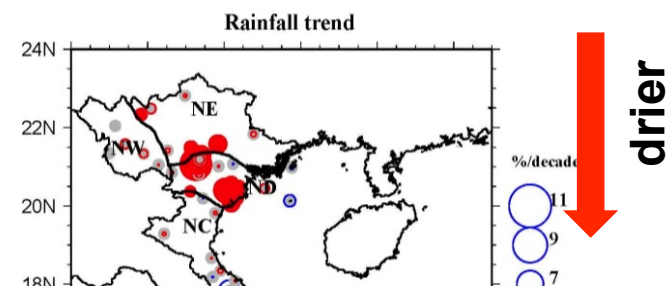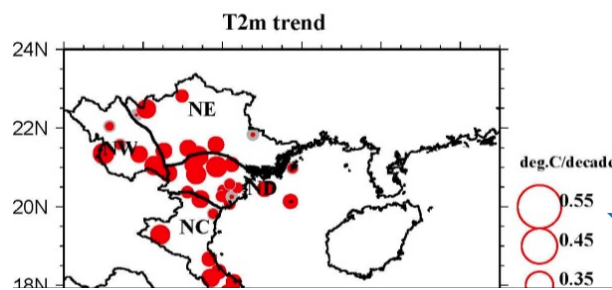2. ## Preliminary data submitted to South Asia CORDEX (R. Krishnan)

3. ## Also plan to submit to other CORDEX domains

   - Using the global 50 km simulations

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Temperature

Rainfall

Observed annual trends (1960-2010) from stations

warmer

cooler

wetter

drier

T2m trend

24N
22N
20N
18N

NE
NW
ND
NC

deg.C/decade
0.55
0.45
0.35

Rainfall trend

24N
22N
20N
18N

NE
NW
ND
NC

%/decade
11
9
7

Projected annual changes by end-of-century RCP 8.5 from RCMs

0 0.5 1 1.5 2 2.5 3 3.5 4 4.5

warmer Australian Government
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-25 -20 -15 -10 10 15 20 25

drier **wetter**
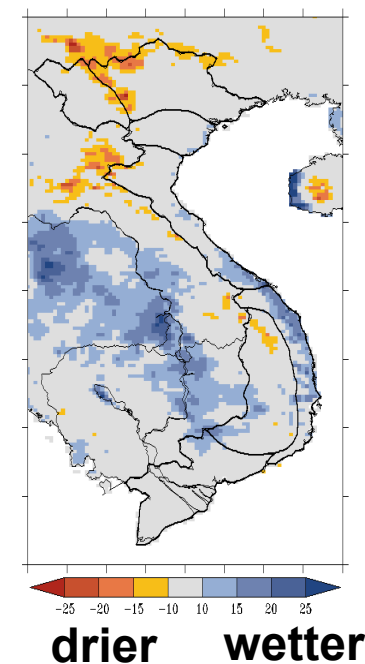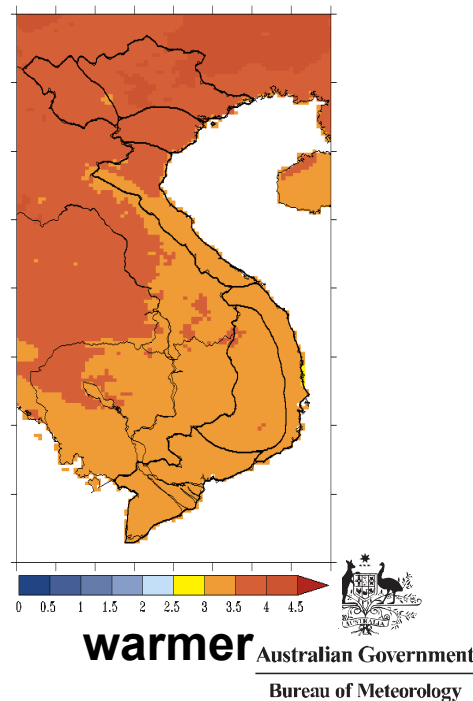
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Important issues

- Australia centric:
  - Reflect the focus of main contributors
  - No workshop (CORDEX stamped) so far
  - How to promote uptake of CORDEX data?
  - Interest expressed in results over Pacific (USP)
    - CSIRO has downscale to 8 km over seven Pacific nations with CMIP3
    - Multi RCM at 50 km for western Pacific (CCAM, RegCM, WRF, PRECIS, Zetac)
- Funding model?
  - Projects driven: bottom-up, hard to coordinate, lack of core funding
  - In serious trouble in Australia (NRM finishing, NARCLIM CMIP3-focus)
- Pilot studies:
  - High resolution testing has started --> subdomains ? Double nesting rules ?
  - Added values / interactions with users (NRM program)
  - Continental wide SDM and RCM projections / comparison

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Asian Development Bank

Regional Climate Projections Consortium and Data Facility in Asia and the Pacific :

- Aims to support the developing member countries (DMCs) to better manage climate change risks
- Need National specialists for:
  - Senior Climate Scientist
  - Climate Change Impacts, Adaptation and Vulnerability Assessment Specialist
  - Knowledge Management Specialist
- Looking for representatives from target countries:
  - Bureau of Meteorology, Climatology and Geophysics in Indonesia
  - Philippine Atmospheric Geophysical and Astronomical Services Administration in the Philippines
  - Thai Meteorological Department in Thailand
  - One other Asian country
- Please contact me Jack.Katzfey@csiro.au

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