Rainfall projection over Singapore and surroundings during Southwest and Northeast monsoons

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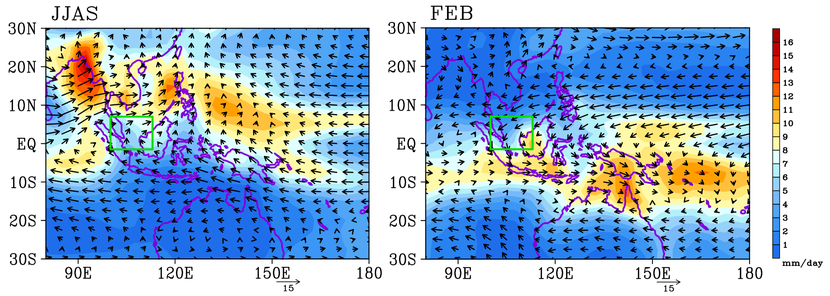
1. Objectives

Seasonal march of rainfall and 850hPa wind

(Data : CMAP+GPCP and NCEP, 1979 – 2012)



Singapore and surroundings (SG) experience two dry seasons, in June – September (JJAS) and February (FEB).

Q1: Would they become drier in the future ?

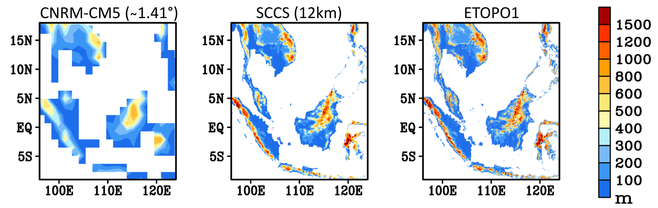
Q2: How does downscaling modify the results in the rainfall projection ?

Q3: What may affect the robustness of the projection ?

2. Data

- ❑ Coupled Model Intercomparison Project Phase5 (CMIP5)
- ❑ Downscaled CMIP5 models (SCCS1)*
  - Model: HadGEM3-RA regional model (RCM)
  - Resolution: 12km
  - Region: 9S – 19N, 95N – 125E
  - 9 of 30 models selected based on the model performance in regional key processes (ITCZ, monsoons, annual rainfall and temperature variability, MJO, ENSO, tropical cyclone, cold tongue biases)

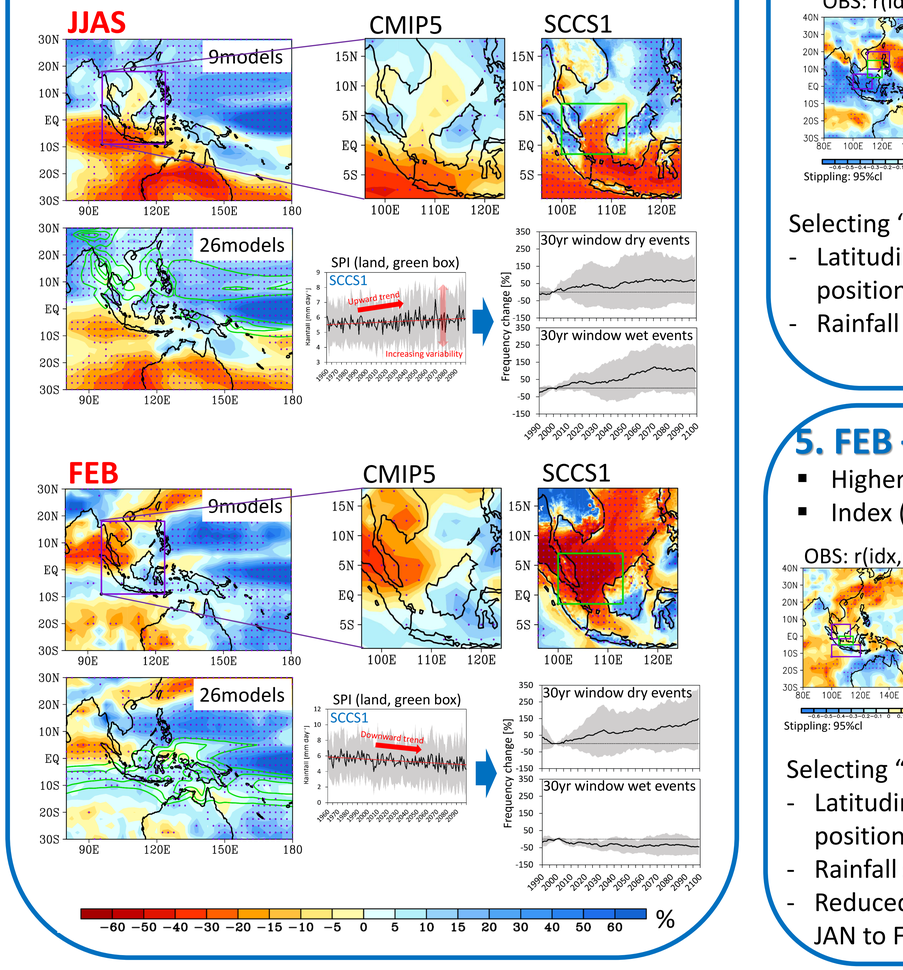
Orography



SCCS1, Climate Projections to 2100 Science Report 2015

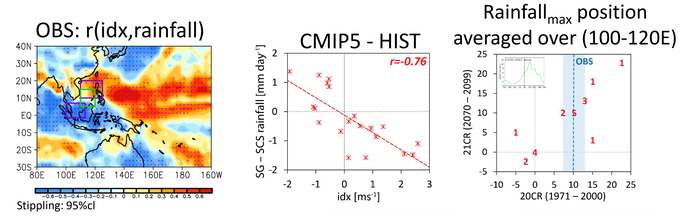
3. CMIP5 v.s. SCCS1: rainfall change

- Change in 2070 – 2099 relative to 1971 – 2000
- Standard Precipitation Index (SPI) = Δrainfall/std
- Stippling: 90%cl (agreement among models)

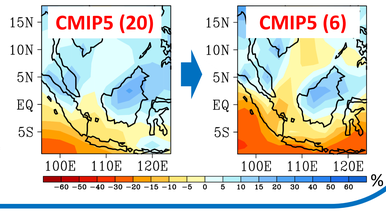


4. JJAS – South China Sea (SCS) monsoon

- ITCZ shift ↔ SCS monsoon *(Lestari and Iwasaki 2012)*
- Index (idx): 850hPa zonal wind over (5-15N, 110-120E)

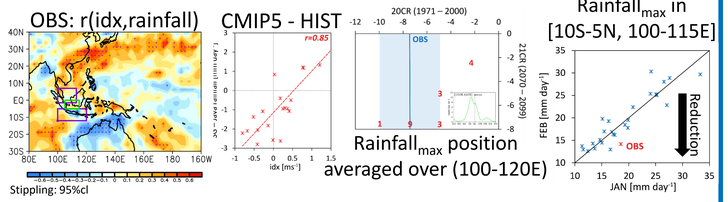


Selecting "good" models:
- Latitudinal $rainfall_{max}$ position
- Rainfall shape over EQ.

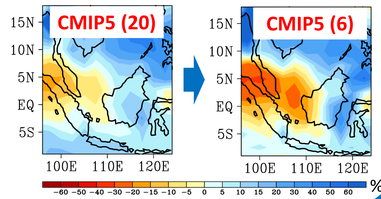


5. FEB – Cross Eq. Northerly Surge (CENS)

- Higher Java's rainfall ↔ CENS events *(Hattori et al. 2012)*
- Index (idx): 925hPa zonal wind over (5S-EQ, 105-115E)



Selecting "good" models:
- Latitudinal $rainfall_{max}$ position
- Rainfall shape over EQ.
- Reduced rainfall from JAN to FEB



6. Summary

- ❑ Singapore and surroundings experience two dry seasons, in JJAS and FEB
- ❑ Future rainfall mean increases (decreases) in JJAS (FEB) and dynamical downscaling enhances the significance of the rainfall change
- ❑ In **JJAS**, the frequency of dry (wet) events increases (increases), associated with increasing variability
- ❑ In **FEB**, the frequency of dry (wet) events increases (decreases)
- ❑ SCS Monsoon (CENS) activity may influences the robustness of the rainfall change in JJAS (FEB)