Evaluation of CMIP6 models for downscaling on the Southeast Asia CORDEX domain

CORDEX Pune

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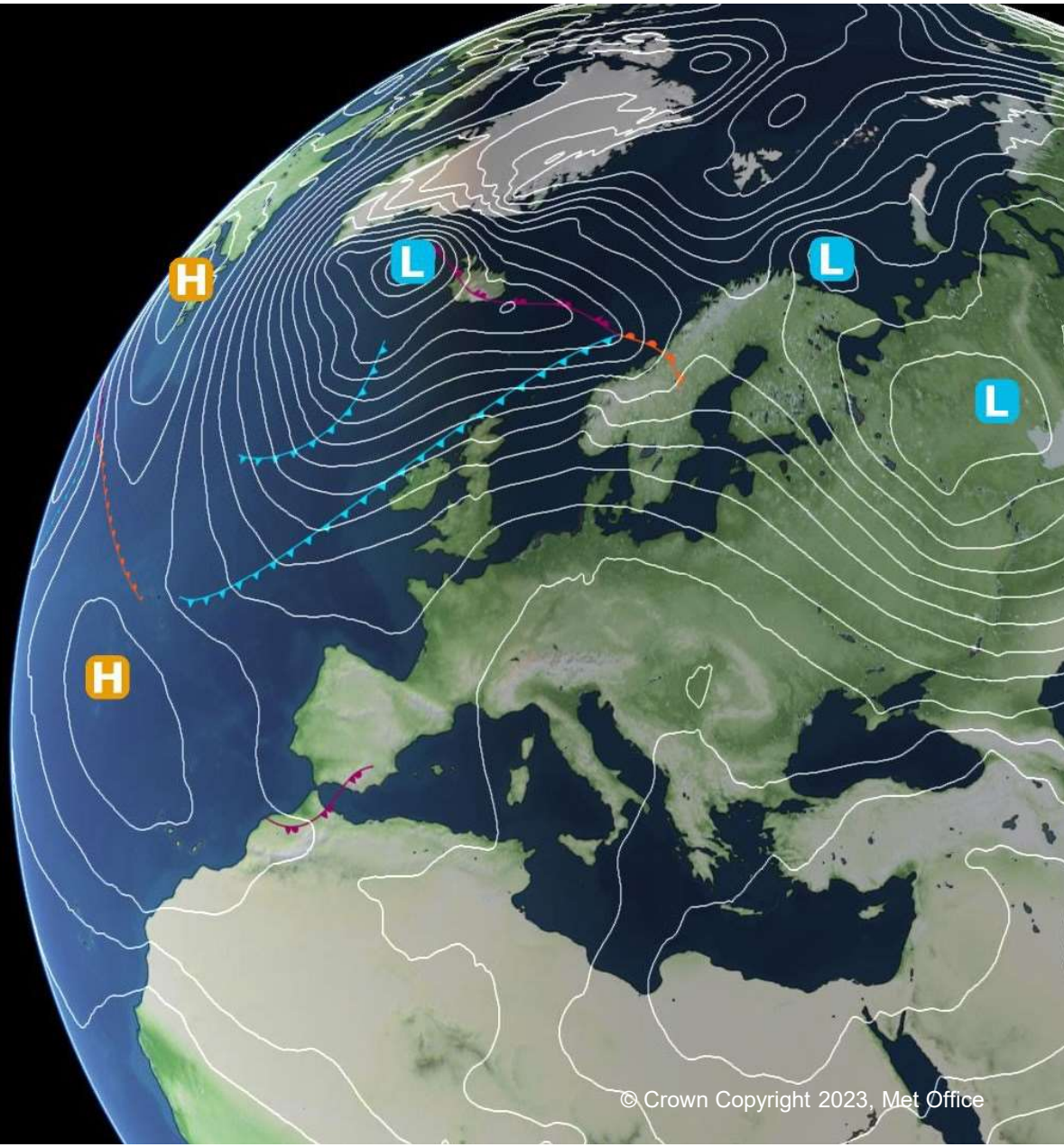

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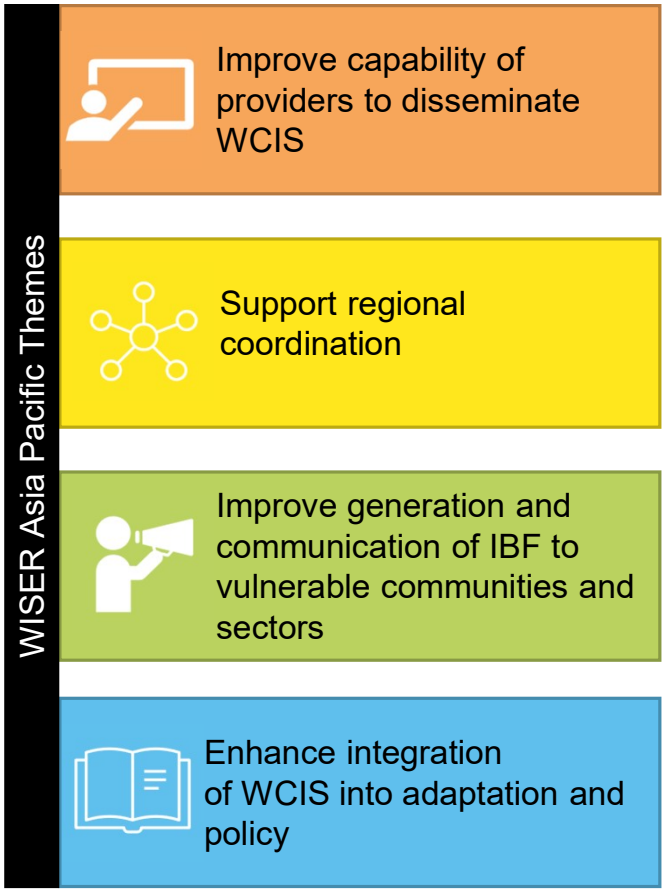
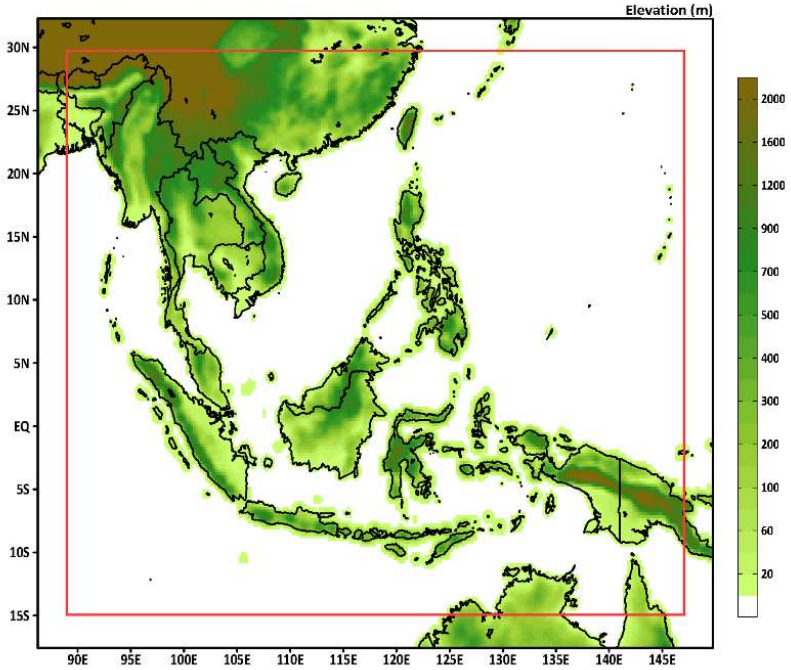
Introducing WISER Asia Pacific

Funder	UK Government through the CARA (Climate Action for a Resilient Asia) Programme. (Follow-on to the ARRCC Programme)
Timescale	2023 to 2029 – currently in planning phase
Partners (so far)	South Asia HydroMet Forum (SAHF), Secretariat for the Pacific Regional Environment Programme (SPREP), Coordinating Centre for Humanitarian Assistance on Disaster Management (AHA Centre)
Purpose	To improve quality, access, and use of Weather and Climate Information Services (WCIS) to strengthen the resilience of vulnerable people
Start-up Activities	**Regional modelling to support development of national scenarios** (initially with IMHEN for Vietnam) Support for Climate Outlook Forums (SASCOF and ASEANCOF)



Introduction

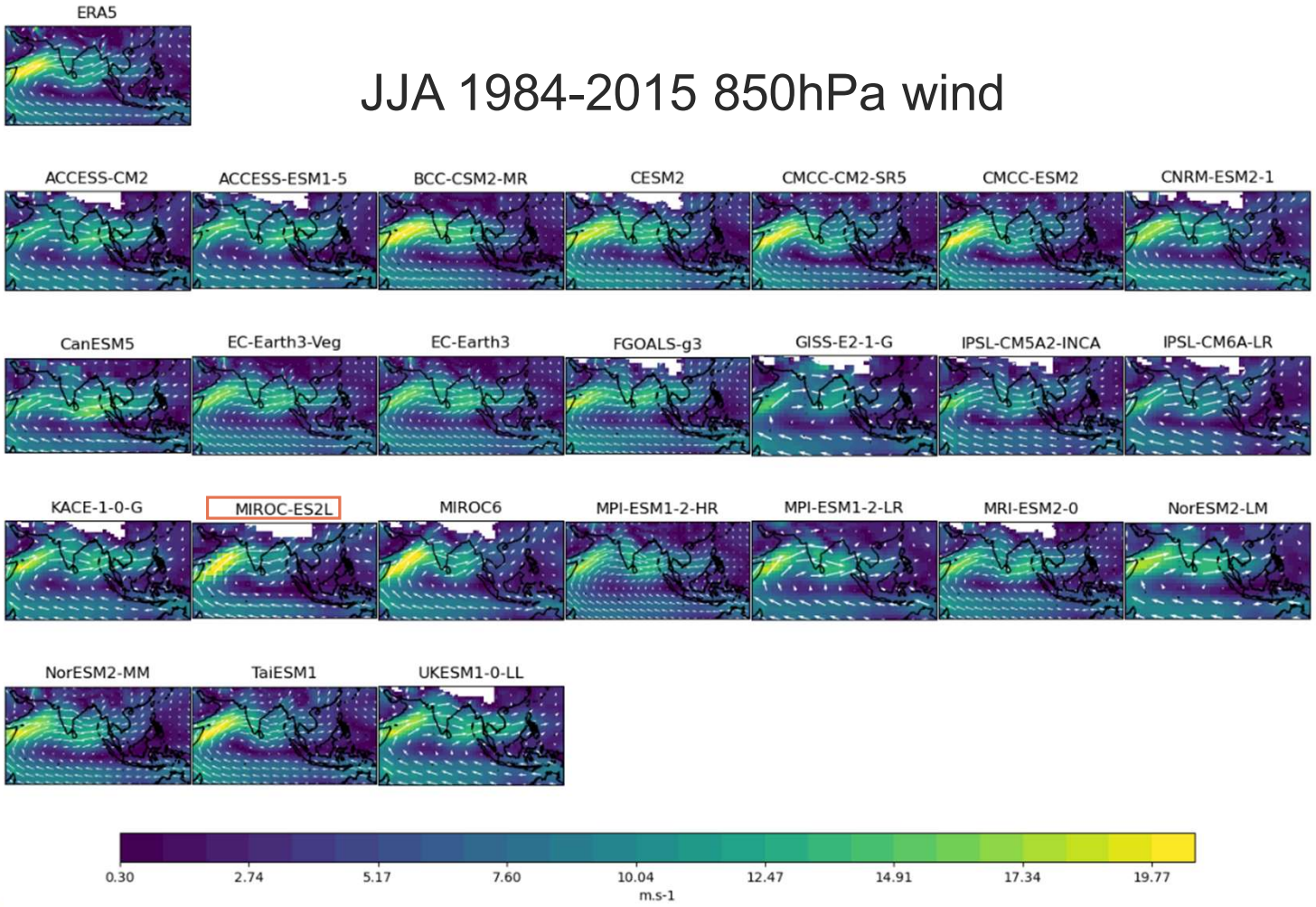
- Follows the approach of McSweeney et. al 2015, ‘Selecting CMIP5 GCMs for downscaling over multiple regions’. https://link.springer.com/article/10.1007/s00382-014-2418-8 and EuroCORDEX (Sobolowski et al., 2023)
- Analysis of CMIP6 models over Southeast Asia to identify models that can reproduce key processes in the region (and rule out any which can’t.)
- Focus on large scale processes and metrics e.g. summer and winter monsoon circulation, SSTs.
- Identify models that span future range of outcomes.
- If more than one model has similar future outcomes, consider selecting the one with the fewest biases.



New CORDEX SEA domain

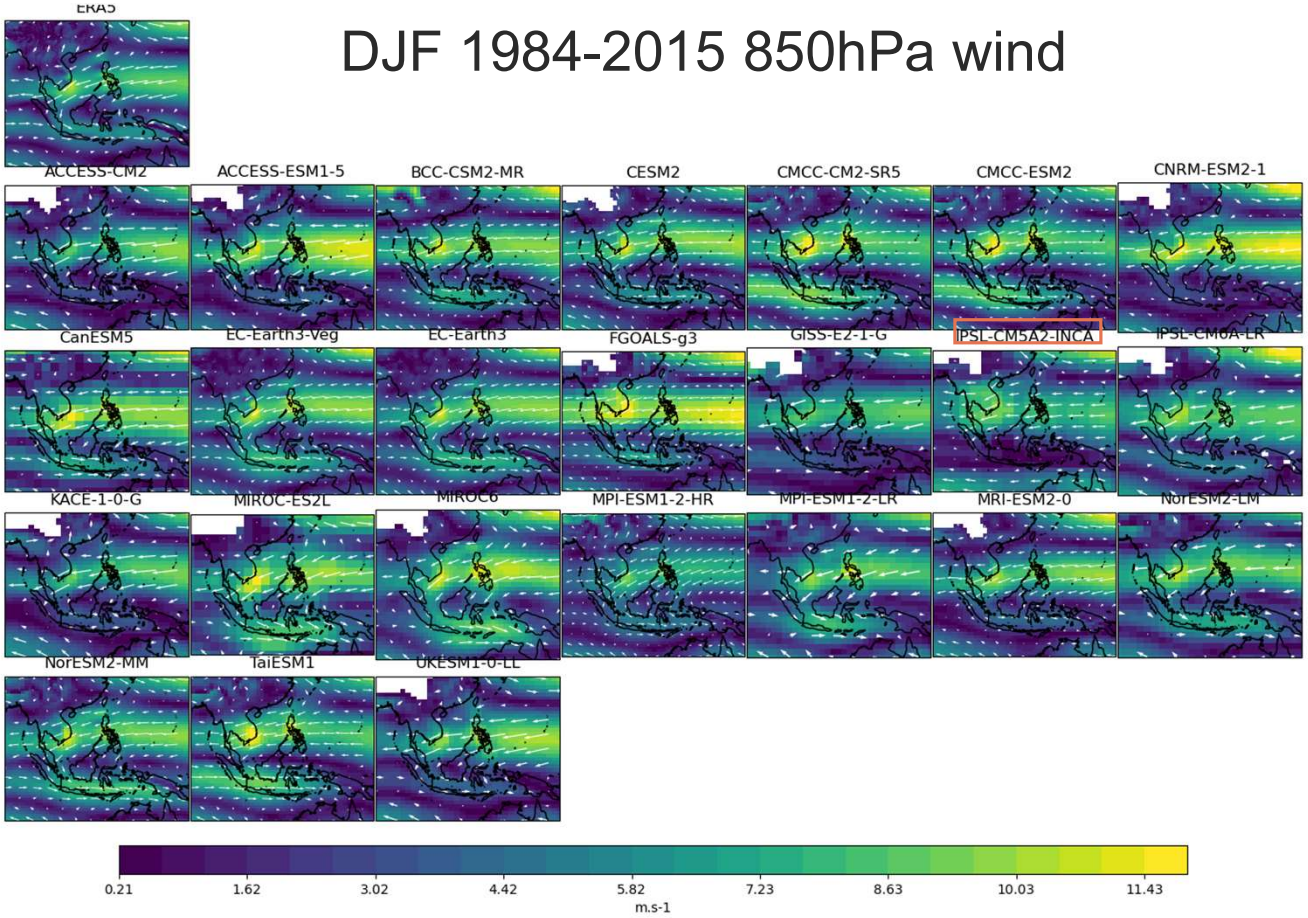
Summer Monsoon

JJA 1984-2015 850hPa wind



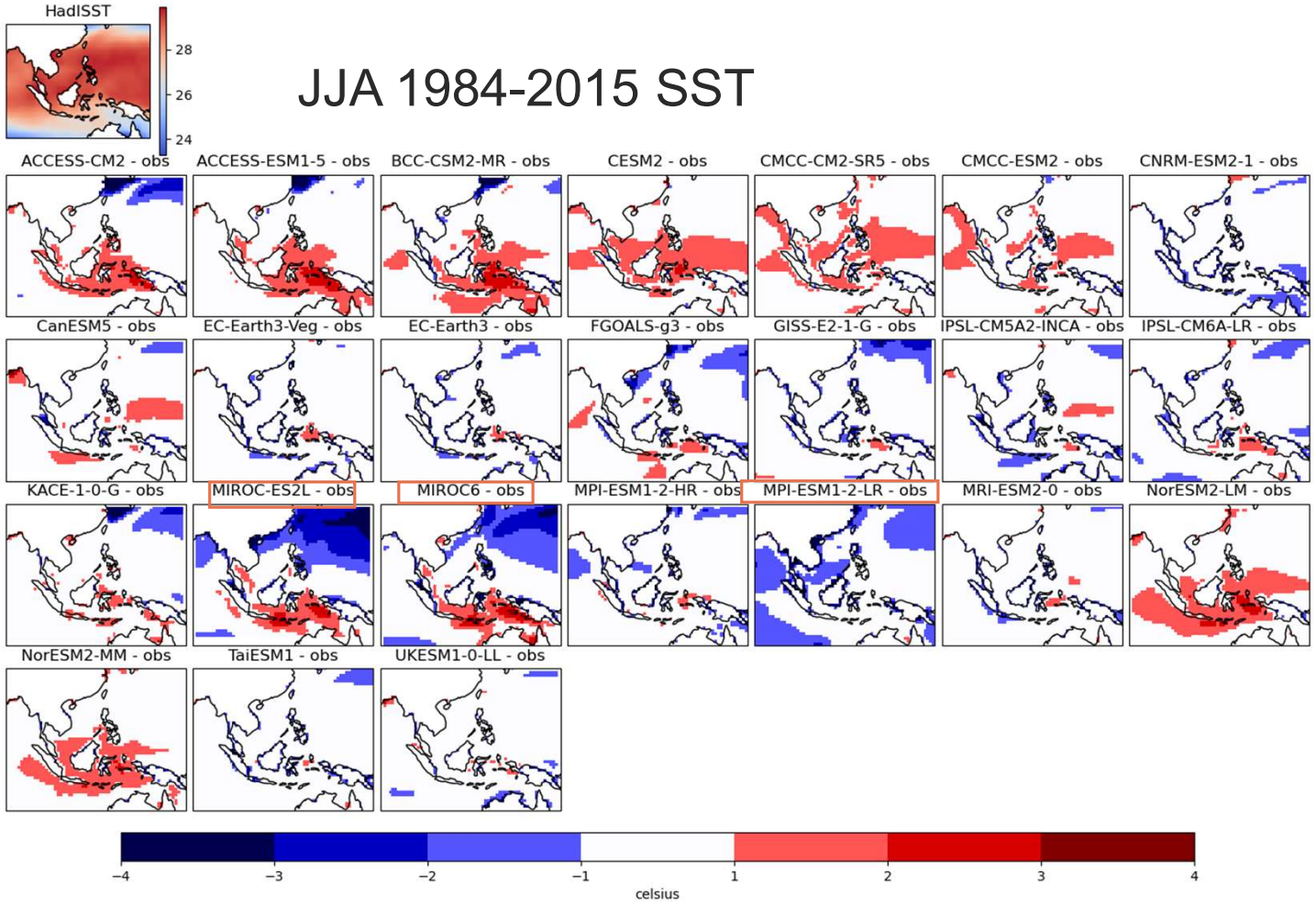
- Overall improvement compared to CMIP5, no models poor enough to rule out outright.
- Significant biases in some models e.g. MIROC-ES2L, circulation too far north over Vietnam.

Winter Monsoon



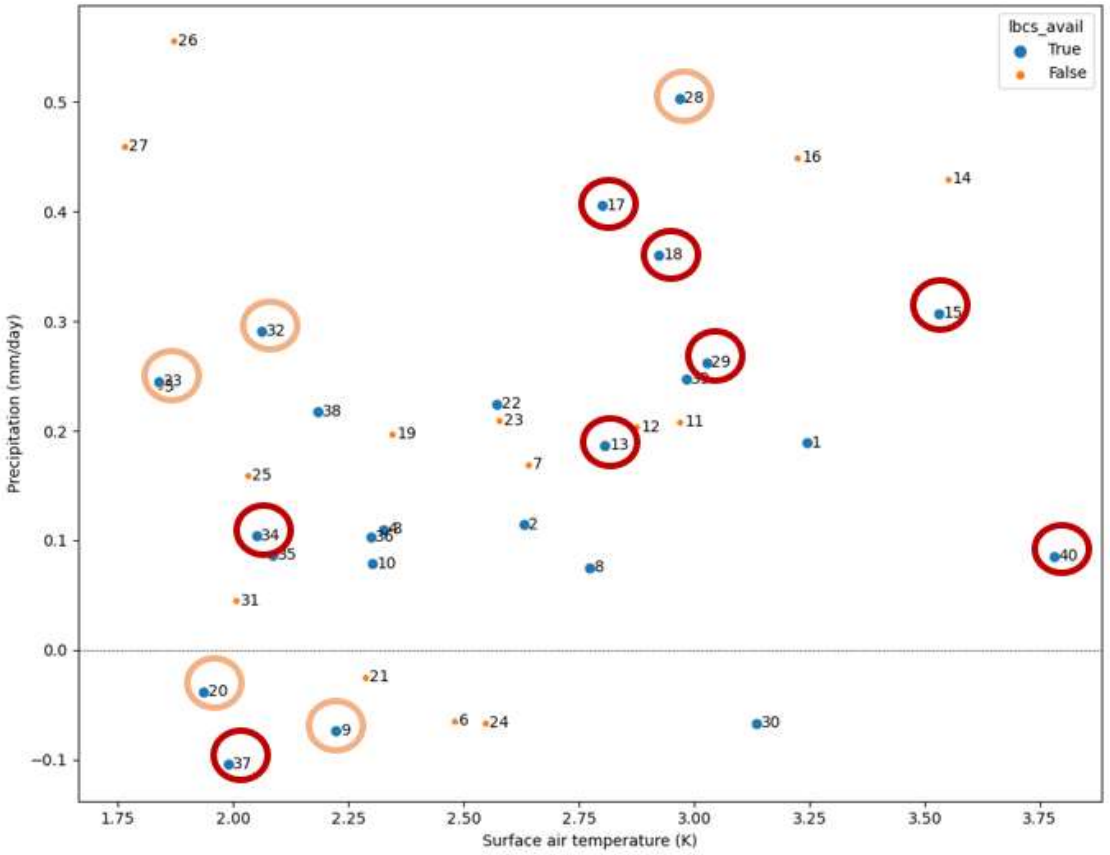
- No models poor enough to be excluded, IPSL-CM5A-INCA is borderline as there is no westward flow over Indonesia.
- The easterly component in a number of models is too strong, should turn SW off the coast of Vietnam.

Summer SSTs



- RCM takes SSTs directly from the GCM, biases important.
- Ocean temperate in the region important for tropical cyclone formation. About half satisfactory but several are biased and 4 significantly biased.
- MIROC models and one MPI model too cold in northern part of domain. Not ruled out but significantly biased.
- Number of models ~1 degree too warm over Maritime Continent.

Future changes in precipitation and temperature



1 - ACCESS-CM2
2 - ACCESS-ESM1-5
3 - AWI-CM-1-1-MR
4 - BCC-CSM2-MR
5 - CAMS-CSM1-0
6 - CAS-ESM2-0
7 - CESM2-WACCM
8 - CESM2
9 - CMCC-CM2-SR5
10 - CMCC-ESM2
11 - CNRM-CM6-1-HR
12 - CNRM-CM6-1
13 - CNRM-ESM2-1
14 - CanESM5-CanOE
15 - CanESM5
16 - EC-Earth3-AerChem
17 - EC-Earth3-Veg
18 - EC-Earth3
19 - FGOALS-f3-L
20 - FGOALS-g3
21 - GFDL-ESM4
22 - GISS-E2-1-G
23 - GISS-E2-1-H
24 - GISS-E2-2-G
25 - IITM-ESM
26 - INM-CM4-8
27 - INM-CM5-0
28 - IPSL-CM5A2-INCA
29 - IPSL-CM6A-LR
30 - KACE-1-0-G
31 - MCM-UA-1-0
32 - MIROC-ES2L
33 - MIROC6
34 - MPI-ESM1-2-HR
35 - MPI-ESM1-2-LR
36 - MRI-ESM2-0
37 - NorESM2-LM
38 - NorESM2-MM
39 - TaiESM1
40 - UKESM1-0-LL

- We use SSP370 for future evaluation because this is the most extreme scenario used by CORDEX.
- Blue means boundary data available, orange means no boundary data available, but model included for context.
- In the report we suggest 8-10 models which cover range of outcomes.
- Particularly for precipitation, important to also consider spatial changes (i.e. two models might have similar mean change but different spatial patterns.)

Summary and next steps for selection

- No models in the present day were implausible enough we could exclude them outright, but some were significantly biased (see report for full list of model biases against different metrics.)
- In the report we recommend 8-10 suitable models but we only have resource to downscale 3-5.
- Recommended models are: MIROC6 or MPI-ESM1-2-HR, NorESM2-LM, EC-Earth3-Veg or IPSL-CM6A-LR, and CNRM-ESM2-1. CanESM5 or UKESM1-0-LL could also be included as low likelihood/high impact models.