清華大學
Tsinghua University

CENTER FOR EARTH SYSTEM SCIENCE
清华大学地球系统科学研究中心

Impacts of climate change on the hydrological processes in the Mekong River

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Outline

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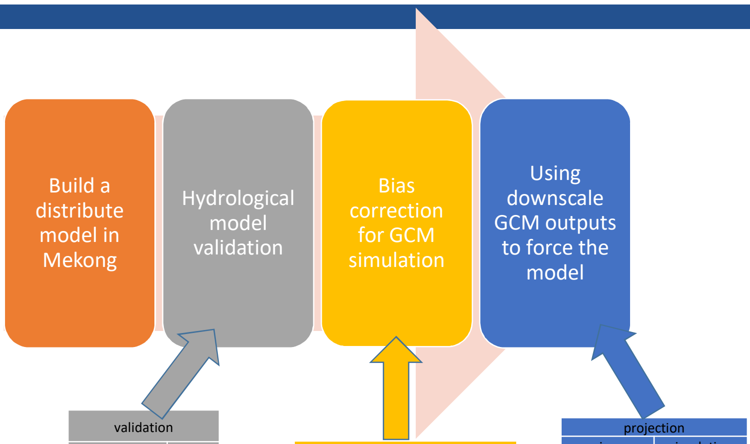
- Backgrounds
- Method and data
- Model calibration
- Temperature and rainfall trends
- Runoff trends
- Summary
- Acknowledgement

Backgrounds

- Climate change will likely change rainfall amounts and patterns and the frequency and extent of extreme weather events
- Evaluation of the hydrological impacts of climate change become a research hotspot
- As changes in weather patterns are being felt across the Lower Mekong Basin, the impacts of climate change have become a topic of strong public interest
- The IPCC 5th Assessment Report has been released this year

Method and data

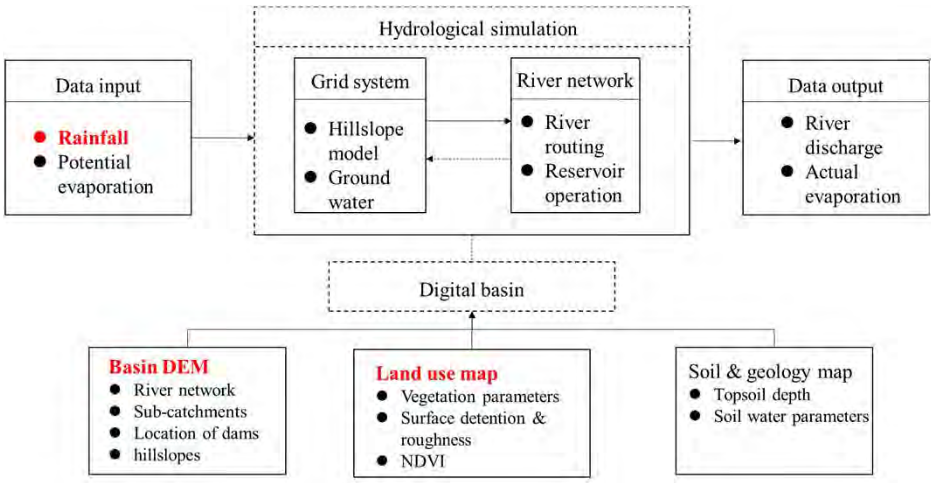


validation	
period	data
1998-2007	TRMM

bias correction	
spin up	simulate
1990-1994	1995-2004

projection	
spin up	simulation
2001-2010	2011-2040
2056-2060	2061-2070
2086-2089	2090-2099

Model and data



Method and data

- Data for building the digital basin

✓ *DEM data, Land use and land cover from the USGS*

✓ *Soil type and soil depth data are from FAO*

✓ *NDVI from MODIS*

Method and data

❑ Data fo

➢ Calibra

➢ TRMM

➢ Future p

➢ 0.25°

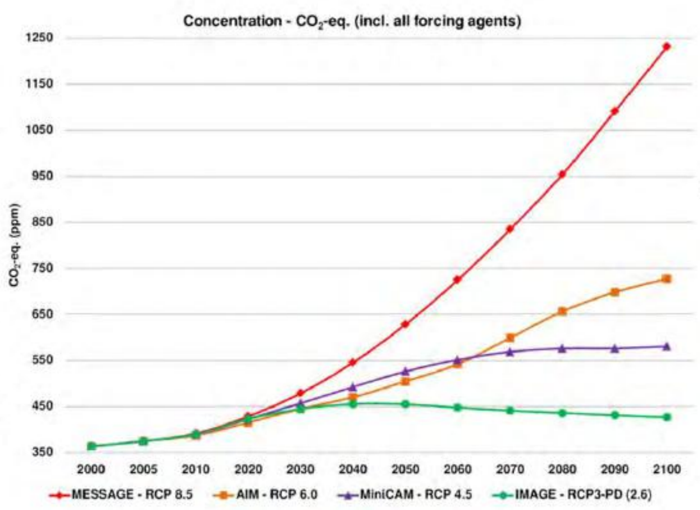
✓ GFDL-

✓ HadG

✓ IPSL-C

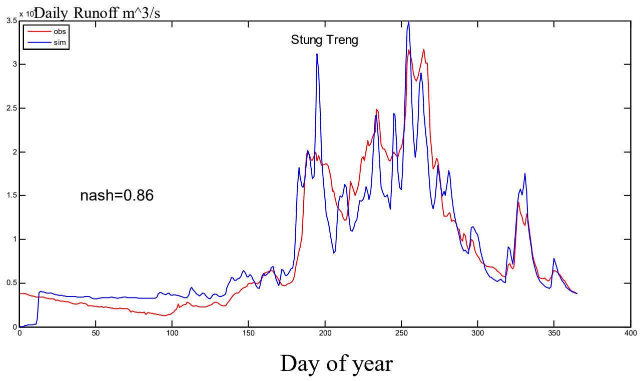
✓ MIRO(

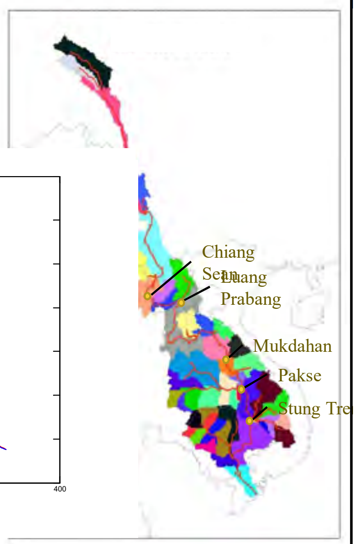
✓ NorES



Model calibration

❑ Calibration by TRMM (1999)





Model calibration

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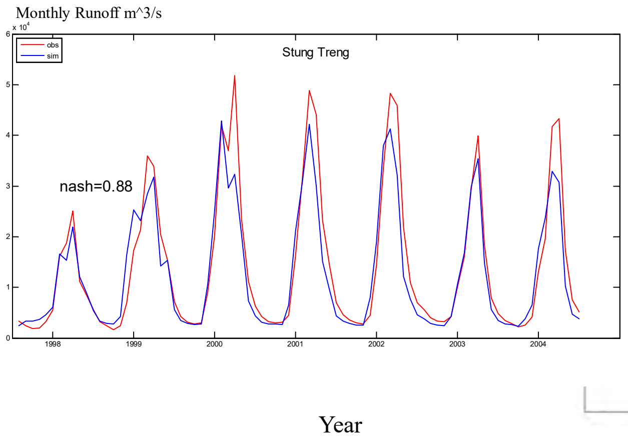
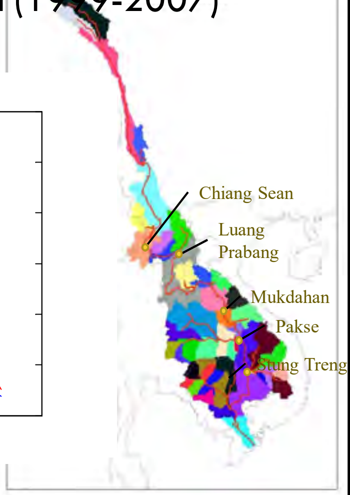
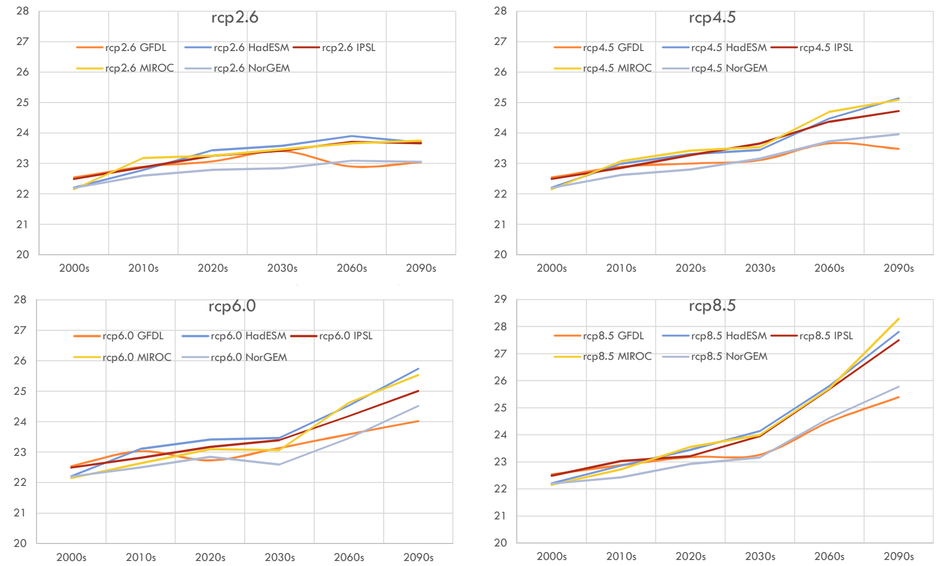
- Model performance in validation (1999-2007)



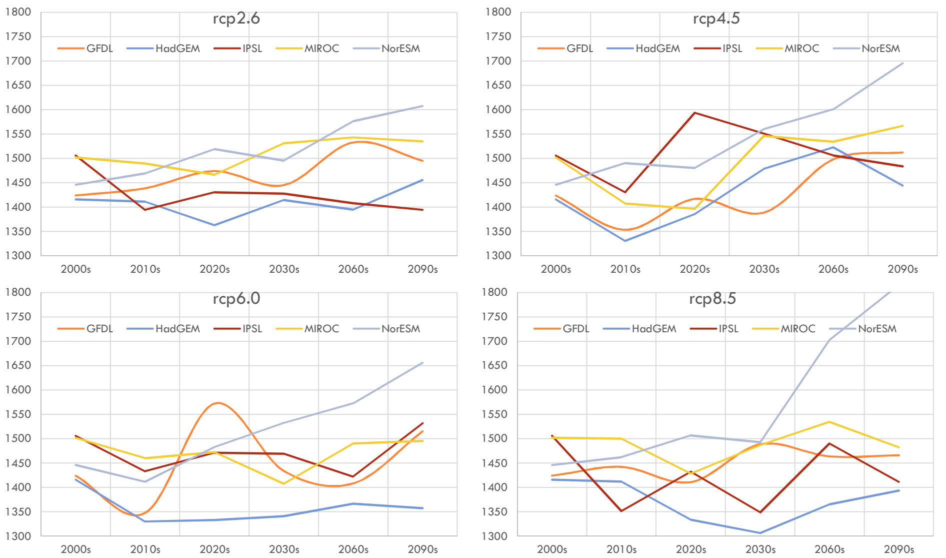


station	GCM	bias	bias_r	CORR	nash	RMSE
Chiang Sean	GFDL	-108.779	-0.04	0.474	-0.427	2490.549
	Had	-287.295	-0.105	0.823	0.652	1230.533
	IPSL	90.892	0.033	0.783	0.516	1449.881
	MIROC	44.172	0.016	0.793	0.57	1367.943
	Nor	135.205	0.049	0.774	0.486	1494.461
Mukdahan	GFDL	-529.076	-0.063	0.669	0.336	6510.556
	Had	-1052.019	-0.125	0.816	0.647	4745.339
	IPSL	354.59	0.042	0.759	0.474	5797.509
	MIROC	387.416	0.046	0.835	0.663	4639.135
	Nor	116.308	0.014	0.822	0.651	4720.134
Pakse	GFDL	-642.115	-0.062	0.704	0.421	7646.033
	Had	-1296.422	-0.126	0.796	0.615	6235.71
	IPSL	205.337	0.02	0.776	0.529	6897.488
	MIROC	87.19	0.008	0.848	0.708	5429.155
	Nor	-322.535	-0.031	0.836	0.689	5604.019
Stung Treng	GFDL	-209.218	-0.015	0.781	0.526	9594.309
	Had	-1458.809	-0.103	0.78	0.583	8994.594
	IPSL	715.313	0.05	0.801	0.552	9321.214
	MIROC	222.555	0.016	0.866	0.735	7168.04
	Nor	-597.948	-0.042	0.855	0.715	7433.296

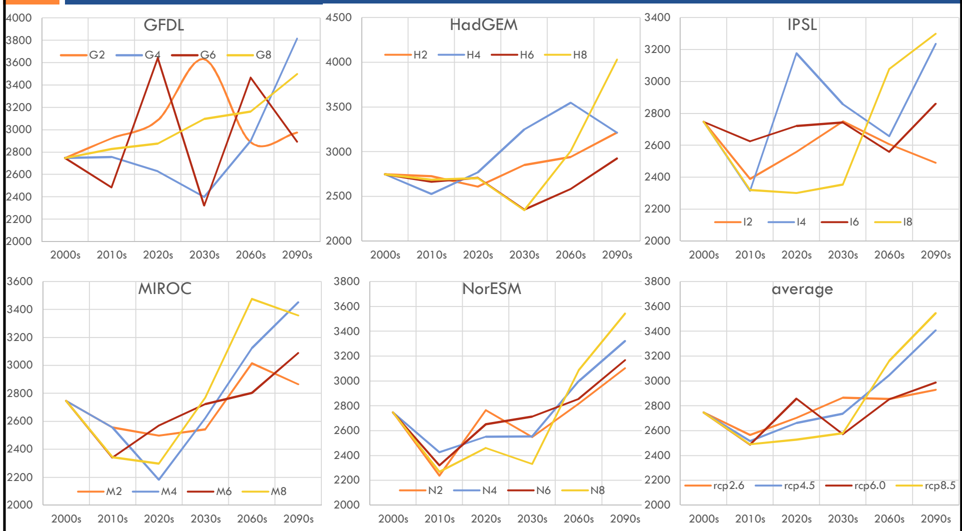
Temperature and rainfall trends



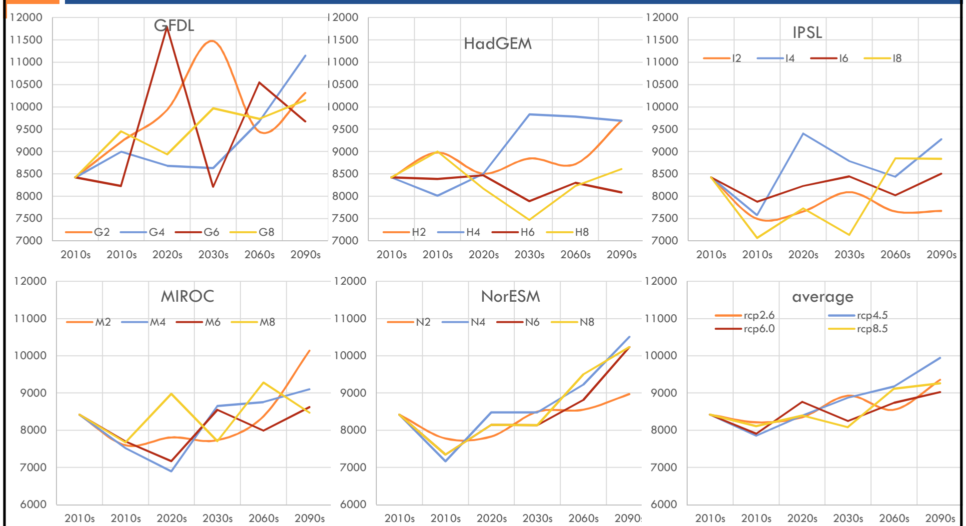
Temperature and rainfall trends



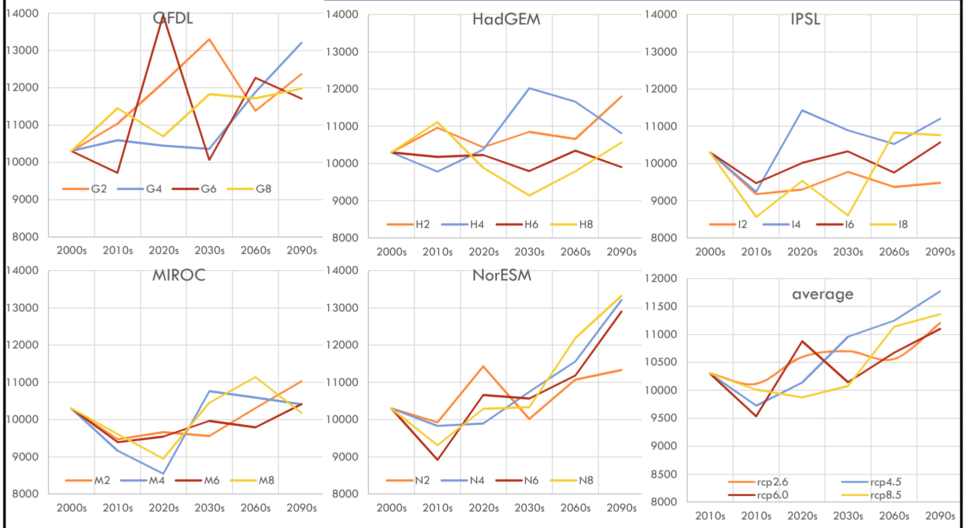
Runoff trends-Chiang Sean



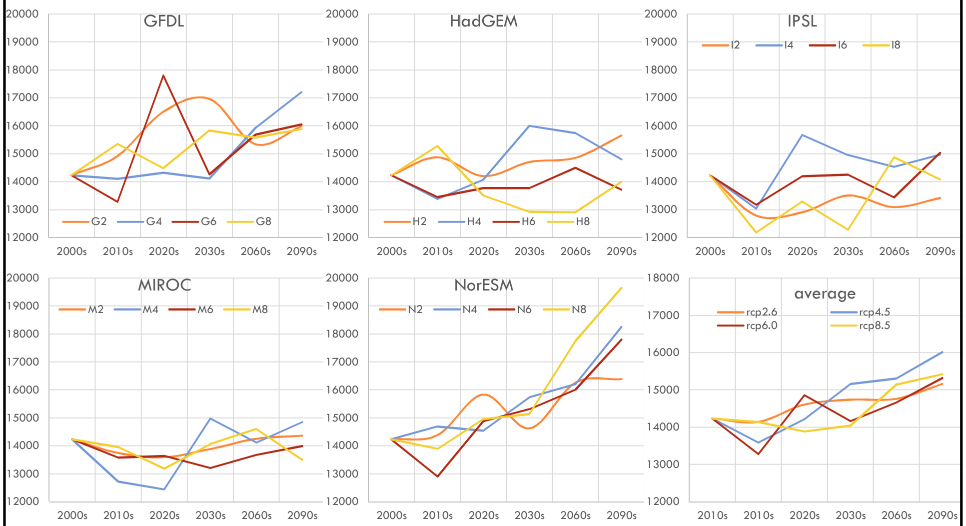
Runoff trends-Mukdahan



Runoff trends-Pakse



Runoff trends-Stung Treng

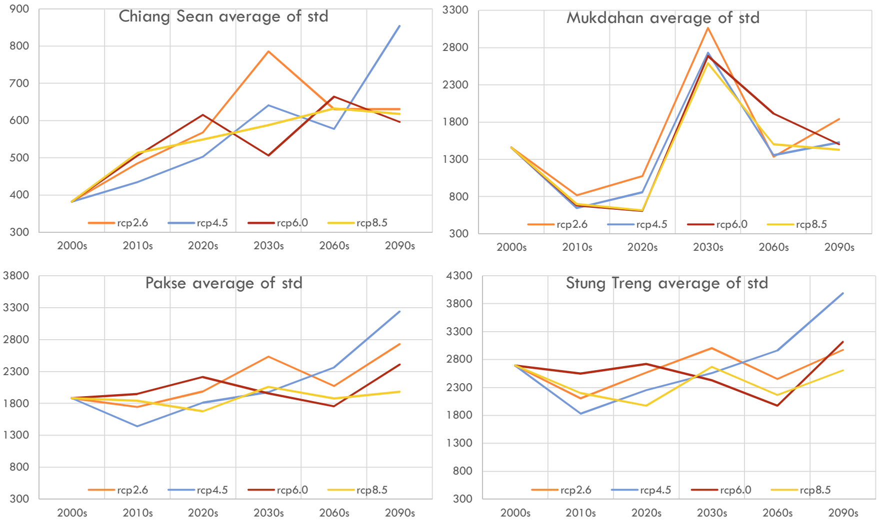


Runoff trends- in 2090s

- Runoff increase biggest in RCP4.5
- Chiang Sean increase biggest for most scenarios
- Stung Treng increase smallest for all scenarios

	Chiang Sean	Mukdahan	Pakse	Stung Treng
RCP2.6	6.7%	11.1%	8.7%	6.5%
RCP4.5	24.1%	18.1%	14.2%	12.5%
RCP6.0	8.7%	7.2%	7.7%	7.6%
RCP8.5	29.1%	10.0%	10.3%	8.4%

Runoff trends-Inter-annual variations



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Summary

- It is obviously that the average of temperature in the basin will increase in the future
- For the precipitation, the GCMs shows great disagreement from each other
- For the runoff, it depends largely on precipitation trends
- The inter-annual variations will increase especially in Chiang Sean, the discharge in Chiang Sean increase biggest for most scenarios→ the upper Mekong is more vulnerable to climate change