“Assistance to the Philippines: searching for the definition of NO REGRET”

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(climate and hydro data from Professor Toshio Koike, The University of Tokyo and IPCC)

Climate Change is a challenge for planning

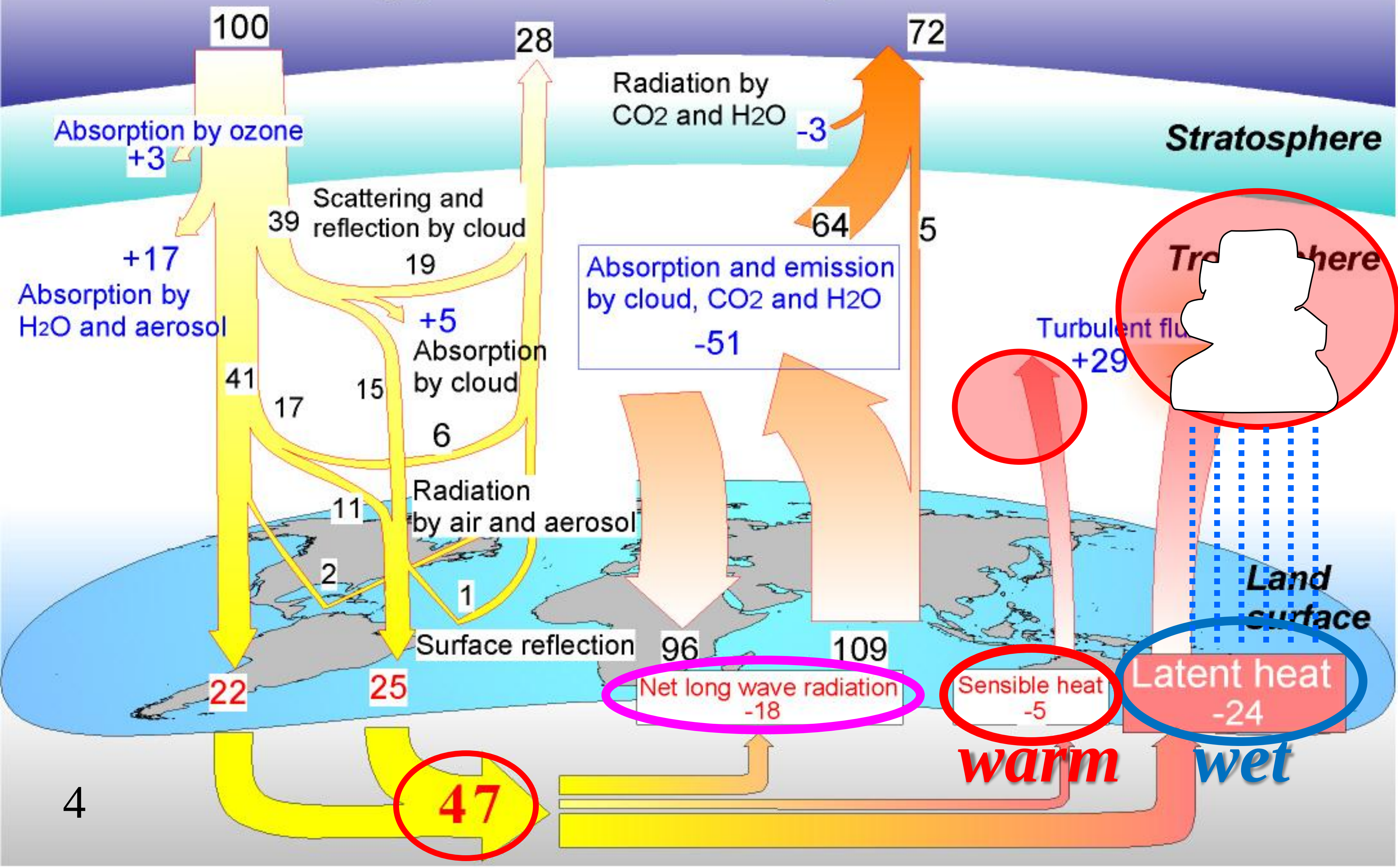
- Planning horizon for flood control structures
  - life cycle up to 40 to 50 years
  - current decision to be locked in for decades
- What is NO REGRET under climate change?
  - need to be accountable for future generations
- How can we assist for NO REGRET planning?
  - <u>well informed by rigorous science</u>
  - broad based decision making

What science can tell us

- Challenge 1: Effect of climate change is not linear, affects the "peak" events

- Flood control structures are intended to protect people, assets and activities from peak flood events
- Extent of increase in peak directly affects structure design
- Need to downscale general circulation models to calculate the increase in peak precipitation (Statistical downscaling, Multi model analysis, Bias correction)

Global Energy and Water Cycle

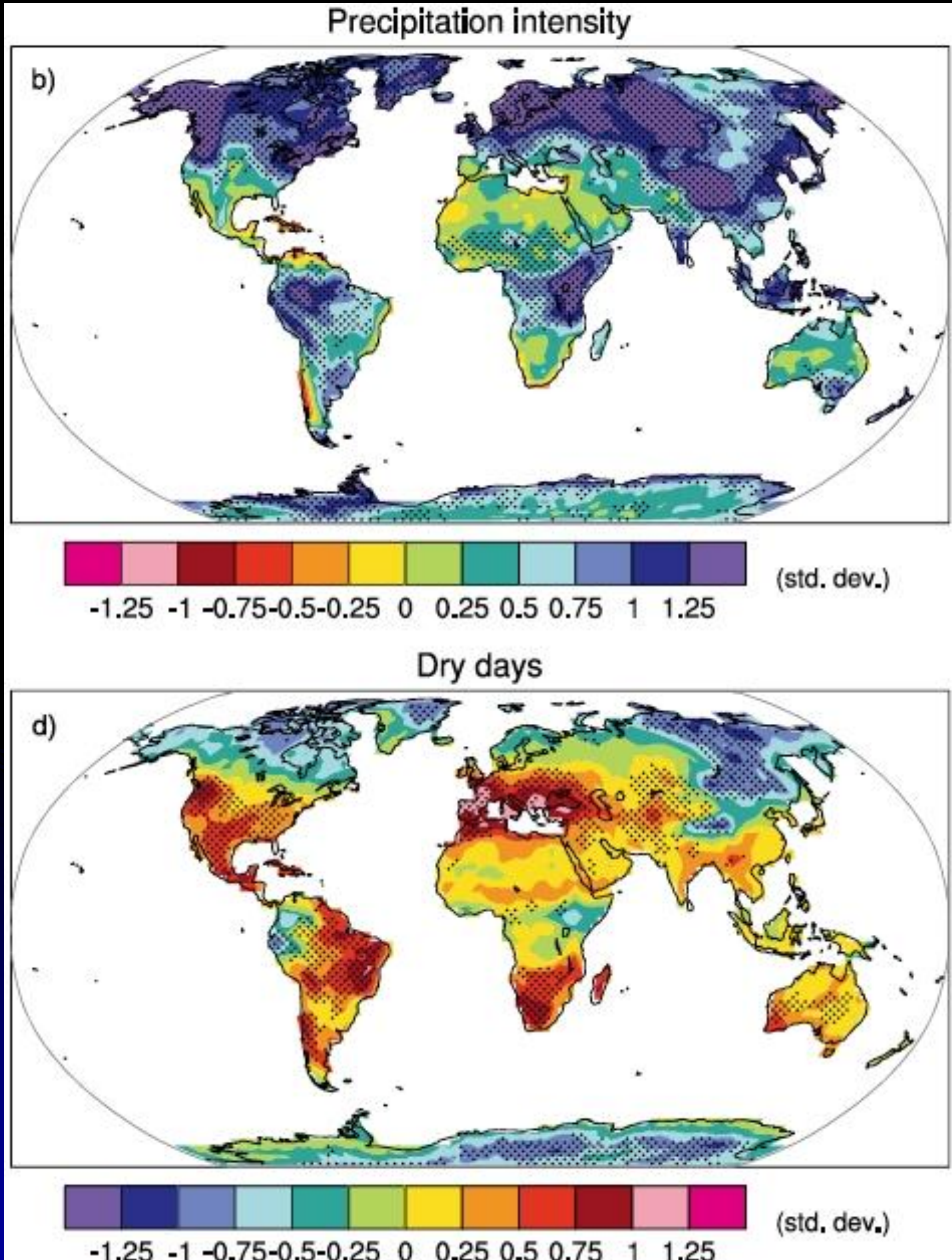


Ranking Scores and Selected GCMs

RANK	Models	Precipitation 115°E to 130°E; 10°N to 20°N	T air 80°E-160°E; 0°N-20°N	OLR 80°E-160°E; 0°N-20°N	U Wind 80°E-160°E; 0°N-20°N	V Wind 80°E-160°E; 0°N-20°N	SLP 80°E-160°E; 0°N-20°N	SST 80°E-160°E; 0°N-20°N	Grand Total
1	gfdl_cm2_0	1	1	1	1	1	1	1	**7**
2	gfdl_cm2_1	1	1	1	1	1	1	1	**7**
3	cccma_cgcm3_1	0	1	0	1	1	1	1	**5**
4	ipsl_cm4	1	1	-1	1	1	1	1	**5**
5	ncar_ccsm3_0	1	1	1	0	0	1	1	**5**
6	ukmo_hadgem1	0	1	1	1	0	1	1	**5**
7	bccr_bcm2_0	0	0	1	1	1	1	0	**4**
8	cccma_cgcm3_1_t63	-1	1	0	1	1	1	1	**4**
9	giss_aom	1	0	1	-1	1	1	1	**4**
10	ingv_echam4	1	0	1	1	1	0	0	**4**
11	csiro_mk3_0	0	1	-1	1	1	1	0	**3**
12	miub_echo_g	1	**	0	**	**	1	1	**3**
13	mpi_echam5	-1	1	0	1	1	0	1	**3**
14	cnrm_cm3	0	1	1	0	0	0	0	**2**
15	csiro_mk3_5	0	0	-1	1	1	1	0	**2**
16	miroc3_2_medres	1	0	1	0	0	0	0	**2**
17	mri_cgcm2_3_2a	-1	0	0	1	1	0	1	**2**
18	miroc3_2_hires	0	1	0	0	0	-1	0	**0**
19	giss_model_e_r	1	0	-1	0	0	-1	0	**-1**
20	ukmo_hadcm3	-1	0	0	0	0	0	-1	**-2**
21	iap_fgoals1_0_g	0	-1	0	-1	0	-1	-1	**-4**
22	inmcm3_0	0	-1	-1	-1	-1	0	-1	**-5**
23	giss_model_e_h	0	-1	-1	-1	-1	-1	-1	**-6**
24	ncar_pcm1	-1	0	-1	-1	-1	-1	-1	**-6**

*But **#5,#6,#12** were either **missing** or **incomplete**; **#9** showed poor representation of extreme events*

Projected changes in extremes



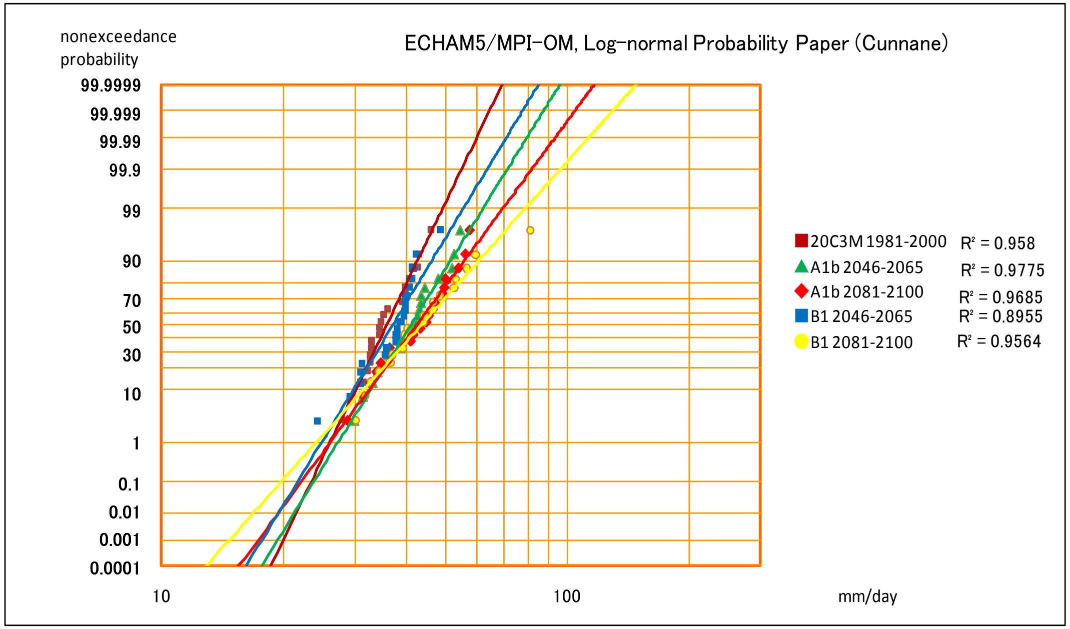
It is *very likely* that heavy precipitation events will continue to become more frequent.

> 90%

It is *likely* that area affected by drought increases.

> 67%

Climate Change Impacts on Heavy Rainfall in Indonesia

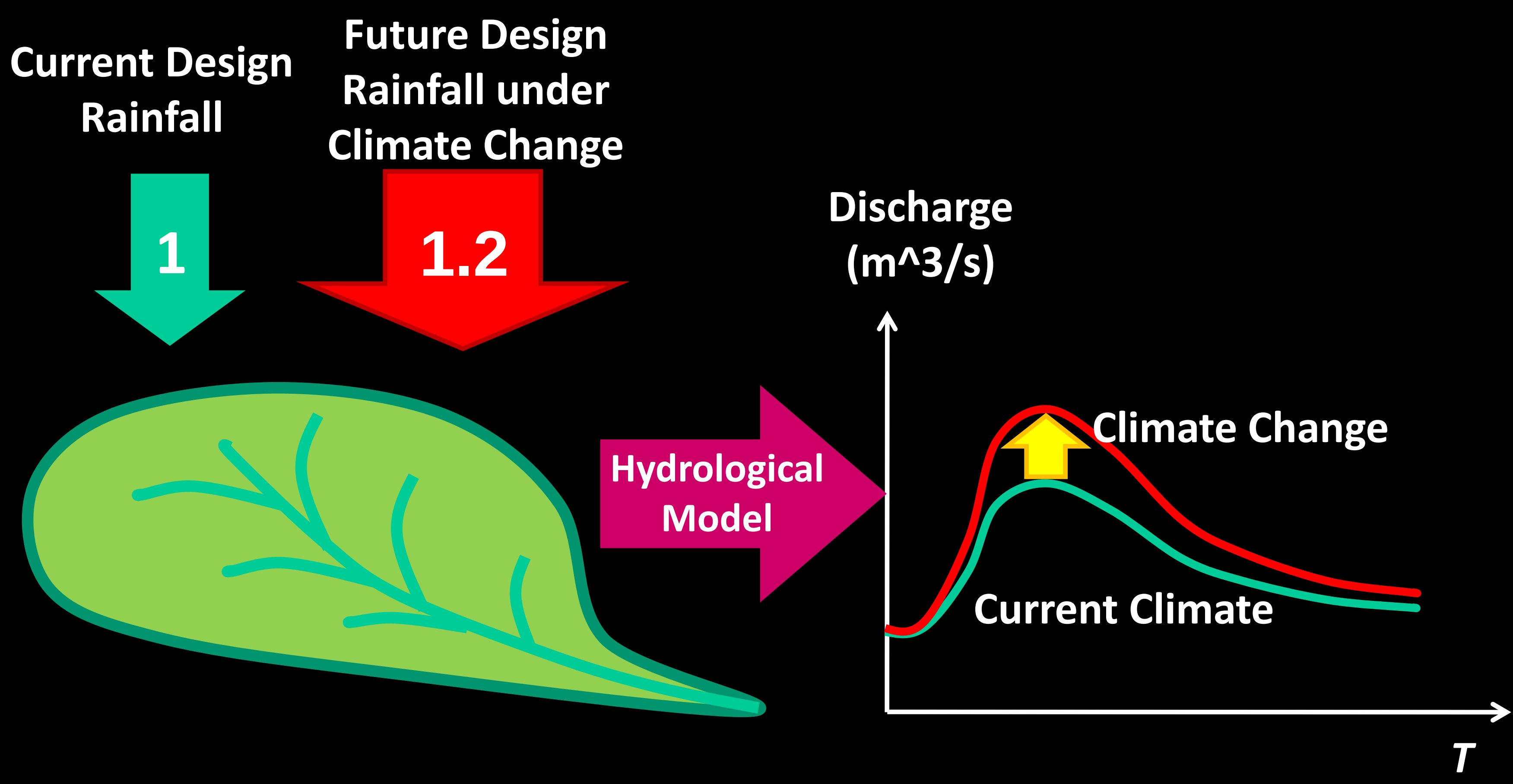


	A1B		B1	
	2046−2065	2081−2100	2046−2065	2081−2100
Number of models which show more severe distribution than now	82% 14(/17)	94% 16(/17)	76% 13(/17)	53% 9(/17)
5−year probable rainfall	1.18	1.31	1.14	1.18
10−year probable rainfall	1.20	1.35	1.15	1.2
100−year probable rainfall	1.20	1.36	1.17	1.18

Araki & Koike, 2008

Design Rainfall

Design Hydrograph



What science can tell us

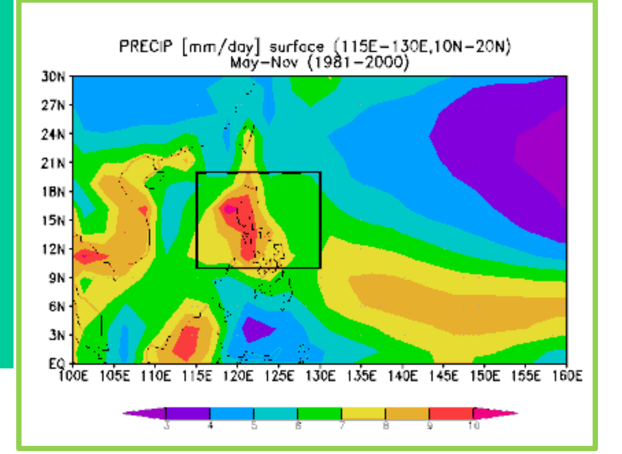
- <u>Challenge 2: Spatial distribution of precipitation</u>
- 3D of flood depends critically on the spatial distribution of precipitation
- Need to downscale general circulation models
- Combine with hydro dynamic models to simulate floods under most likely spatial distribution of precipitation

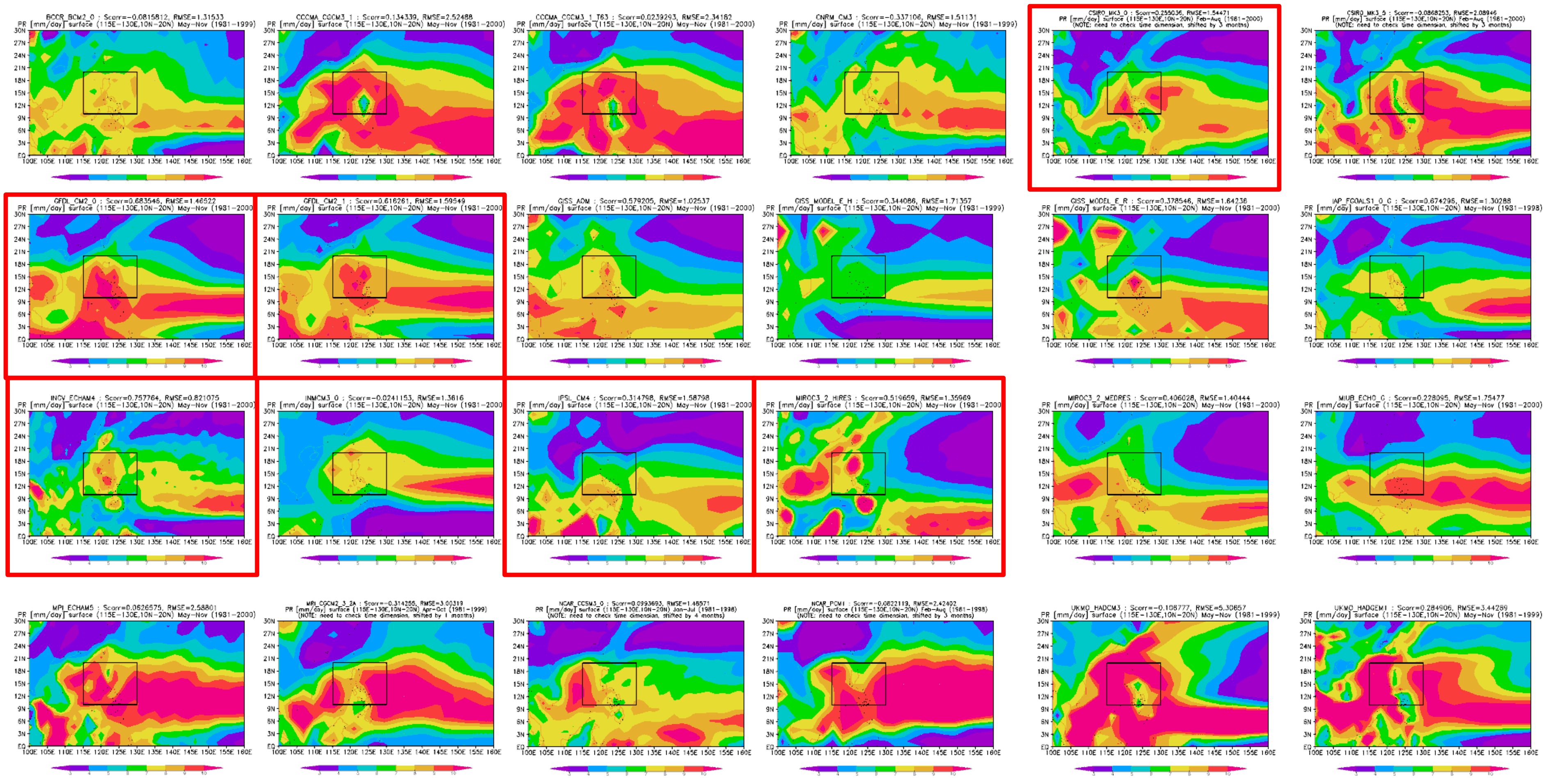
Upper Watershed of Metro Manila

Figure 3.6: Metro manila and its watershed

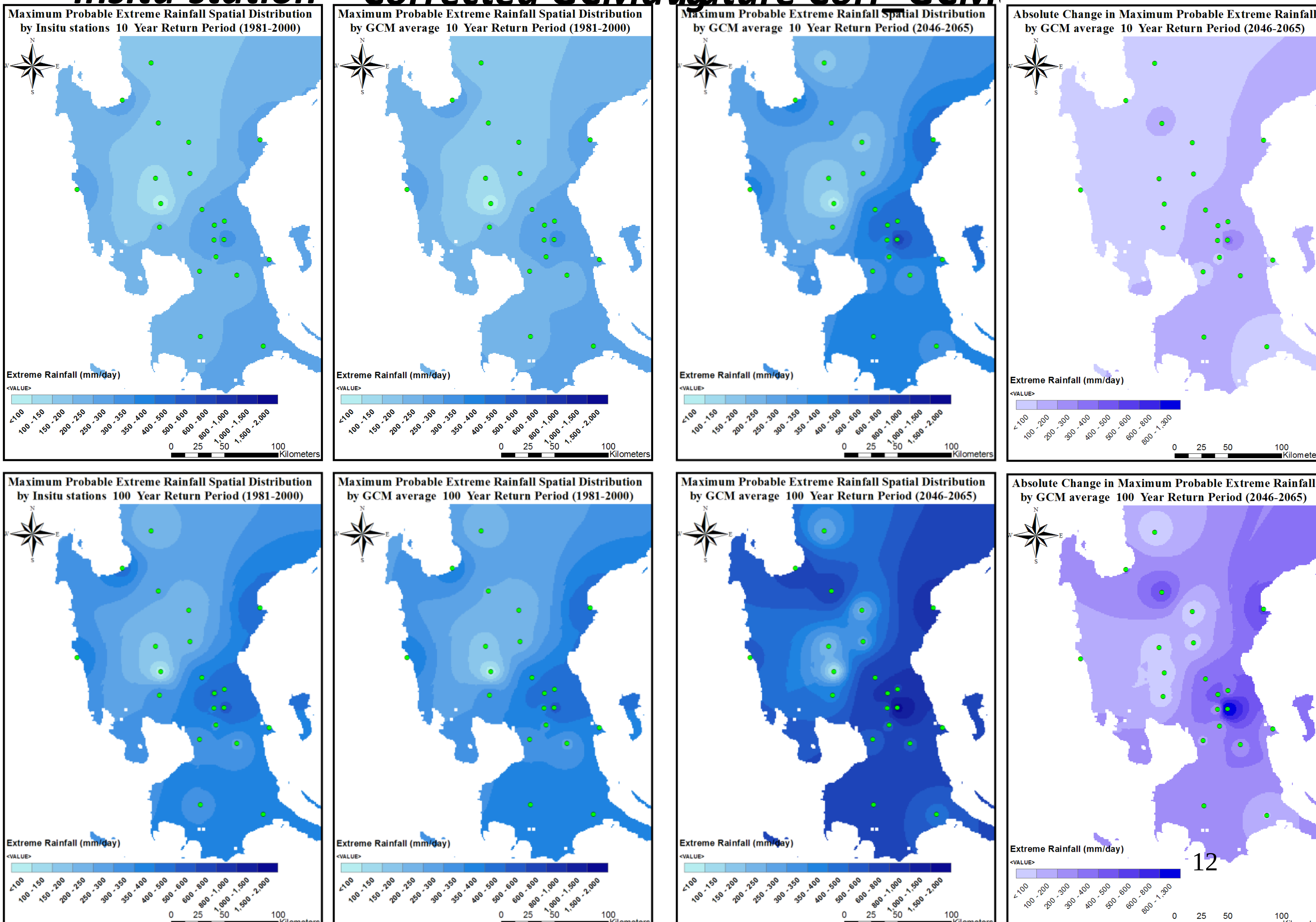
Source: World Bank cartography department

MODEL SELECTION: Precipitation (May-November)





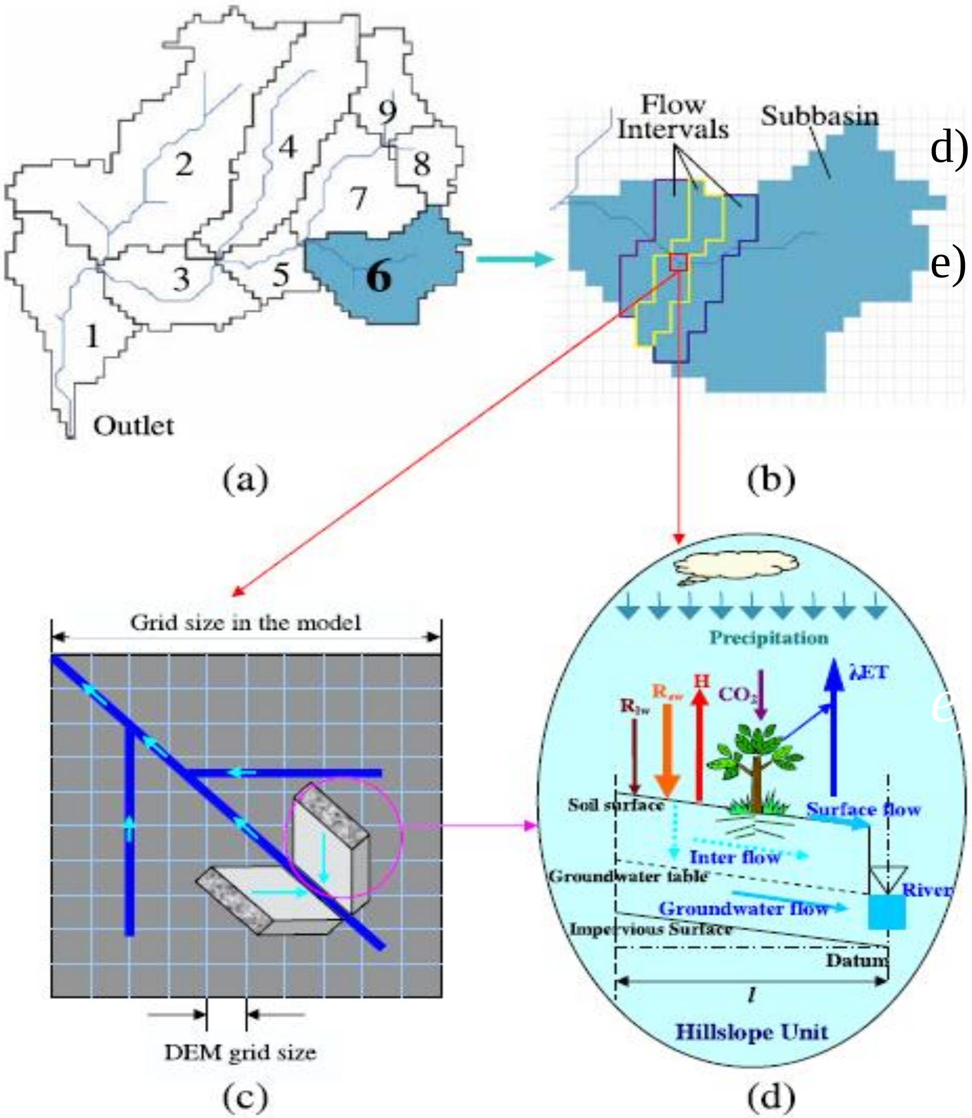
Insitu-station | *Corrected GCMavg* | *Future Corr_GCMavg* | *Future - Past*

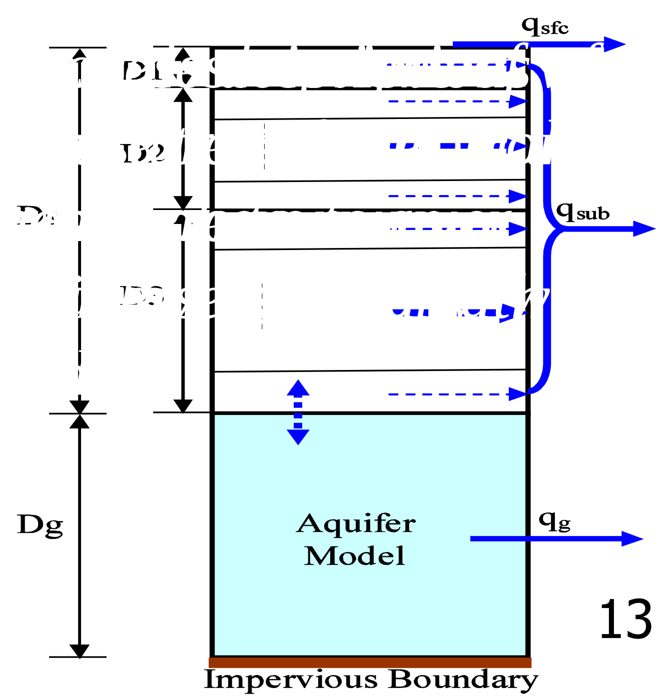


WEB-DHM

Water and Energy Budget-based Distributed Hydrological Model

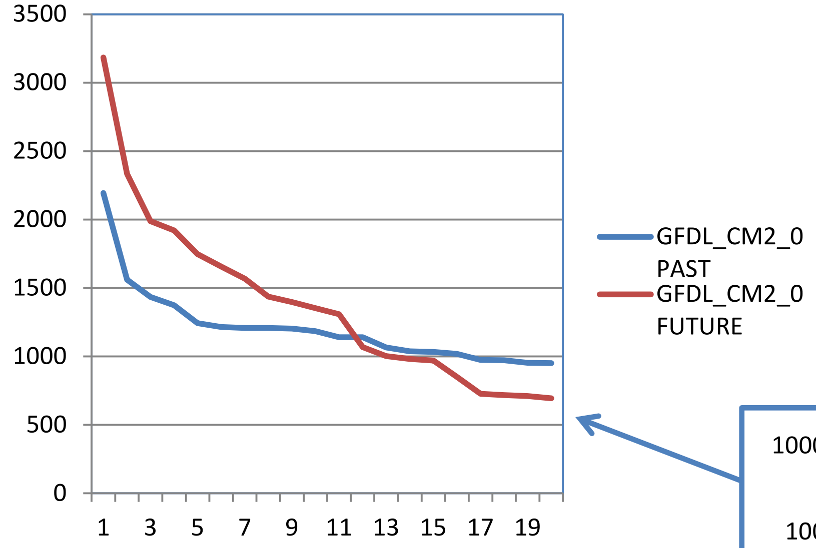
a) division from a basin to sub-basins
b) subdivision from a sub-basin to flow intervals comprising several model grids
c) discretization from a model grid to a number of geometrically symmetrical hillslopes,
d) process descriptions of water moisture transfer from the atmosphere to river
e) soil layers coupled with aquifer model





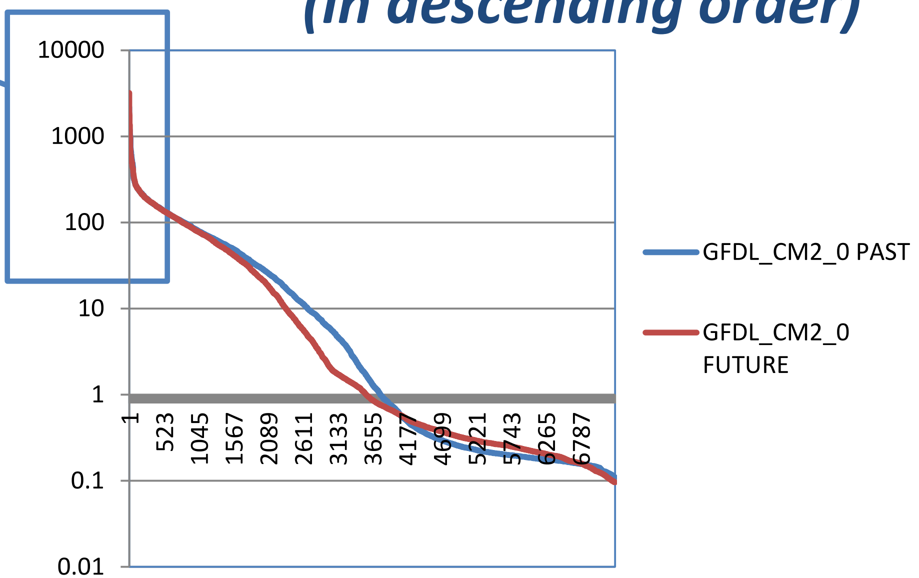
Climate Change Trends in Angat: (GCM MODEL: GFDL_CM2_0)

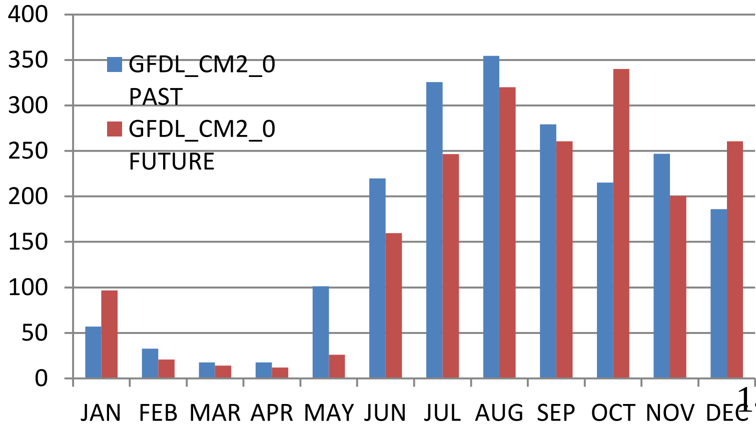
Top 20 peak flows:



Extreme Q	Baseflow
INCREASE	SLIGHT INCREASE

20 years simulations (in descending order)





Broad based decision making

- Challenge: Policymakers have to agree on likely future scenario
- Spatial pattern of flood depends on the downscaling and hydrodynamics results
- Policymakers tend to center decision on recent events to convince constituencies
- Political consensus favored over science – NO REGRET planning?

Way forward

- Assisting partner countries in long term planning under Climate Change: emerging case of "cutting edge science" based ODA
- Informing on choices through science can be done, but challenges remain in the communication strategy and decision making mechanism within partner countries
- Donor coordination on a shared platform of science is becoming increasingly important