Introduction to Climate Projections Guidance

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www.csiro.au

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ADB

From the People of Japan

Griffith UNIVERSITY

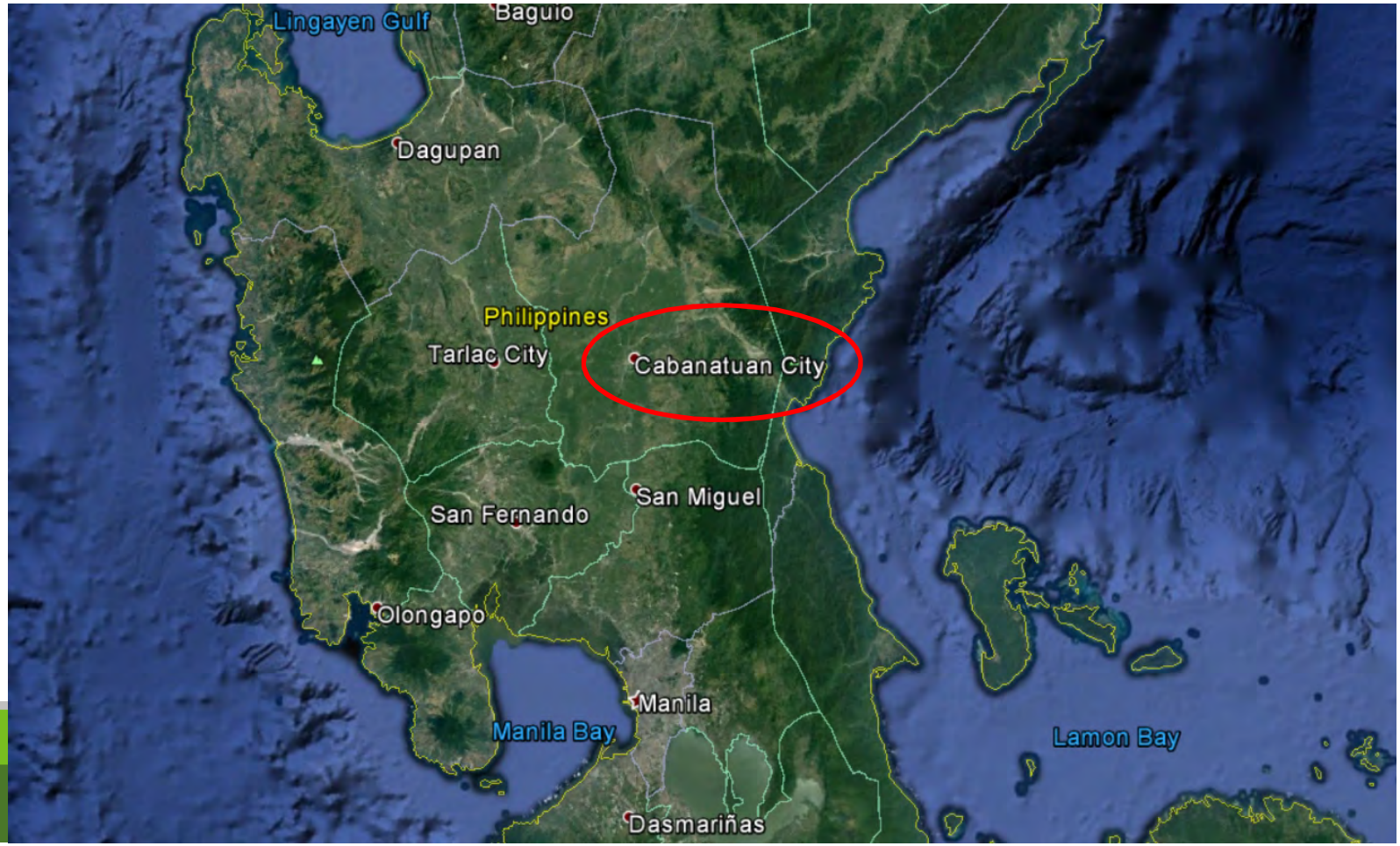
CSIRO

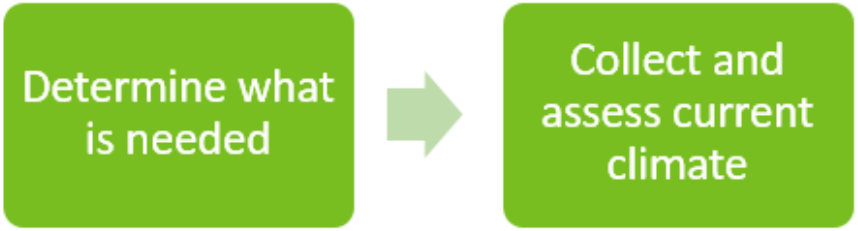
Overall guidelines for using climate information/projections

- Decide **what is needed/important** for assessment
- Collect and **evaluate current climate** information
  - Assess the **natural variability**
- Decide on **time and space scales** needed for projections
- Collect and **evaluate current climate** simulations
- Use **range of** climate projection **scenarios**
  - Ideally assess a ‘median’, ‘best-case’ and ‘worst-case’ projection
- Do we need to **application-ready** projections?
- **Assess confidence and uncertainty of projections**

Determine what is needed

Irrigation Model needs daily:
Rainfall and temperature





Station data for:
Cabanatuan City, Nueva Ecija
CLSU Muñoz Nueva Ecija

Criteria for Selecting Historical Observational Climate Data

- What **variables** are needed for case study?
- Do you need **point or gridded** spatial data?
- What **spatial resolution and time frequency** is needed?
- What data is **available**?
- What is the **quality** of the data?
  - Accuracy of observations (station metadata?)
  - Accuracy of gridding process (number/location on input data used, interpolation technique)
- Is the available data **representative** for case?
- Is there sufficient data to capture the **natural variability**?

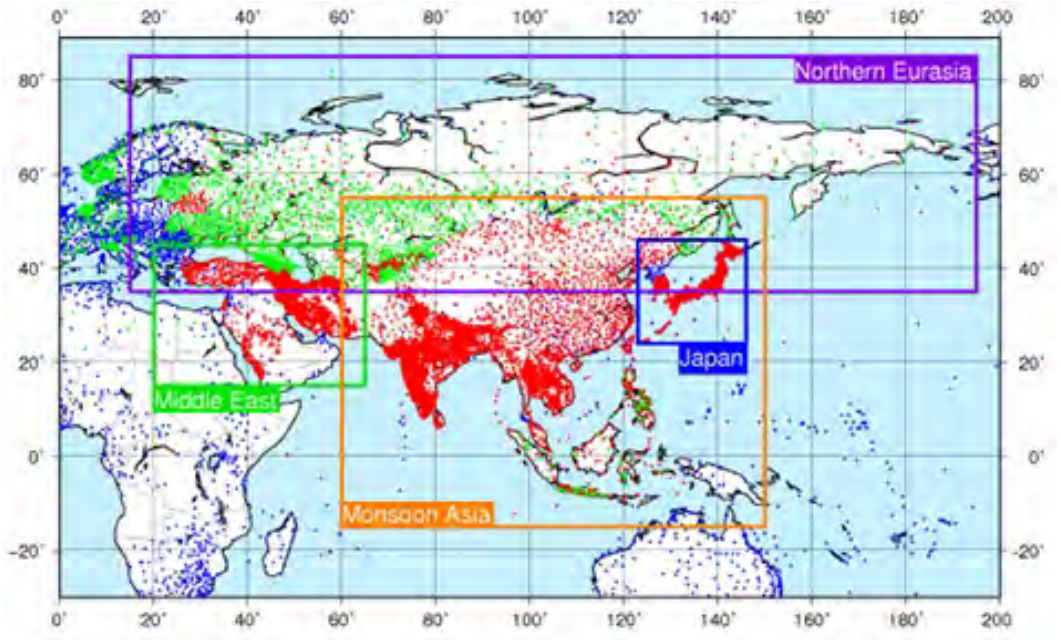
Example of gridded data

APHRODITE: Asian Precipitation - Highly-Resolved Observational Data Integration Towards Evaluation of Water Resources

Years of Record: 1951/01 to 2007/12

Type of data product: Gridded rainfall and temperature from obs

Institution and PI: University of Tsukuba, Japan Meteorological Agency/ Akiyo Yatagai



Cuurent version: V1101 Download »Readme

Name	Domain	Resolution	Period
Monsoon Asia (MA)	60°E-150°E, 15°S-55°N	0.5° and 0.25°, daily	1951-2007
Middle East (ME)	20°E-65°E, 15°N-45°N		
Russia (RU)	15°E-165°W, 34°N-84°N		

Current version, with Rain/Snow discrimination: V1101R2 Download »Readme

Name	Domain	Resolution	Period
Monsoon Asia (MA)	60°E-150°E, 15°S-55°N	0.5° and 0.25°, daily	1961-2007

AphroTemp Current version: V1204R1 Download »Readme

Name	Domain	Resolution	Period
Monsoon Asia (MA)	60°E-150°E, 15°S-55°N	0.5° and 0.25°, daily	1961-2007

APHRO_JP Current version: V1207 Download »Readme

Name	Domain	Resolution	Period
Japan (JP) (Kamiguchi et al. 2010, 2011)	123°E-146°E, 24°N-46°N	0.05°, daily	1900-2011

http://www.chikyu.ac.jp/precip/index.html

APHRODITE evaluation

https://climatedataguide.ucar.edu)

Key Strengths:

- High density and quality station network.

Key Limitations:

- Station network changes with time and season.
- We do not homogenize the observed time series of temperature data. Changes in gauges, location of the stations, and many other factors might cause discontinuity of observation data.
- Lack of observation data (in India, Indonesia and Papua New Guinea)

SACA&D

Southeast Asian Climate Assessment & Dataset

http://sacad.database.bmkg.go.id/

Home FAQ Daily data Indices of extremes Project info

See also: ICA&D KNMI Climate Explorer

Home

Home

Welcome to the website of the Southeast Asian Climate Assessment & Dataset (SACA&D) project. Presented is information on changes in weather and climate extremes, as well as the daily dataset needed to monitor and analyse these extremes.

What's new?

The database is updated until: Dec 30, 2014.
March 2011 - Website online.
January 2011 - Logo included and website colours updated.
All news items

Participants and data

Today, SACA&D is receiving data from 24 participants for 15 countries and the SACA dataset contains 6477 series of observations for 10 elements at 4090 meteorological stations throughout Southeast Asia. 31% of these series is public, which means downloadable from this website for non-commercial research (see Daily data > Data dictionary for an overview of all available series). Participation to SACA&D is open to anyone maintaining daily station data. If you want to join please contact us. See our Data Policy for more details.

DiDaH project

DIDAH project

SACA&D is developed as part of the Digitisasi Data Historis (Didah) project. This project is focusing on the digitization and use of high-resolution historical climate data from Indonesia and other Southeast Asian countries. Didah is a joint project between the National Meteorological Services of Indonesia (BMKG) and the Netherlands (KNMI).

The results on this website contribute to the work of the Asian Pacific Network for climate extremes (APN).

Contact us

Project team SACA&D
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Royal Netherlands Meteorological Institute (KNMI)
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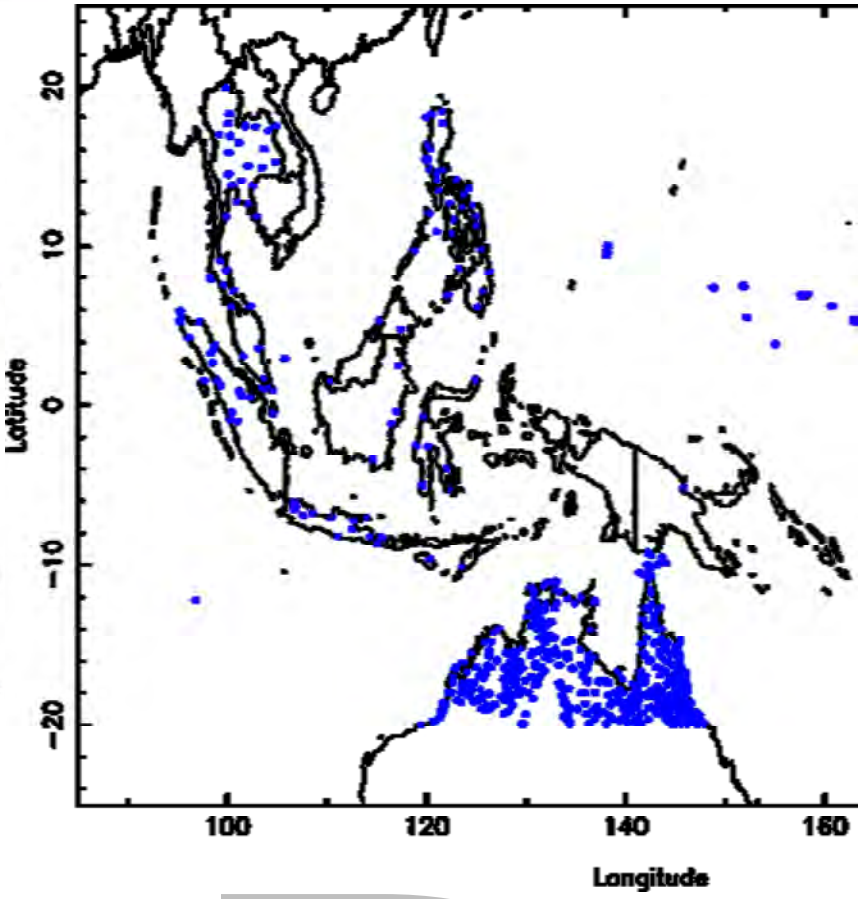
Theo Brandsma (KNMI)
Albert Klein Tank (KNMI)
Rudmer Jilderda (KNMI)
Richard Rothe (KNMI)
Gerard van der Schrier (KNMI)



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Atmosphere

- Overview of current reanalyses
  - Comparison Table
  - EURO4M
  - References
- How to obtain/plot/analyze data
- Comparison
- Tools
- Diagnostic Studies: Climate Variability
- Diagnostic Studies: Weather Variability
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Site Map

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Overview of current atmospheric reanalyses

Last edited by michael.bosilovich on Tue, 10/27/2015 - 10:37

Current / State-of-the-art:
ASR | ERA-20C | ERA-20CM | ERA-Interim | JRA-55 | MERRA-2 | NCEP CFSR | NOAA-CIRES 20CRv2c

Possible issues: Consider other datasets for use in new research projects: NCEP/DOE II | NCEP/NCAR | NCEP NARR
Superseded / Caution use for new research projects: ERA-40 | ERA-15 | JRA-25

Model Change: NCEP CFSR (2011 and after)

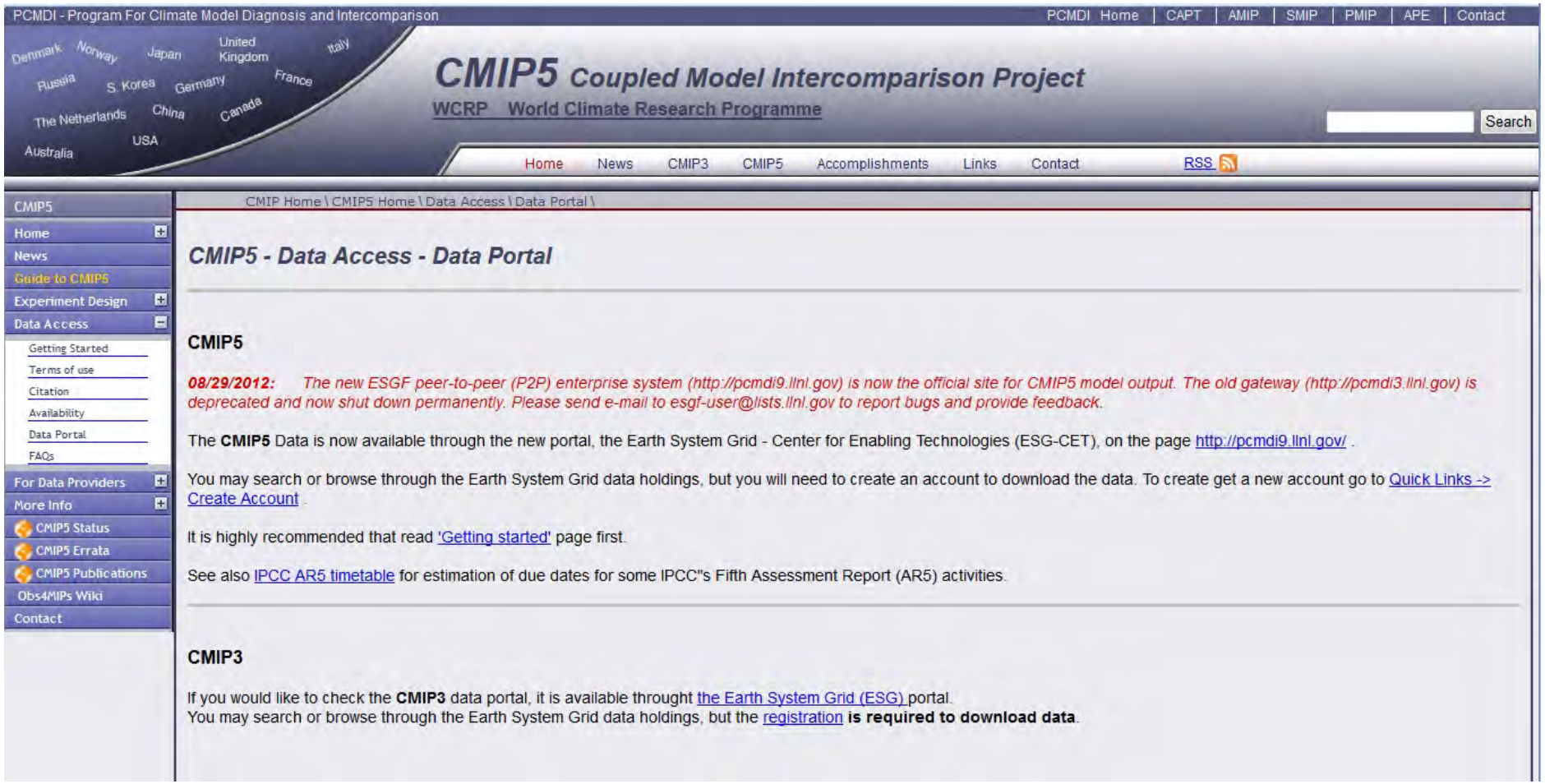
Updated in real-time for public use (days behind): NCEP/DOE II | NCEP/NCAR | NCEP NARR | NCEP CFSR?
Updated in near real-time for public use (months behind): ERA-Interim | JRA-55 | MERRA-2
Updated irregularly for public use (years behind): ERA-20C | ERA-20CM | NOAA-CIRES 20CR | NOAA-CIRES 20CRv2c | NASA MERRA

Arctic System Reanalysis (ASR): 2000-2011

The Arctic System Reanalysis (ASR), which can be viewed as a blend of modeling and observations, will provide a high resolution description in space (10-30 km) and time (3 hourly) of the atmosphere-sea ice-land surface system of the Arctic. There are two versions of ASR:

Arctic System Reanalysis-Interim (ASR-int)
Source: The Ohio State University, Byrd Polar Research Center, Polar Meteorology Group
Time Range: 2000-2010
Assimilation: WRFDA-3DVAR
Model Resolution: 30 km, 71 sigma levels
Model Output Resolution: 30 km
Publicly Available Dataset Resolution: 30 km
Dataset Output Times and Time Averaging: 3-hourly for surface and upper air fields
Monthly means of selected variables
Here is the dataset location: http://rda.ucar.edu/datasets/ds631.4/
A new version is expected late 2012.

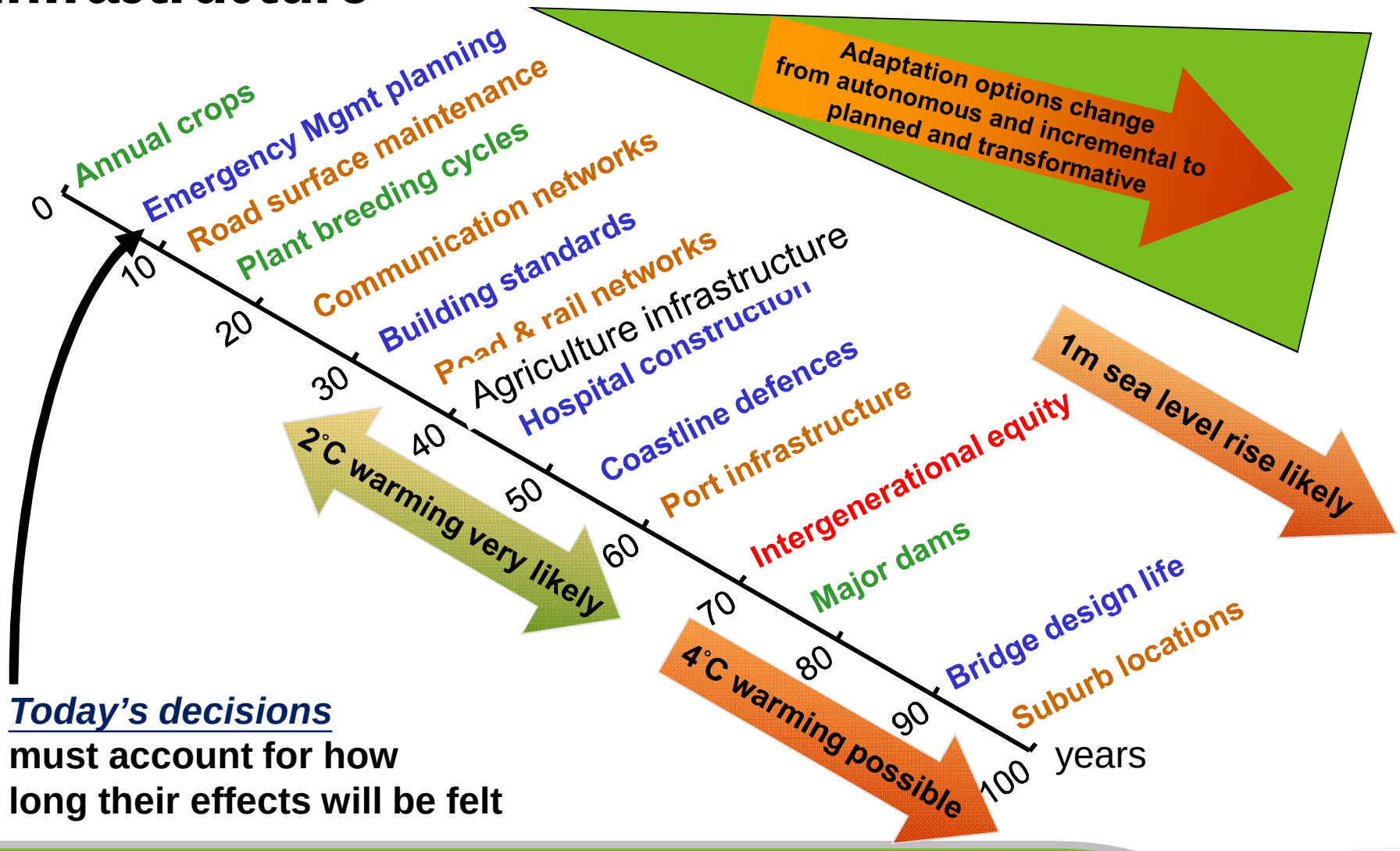
Arctic System Reanalysis-Final (ASR-fnl)
Source: The Ohio State University, Byrd Polar Research Center, Polar Meteorology Group
Time Range: 2000-2011
Assimilation: WRFDA-3DVAR
Model Resolution: 10 km, 71 sigma levels
Model Output Resolution: 10 km
Publicly Available Dataset Resolution: 10 km
Dataset Output Times and Time Averaging: 3-hourly for surface and upper air fields



http://cmip-pcmdi.llnl.gov/cmip5/data_portal.html


Determine what is needed
Collect and assess current climate
Decide on space and timescale required

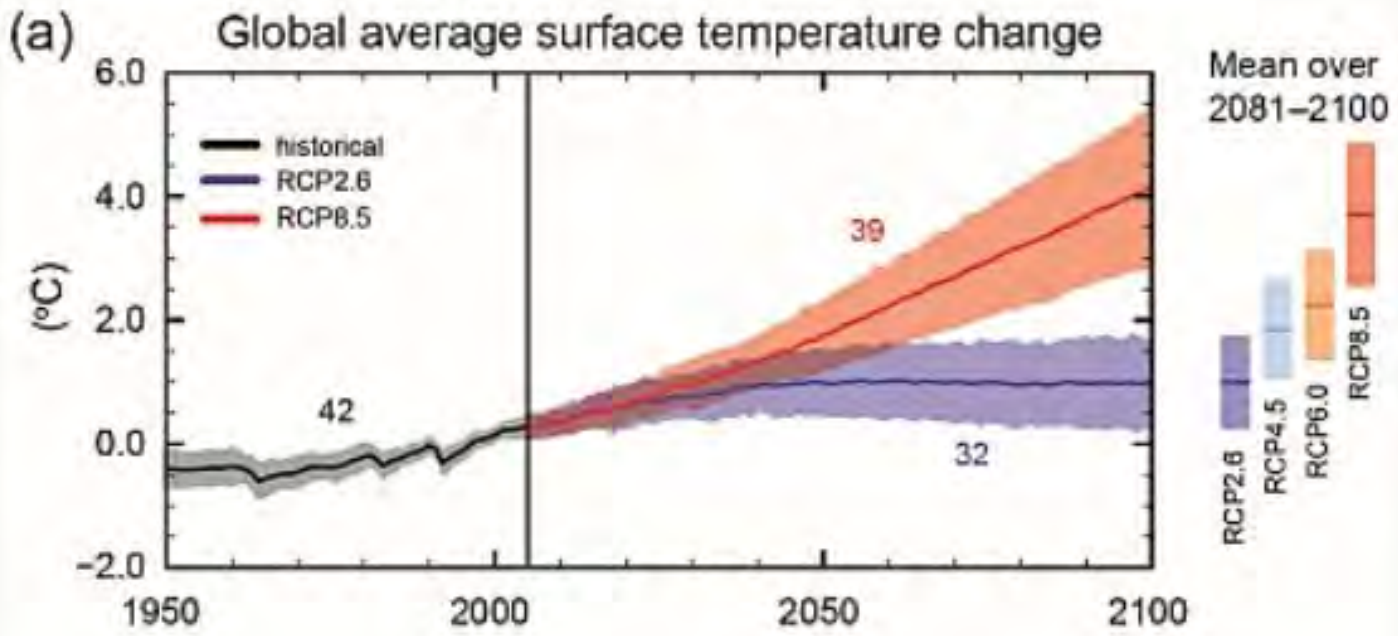
Timescales for detailed adaptation planning for infrastructure



Today's decisions
must account for how long their effects will be felt

Stafford Smith et al, *PhilTransRoySoc* 2011 (after Jones & McInnes 2004)

Determine what is needed → Collect and assess current climate → Decide on space and timescale required → Select scenario



CMIP5 multi-model simulated time series from 1950 to 2100 for change in global annual mean surface temperature relative to 1986–2005. SOURCE: IPCC 2013

Determine what is needed → Collect and assess current climate → Decide on space and timescale required → Select scenario

Select scenario → Source projections data

www.hpc.csiro.au/users/72365/VN/CCAM/

Wx data soft CMAR Jack Jean Melb SP Rccap rccdf T

Index of /users/72365/VN/CCAM

Name	Last modified	Size	D
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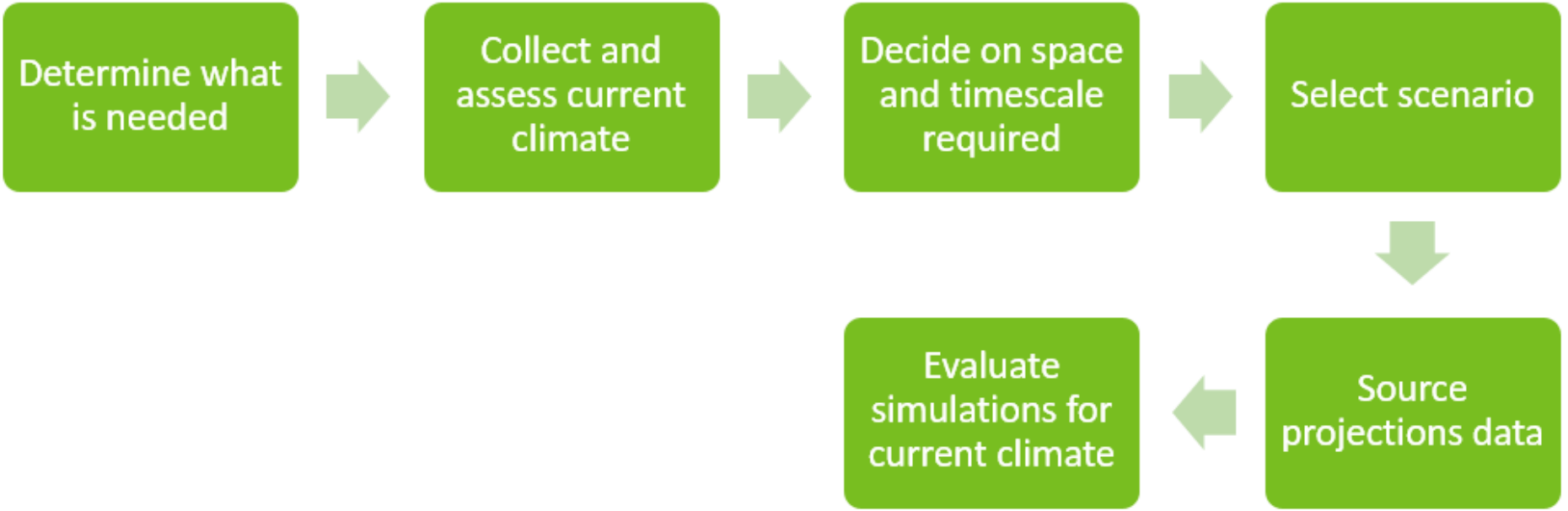
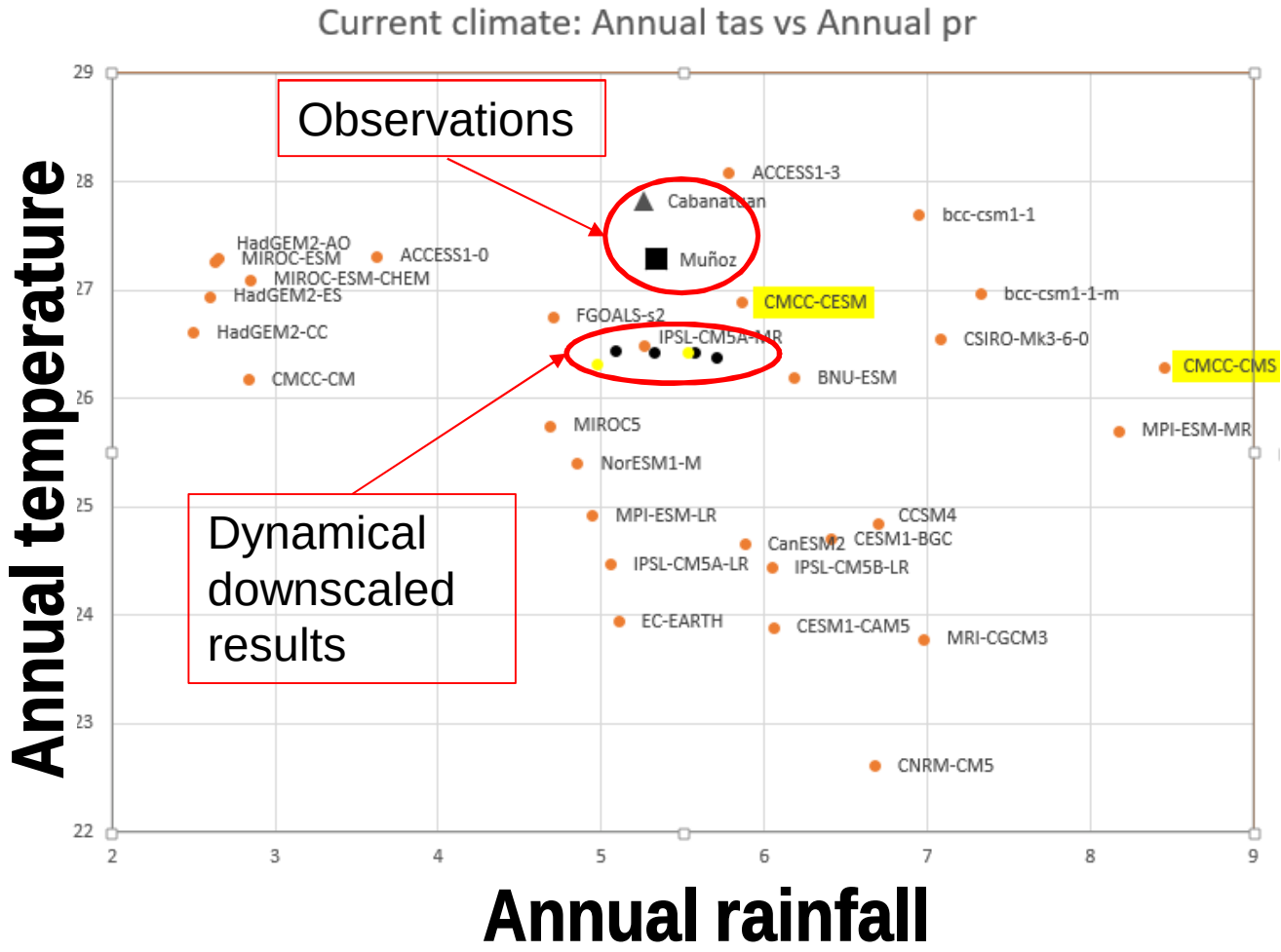
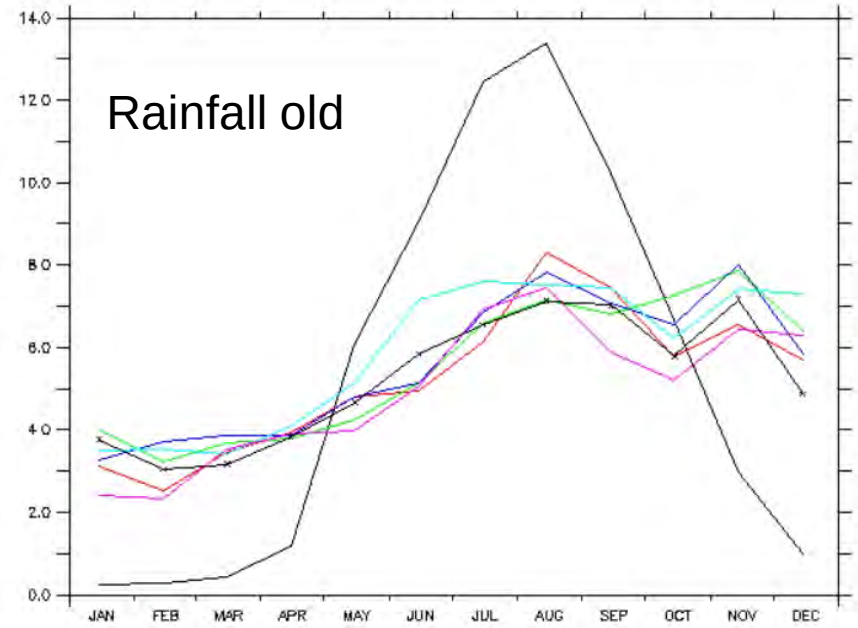
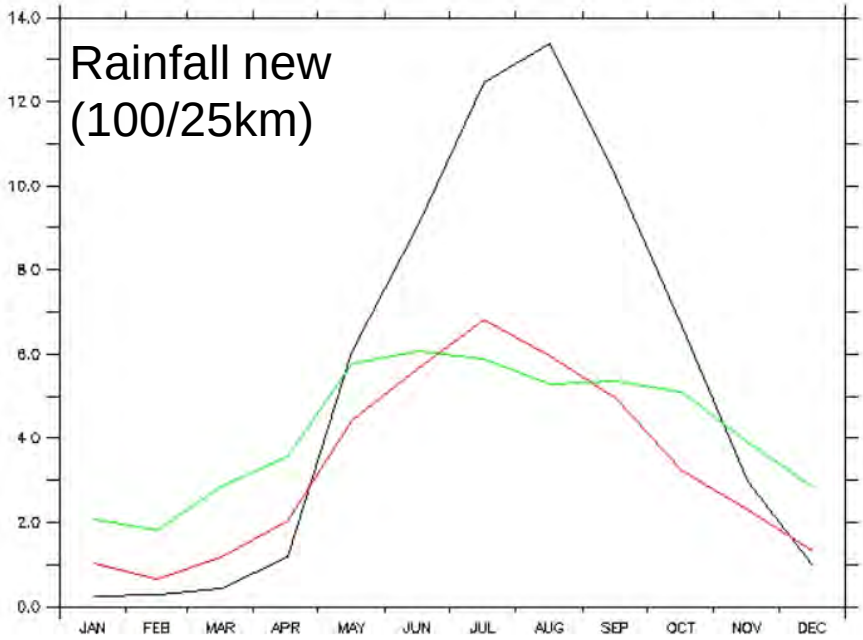

Determine what is needed
Collect and assess current climate
Decide on space and timescale required
Select scenario
Source projections data
Evaluate simulations for current climate

Case Study Example



Plot of mean annual temperature (°C) and rainfall (mm/day) for the baseline period for global climate models (orange markers), regional climate model output (black and yellow dots) and observational data (black square and triangle). The models selected for the case study are indicated in yellow highlight for GCMs and yellow dot for RCMs.
Location: Cabanatuan City


Rainfall old
14.0
12.0
10.0
8.0
6.0
4.0
2.0
0.0
JAN
FEB
MAR
APR
MAY
JUN
JUL
AUG
SEP
OCT
NOV
DEC


Rainfall new
(100/25km)
14.0
12.0
10.0
8.0
6.0
4.0
2.0
0.0
JAN
FEB
MAR
APR
MAY
JUN
JUL
AUG
SEP
OCT
NOV
DEC

Evaluation of model performance

There are several generic model evaluation approaches (See the IPCC Working Group I, Chapter 9, 2013):

- **Evaluate the overall model results**
  - Use standard evaluation metric
- **Isolation of climate processes in climate models**
  - Ensure climate processes are properly represented in the models
- **Instrument simulators**
  - convert model output to match instruments such as satellites
- **Ensemble approaches**
  - explore the uncertainty in climate model simulations

Evaluation of model performance

Why measure model performance?

- Climate models should capture the main internal and external responses (e.g. volcanoes, GHG changes)
- Forms an integral part of the confidence building for climate change projections

What are the regional differences in performances?

- Usually there is a small subset of models that perform poorly across a number of performance metrics

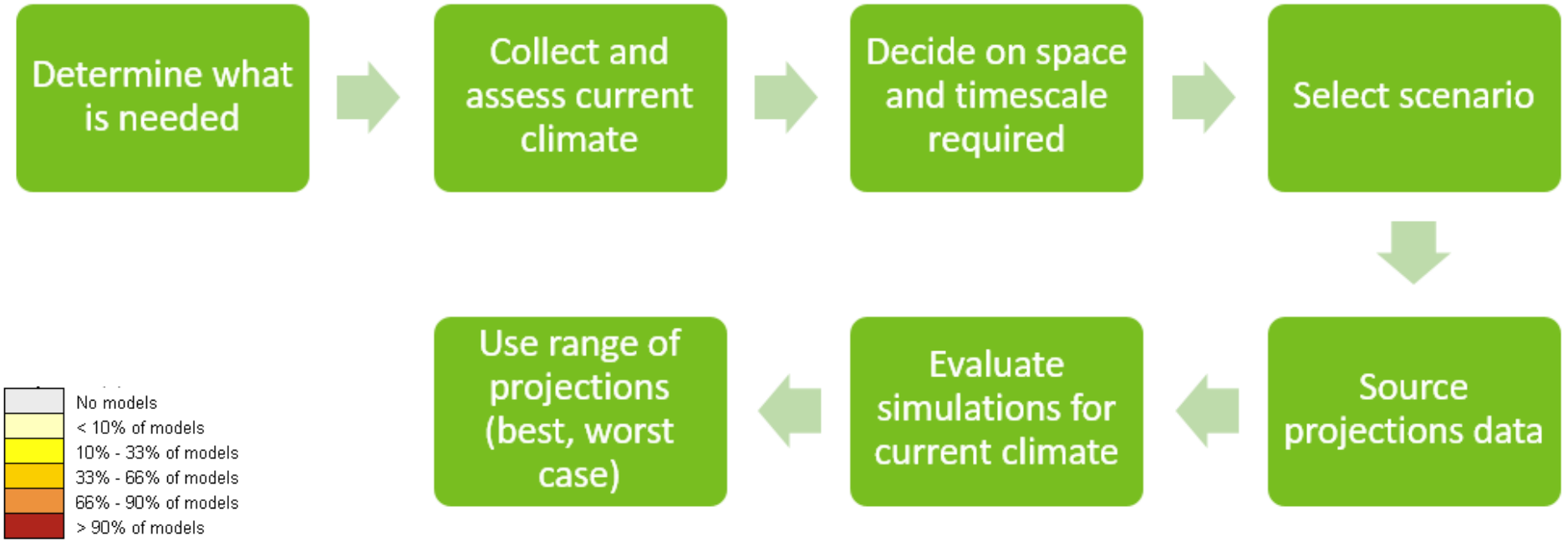
What about El Niño and/or the Monsoon?

- Most models exhibit biases in the central Pacific sea surface temperatures, which impact on the El Niño Southern Oscillation (ENSO) relationship with rainfall. Some of the models also show biases for the monsoon.

Evaluation of model performance

Does sub-setting of models according to evaluation results change rainfall projections?

- Subset of better models did not provide more clarity on the direction of the expected rainfall changes.
- Using the full range of available models, rather than a performance-based selection or weighting, is the chosen method for regional applications.
- Model evaluation results, however, may influence the choice of individual models in some applications.

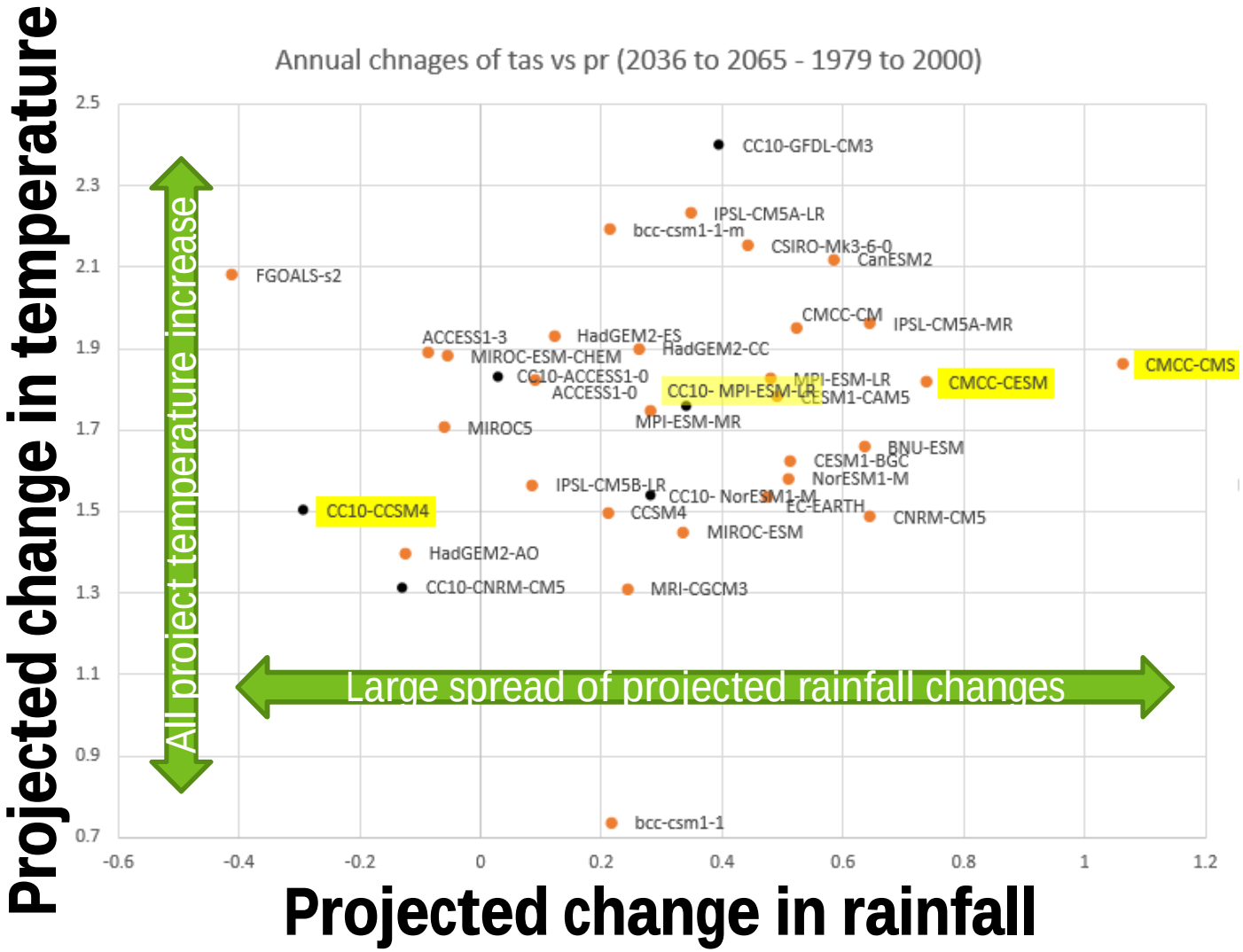


		Surface Temperature - Annual (° C)			
		Slightly Warmer < 0.50	Warmer 0.50 to 1.50	Hotter 1.50 to 3.00	Much Hotter > 3.00
Rainfall - Annual (% change)	Much Drier < -15.00			Likelihood: 12 of 24 models (50%) Most Likely	Likelihood: 1 of 24 models (4%) Worst case
	Drier -15.00 to -5.00			Likelihood: 6 of 24 models (25%)	Likelihood: 2 of 24 models (8%)
	Little Change -5.00 to 5.00		Likelihood: 1 of 24 models (4%)	Likelihood: 1 of 24 models (4%)	
	Wetter 5.00 to 15.00			Likelihood: 1 of 24 models (4%) Best case	
	Much Wetter > 15.00				

Criteria for Selecting Climate Scenarios

- **Criterion 1**: Chose **range** consistency with global projections.
- **Criterion 2**: **Physical plausibility**.
- **Criterion 3**: Applicability in impact assessments. They should describe changes in a sufficient number of **variables on a spatial and temporal scale** that allows for impact assessment.
- **Criterion 4**: **Representative**. They should be representative of the potential range of future regional climate change.
- **Criterion 5**: **Accessibility**. They should be straightforward to obtain, interpret and apply for impact assessment.

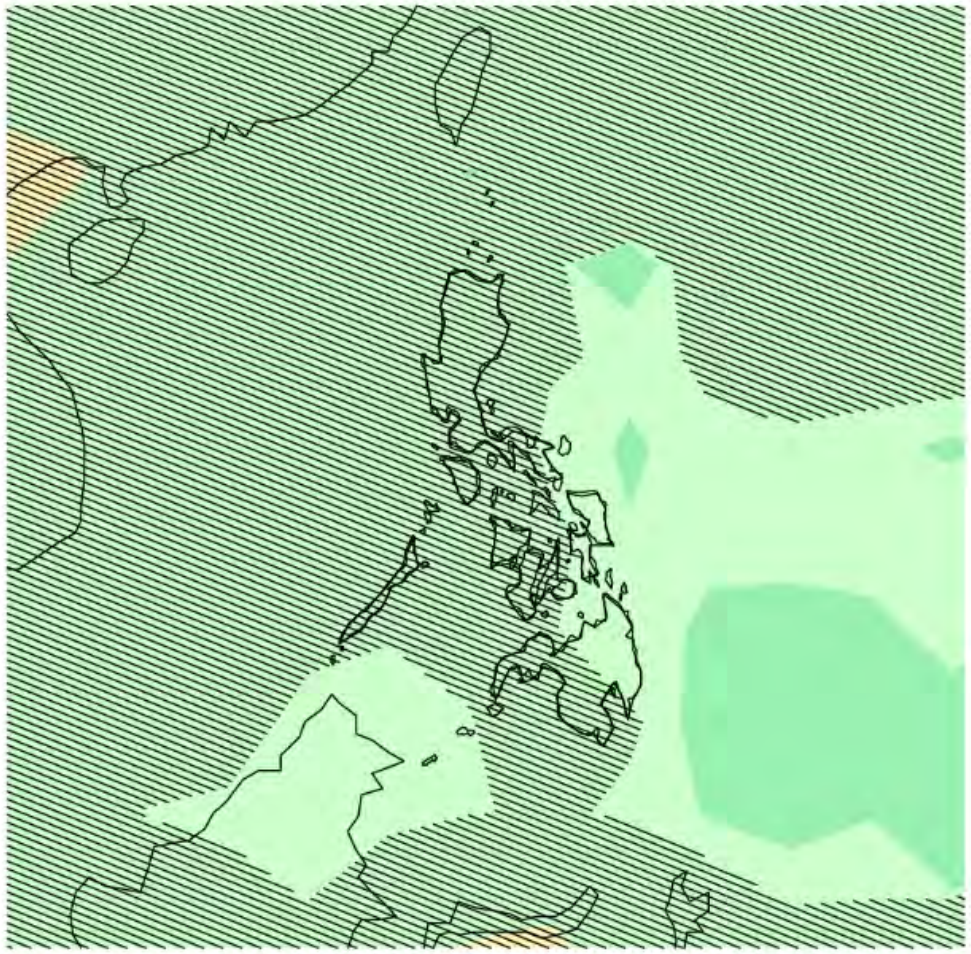
Case Study Example

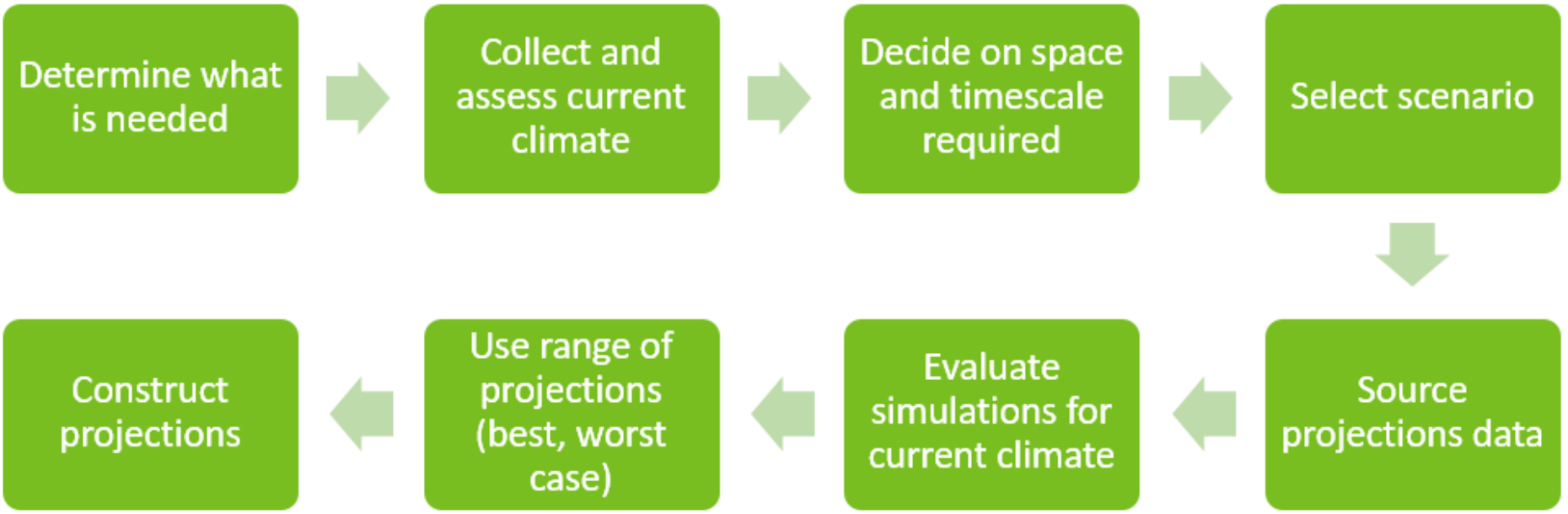


Plot of changes in annual rainfall (mm/day) and annual surface air temperature (°C) for the period 2036-2065 minus the period 1971-2000 for global climate models (orange markers), regional climate model output (black dots). The models selected for the case study are indicated in yellow highlight. Location: Cabanatuan City

50% rcp45to85 relative precipitation 2036-2065 minus 1971-2000 Jul AR5 CMIP5 subset. The hatching represents areas where the signal is smaller than one standard deviation of natural variability (eps, pdf, netcdf)

50% rcp45to85 relative precipitation 2036-2065 minus 1971-2000 Jul AR5 CMIP5 subset





Need to consider

1) 10 day totals
2) 20th %tile

Determine what is needed

Collect and assess current climate

Decide on space and timescale required

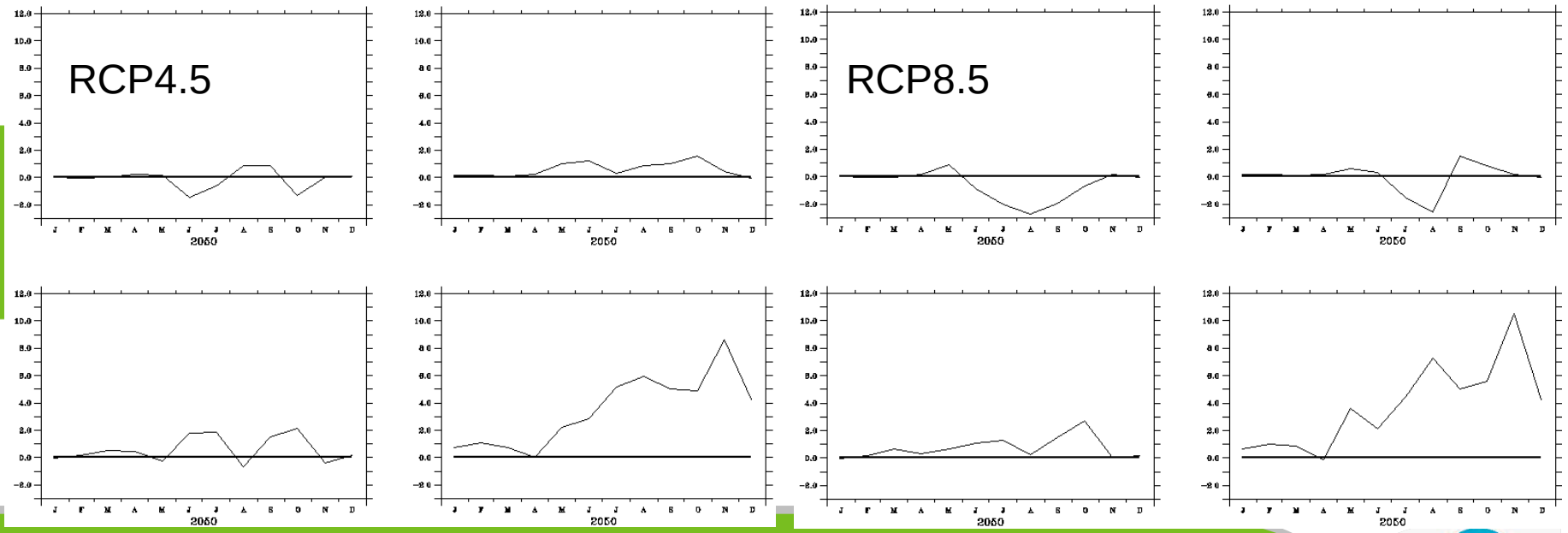
Select scenario

Source projections data

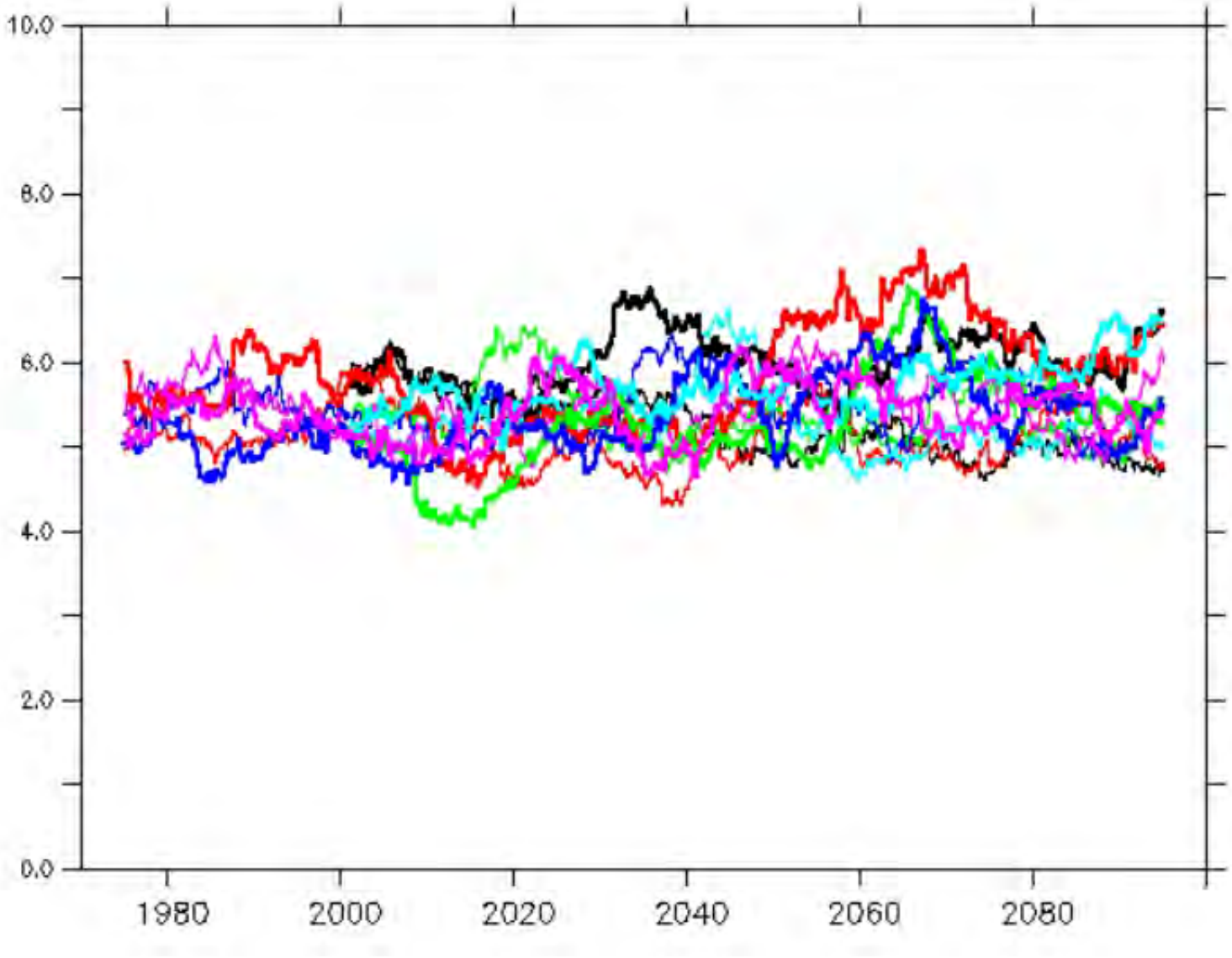
Evaluate simulations for current climate

Use range of projections (best, worst case)

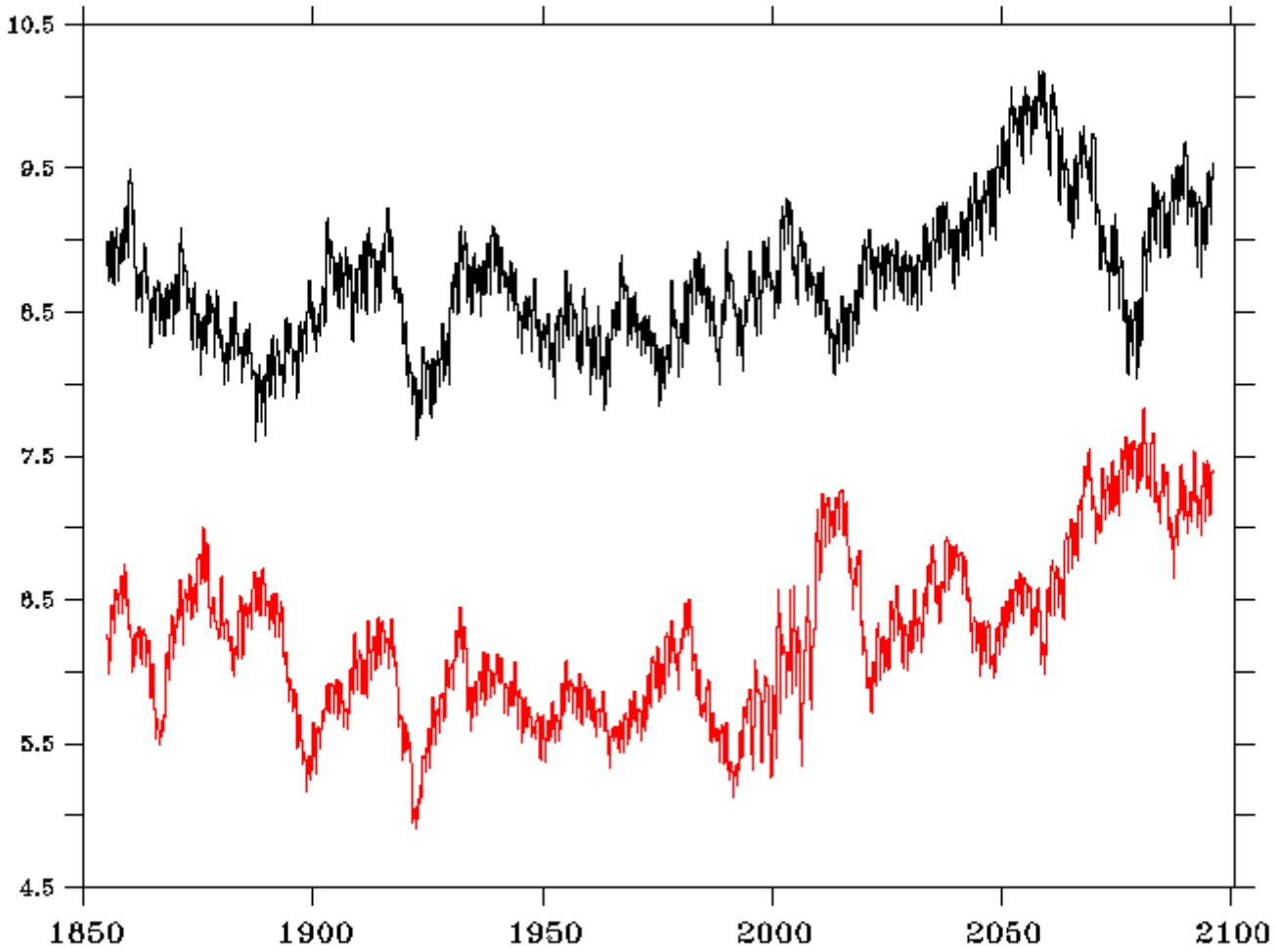
Construct projections

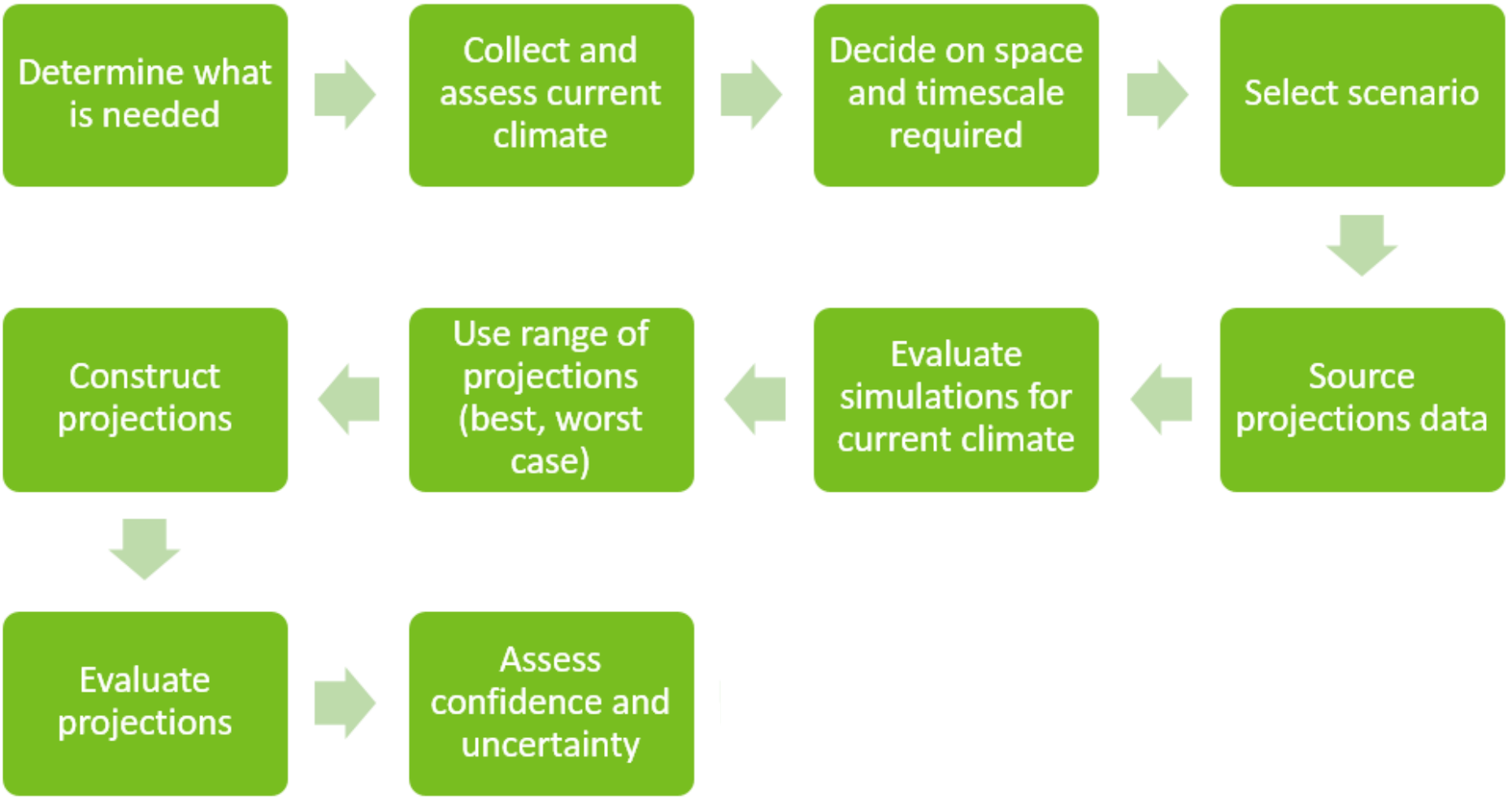


Yearly rainfall (mm/day) for all six CCAM10 runs (RCP 4.5 and RCP8.5)



CMCC-ESM vs CMCC-CMS

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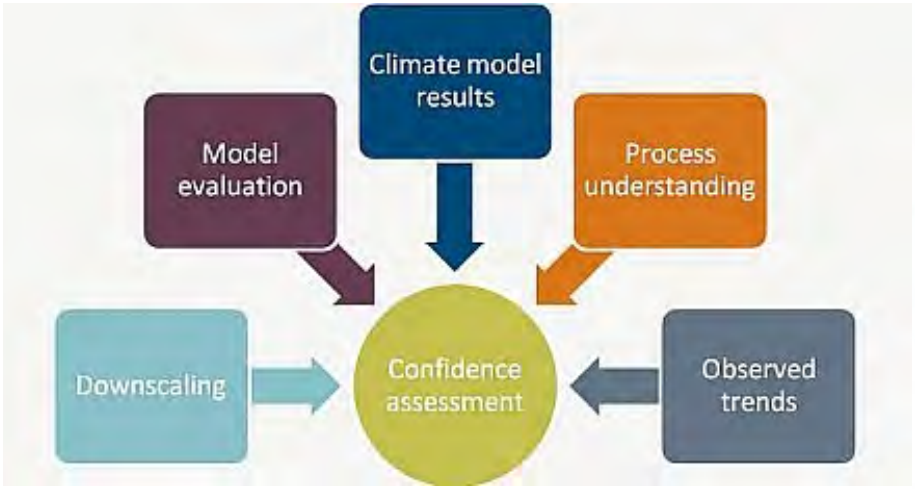
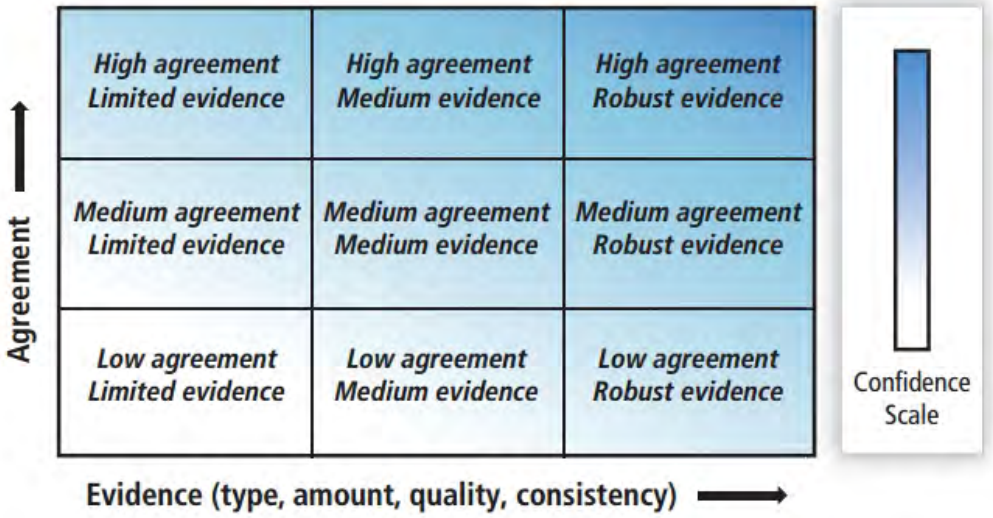
Assess confidence and uncertainty

Uncertainty and confidence in projections

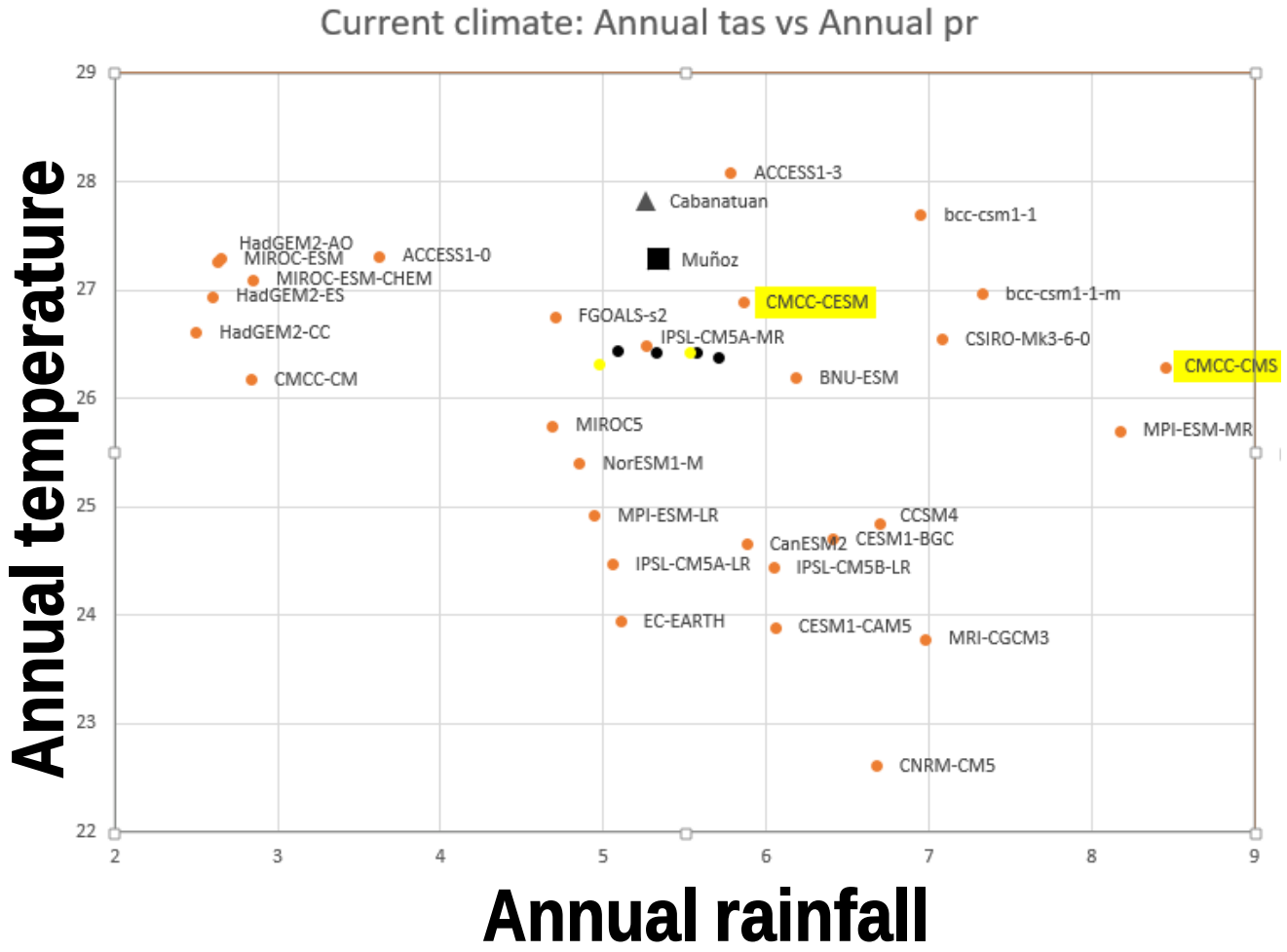




Five lines of evidence to consider when assessing confidence in projections

IPCC

Case Study Example



Plot of mean annual temperature (°C) and rainfall (mm/day) for the baseline period for global climate models (orange markers), regional climate model output (black and yellow dots) and observational data (black square and triangle). The models selected for the case study are indicated in yellow highlight for GCMs and yellow dot for RCMs.
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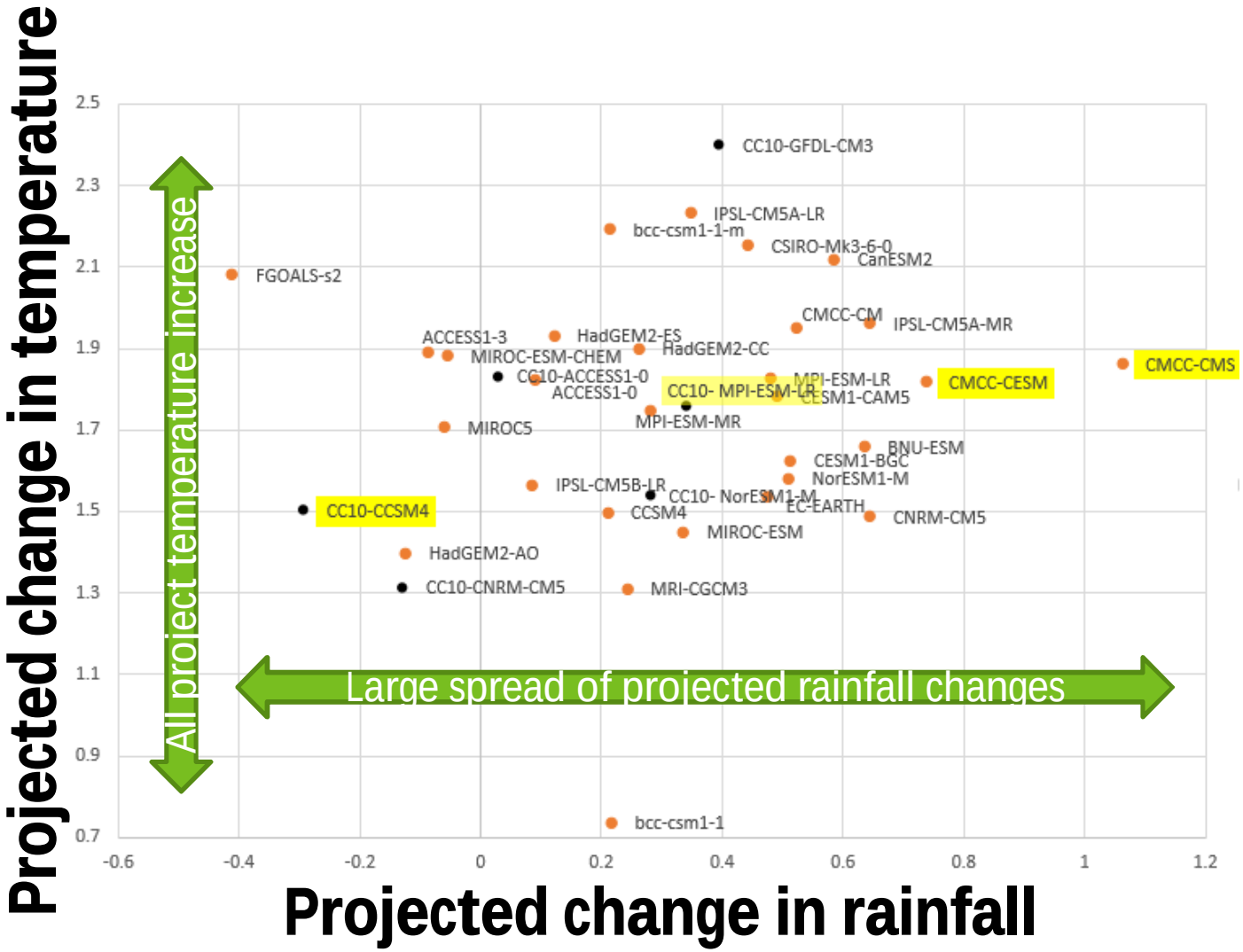

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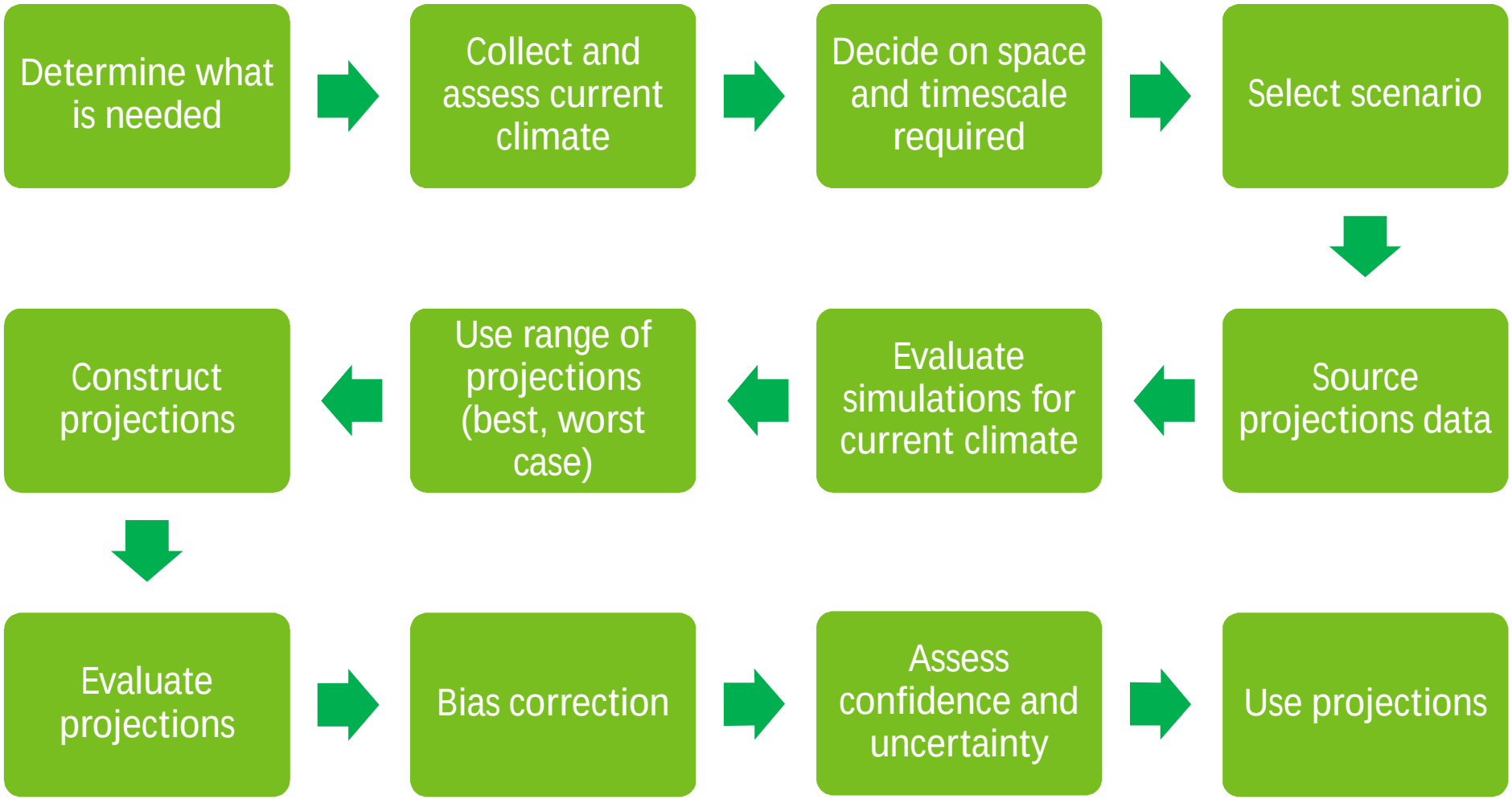
Climate Assessment Flowchart



Thank you

FOR MORE INFORMATION CONTACT:

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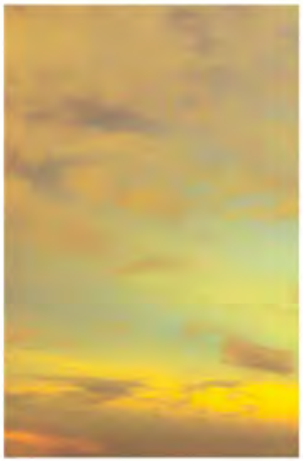
Regional Climate Projections Consortium and Data Facility for Asia and the Pacific

Use of climate services in Asia and the Pacific is challenged by limited reliable climate information, insufficient capacity to interpret and use climate information, and limited technical and financial resources.

The Regional Climate Projections Consortium and Data Facility (RCCDF) will develop a community of practice to provide this in a cost-effective and sustainable manner through capacity building. The RCCDF project[1] will address these challenges by providing:

1. Access to climate information.
2. Guidelines and examples for conducting impacts and vulnerability assessments.
3. Knowledge sharing and learning.



RCCDF GOALS:

- Adopt best practices for adaptation planning
- Support learning by doing
- Develop in-country capacity for using climate information in impacts and vulnerability assessments
- Implement and support the portal (an online resource with links to data and information)
- Increase collaboration on assessment of common regional climate impacts

THE RCCDF WILL PROVIDE ACCESS TO:

- Available current and future climate information
- Guidelines on how to develop, interpret and use climate information
- An online web interface (portal) to provide access to the guidelines, learning materials and other related services.

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