



EVALUATION ON THE IMPACTS OF UPSTREAM DAM DEVELOPMENT ON SALINITY INTRUSION INTO VIETNAMESE MEKONG DELTA

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- Conclusions and recommendation

1. Background of the project

MEKONG RIVER BASIN

Upper Mekong

- 24% of total area

Length: 4,880 km

Annual suspended sediment: 160 Mt/year

Lower Mekong

- 76% of total area



MAINSTREAM AND TRIBUTARY DAMS

Upper Mekong: **21 dams**

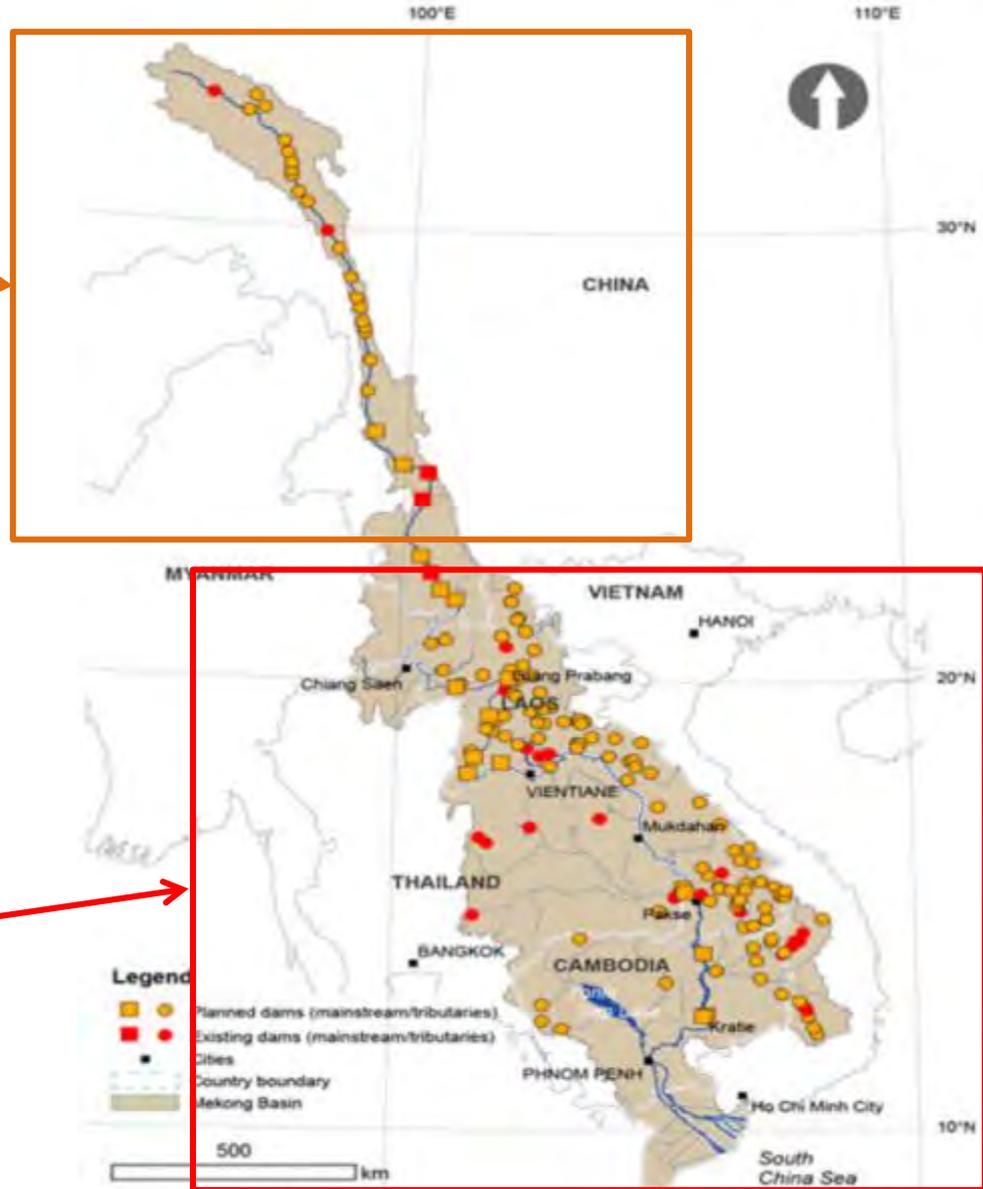
There are many plans for dam construction along Mekong River and its tributaries

Lower Mekong: **136 dams**

+ 31: under construction

+ 82: completed within 20 years

+ 136: completed within 40 years



THE OVERALL OBJECTIVES OF THE PROJECT

Sediment reduction

Evaluate the impacts of upstream dams on sediment flux along main rivers in Vietnamese Mekong Delta

Correlate the erosion rate of Mekong and Bassac riverbanks with the development of upstream dams

Evaluate the combined influence of upstream dams and dyke system on lateral flow and sediment interchange between rivers and floodplains

Salinity Intrusion

Evaluate the impacts of upstream dams on salinity intrusion into Vietnamese Mekong Delta

Evaluate the effectiveness of the operation of existing irrigation system in preventing salinity intrusion

Propose the appropriate change of agricultural, aqua-cultural structure for the whole VMD for adaptation

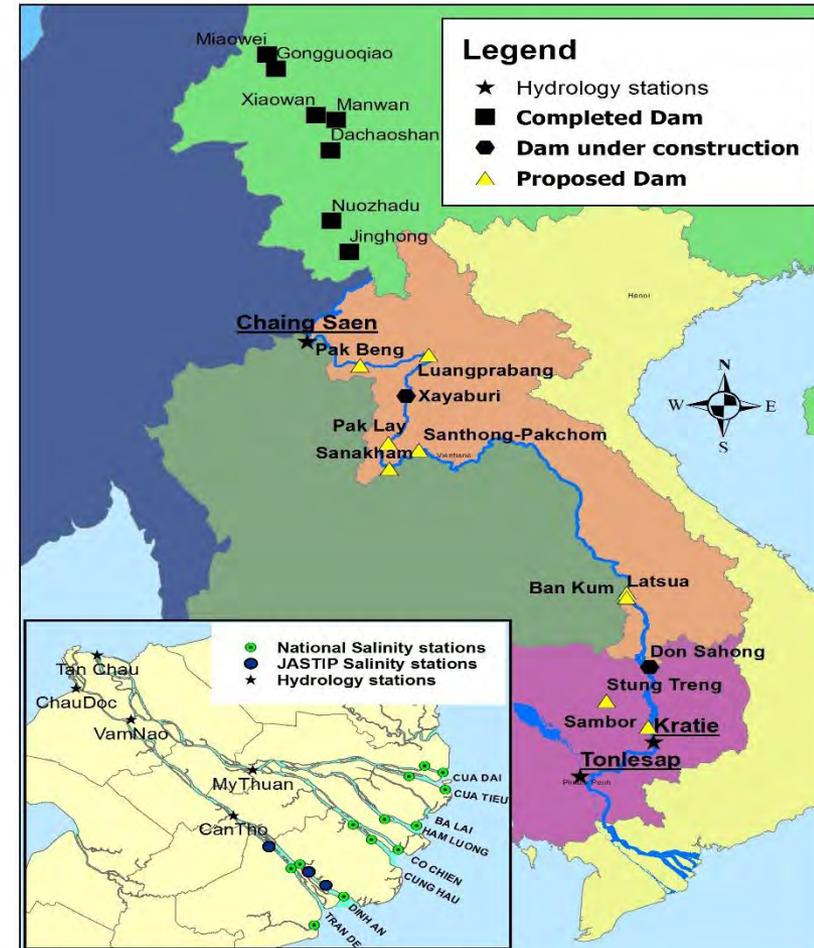
Map of the installed equipment

- ▲ Turbidity meter
- Salinity meter



2. Specific objectives of the study

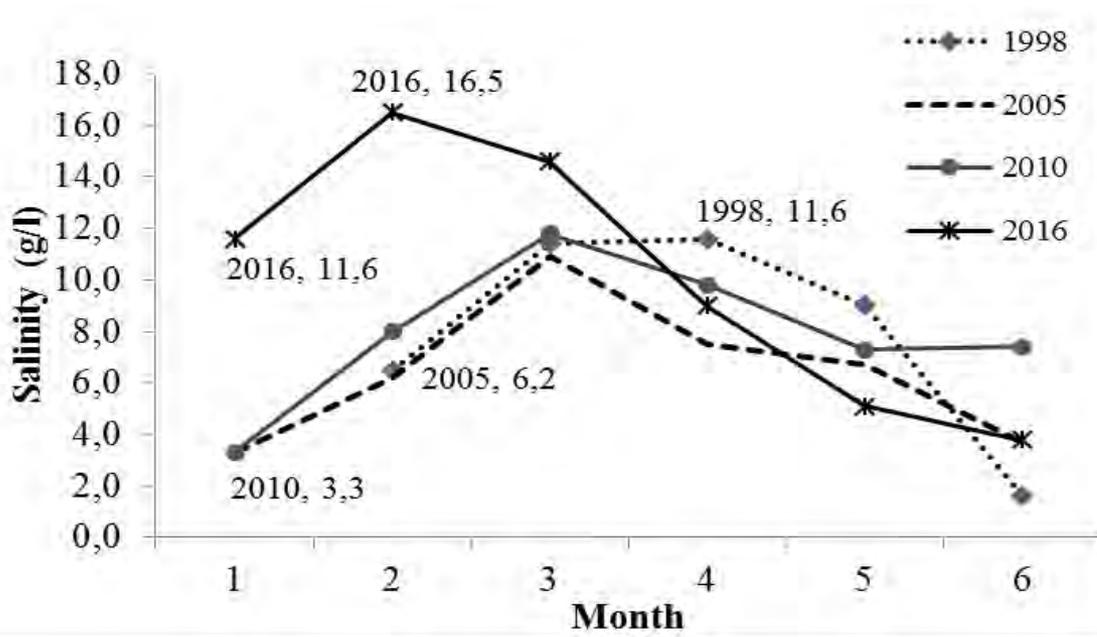
1. To assess the current status of the drought and salinity intrusion in 2016
2. To determine the correlation between the discharge to the delta and salinity concentration at some monitoring stations
3. To elucidate the impact of dam operation on salinity concentration and intrusion length by numerical simulations



3. Results and discussions

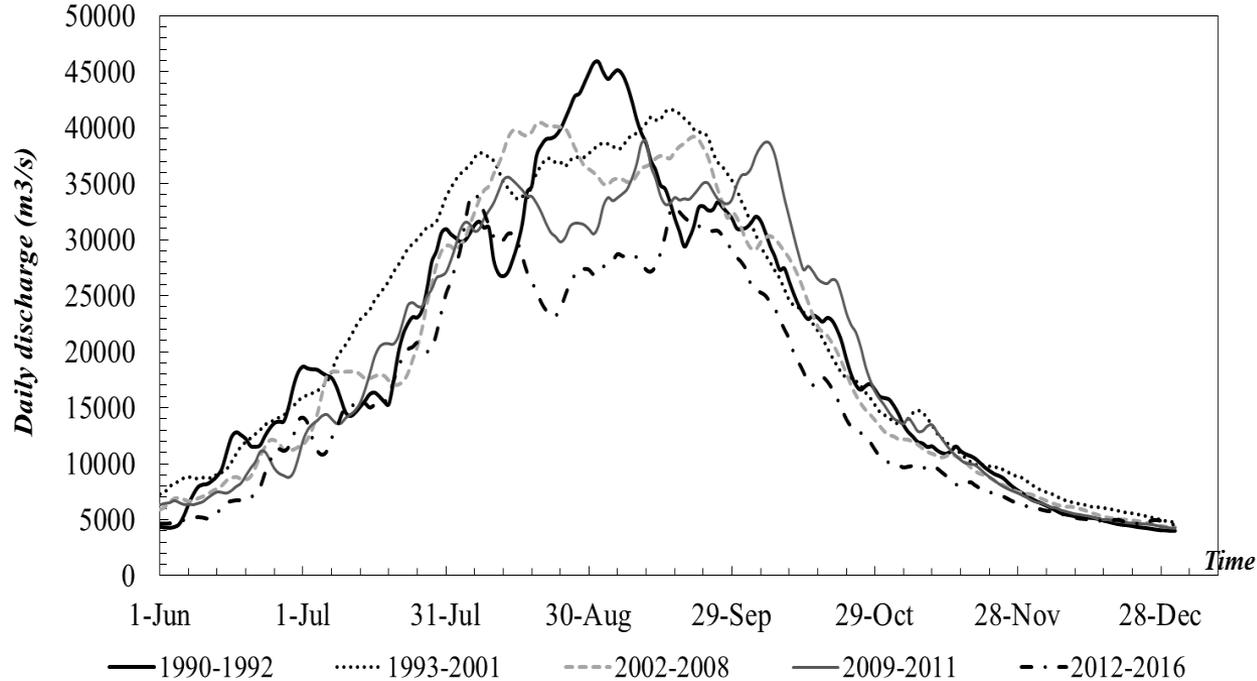
④	⑤	③	②	⑥	①
Manwan	Dachaoshan	Jinghong	Xiaowan	Gongguoqiao	Nuozhadu
1986-1992	1996- Nov.2003	2003-Apr.2008	2001-Dec.2010	2008 -Sep.2011	2006-Mar.2014
1670MW_1993	1350MW_2001	1750MW	4200MW	900MW	5850 MW-
$0.92 \times 10^9 \text{m}^3$	$0.89 \times 10^9 \text{m}^3$	$1.14 \times 10^9 \text{m}^3$	$14.56 \times 10^9 \text{m}^3$	$0.316 \times 10^9 \text{m}^3$	Sep.2012
					$23.7 \times 10^9 \text{m}^3$

3.1. The extreme salinity condition in 2016



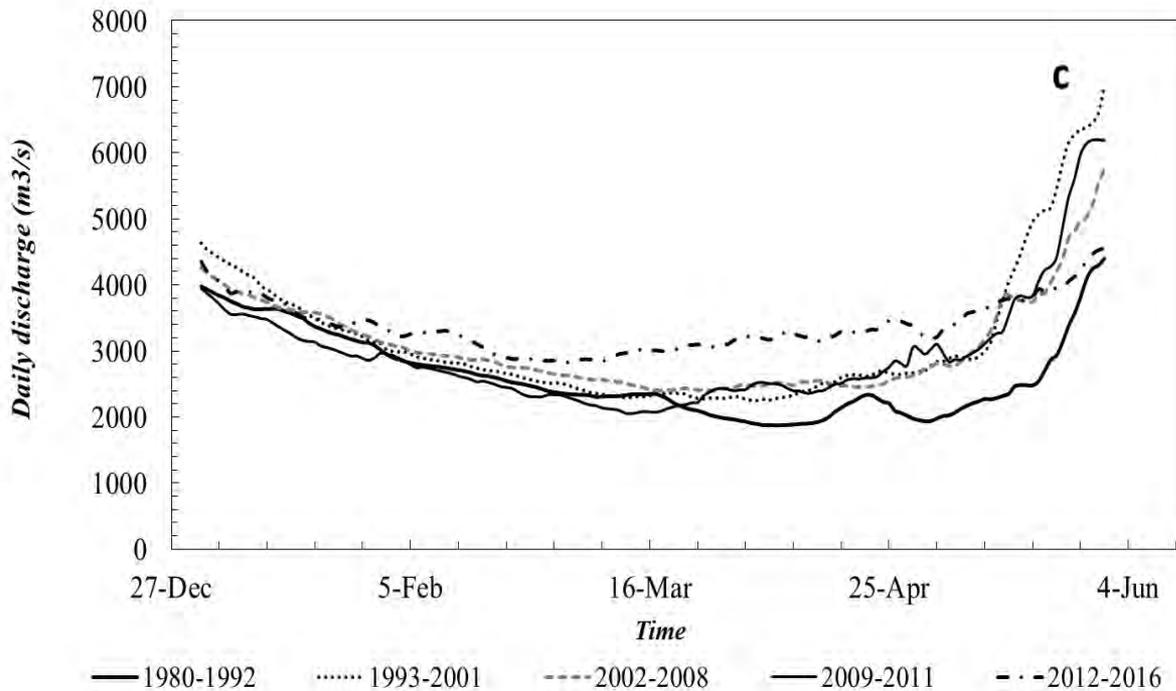
- The salinity in 2016 is extremely high.
- The maximum salinity concentration (S_{max}) in Jan almost equals to the peaks of other years
- The peak in 2016 shifts from Mar or Apr to Feb

3.2. Change of flow and salinity concentration in the post-cascade dam period



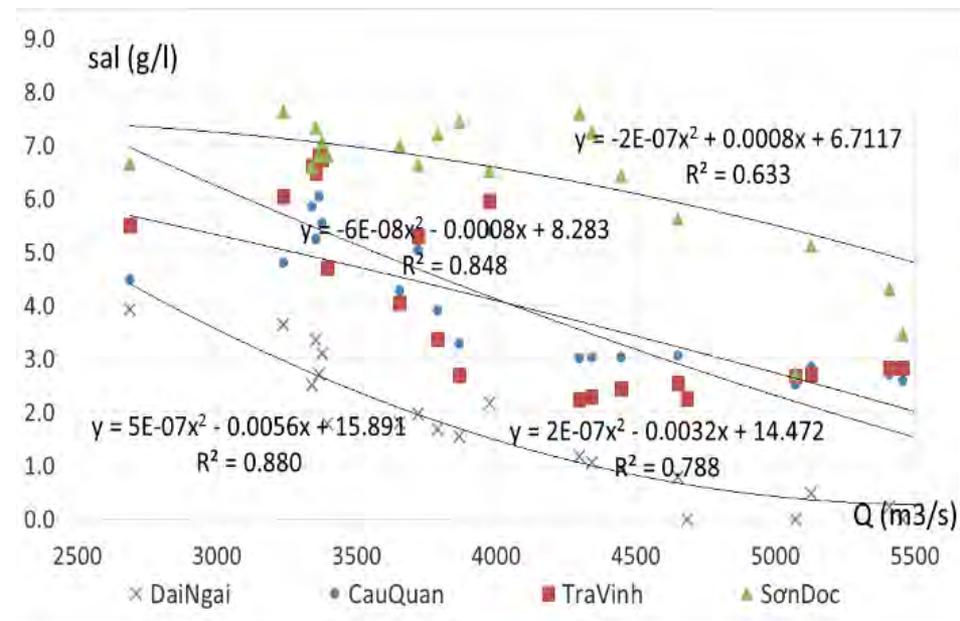
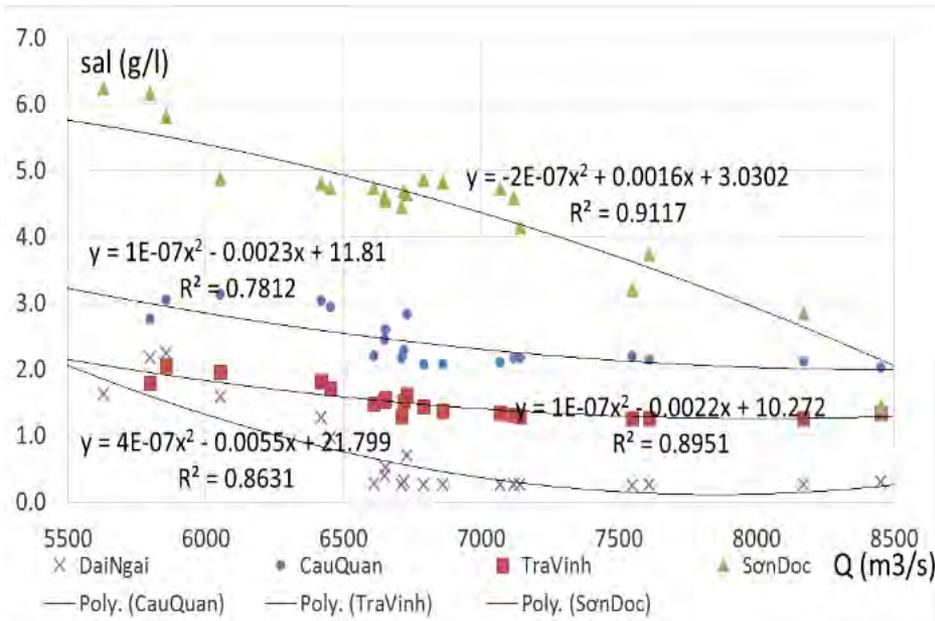
- The flood flow recorded at Kratie station decreases significantly in the period 2009-2011 and 2012-2016. It is due to the appearance of the 2 large reservoirs, Xiaowan (2010 – $14.56 \times 10^9 \text{m}^3$) and Nuozhadu (2014 – $23.7 \times 10^9 \text{m}^3$)
- The active volume of the 2 reservoirs accounts for 12.2% of annual mean discharge in many years, from 1990 to 2009.

3.2. Change of flow and salinity concentration in the post-cascade dam period



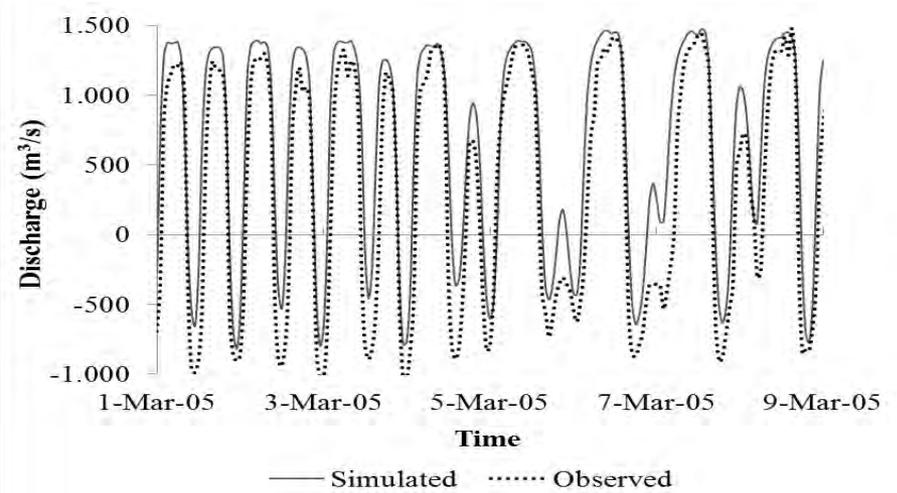
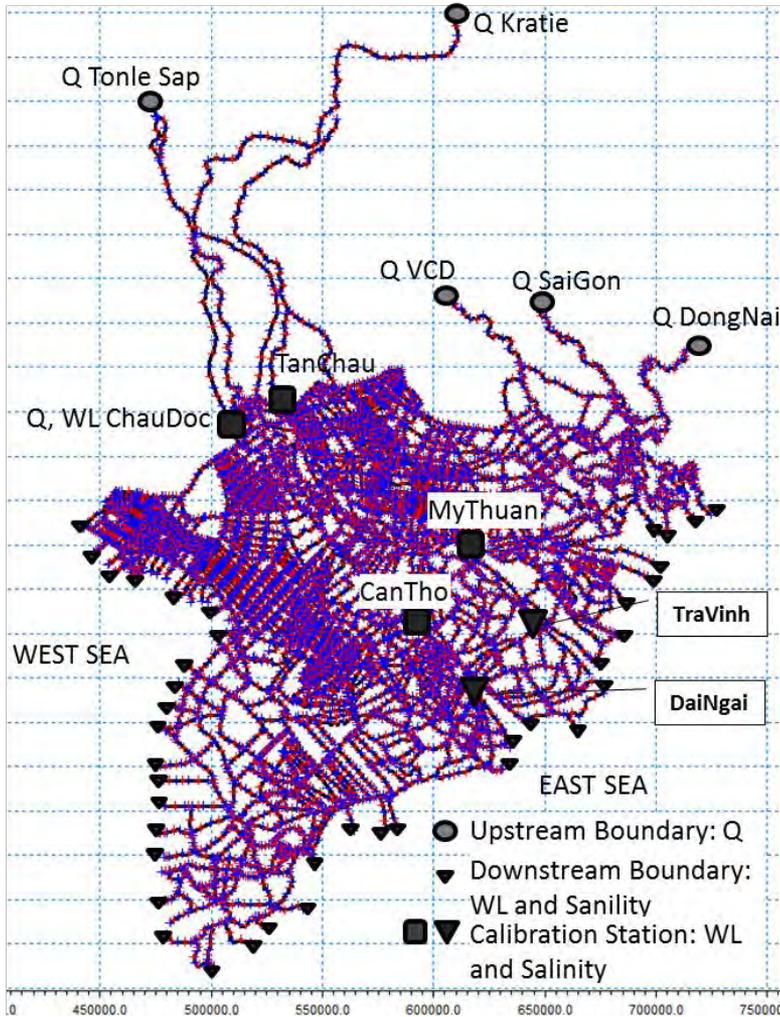
- In the dry season, the total active storage capacity of two Xiaowan and Nuozhadu dams accounts for $22.2 \times 10^9 \text{m}^3$, about 25% of the average total dry flow (Nov - May) at Kratie station.
- The dam operation strongly affects on water releasing downstream and so as salinity intrusion in Vietnamese Mekong Delta
- The dry flow increases slightly in the middle of dry season

3.2. Change of flow and salinity concentration in the post-cascade dam period

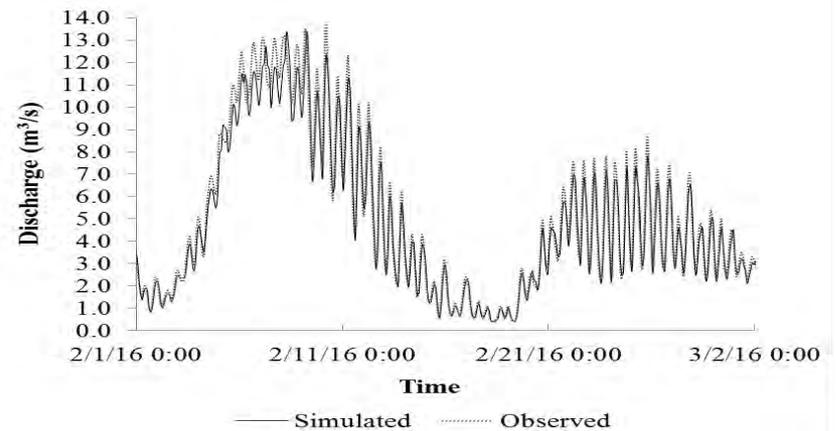


Correlation between discharge to the VMD and max salinity concentration in Jan and Feb, 2016

3.3. Numerical simulation



Comparison of observed and simulated discharge at Chau Doc station



Comparison of observed and simulated salinity concentration at Dai Ngai station

No.	Scenario	S_{\max} in Dai Ngai (g/l)	S_{\max} in Tra Vinh (g/l)	Salinity intrusion length	
				From Tran De estuary (km)	From Co Chien estuary (km)
1	Baseline (Sc0)	13.8	12.7	57	54
2	Sc1	7.4	8.3	41	47



No.	Scenario
Baseline (Sc0)	Real condition of dry season in 2016
Sc1	Dam operation 1 month earlier

4. Conclusions and recommendation

- The flood flow gets decreasing gradually but becomes considerable in the period of 2009-2011 and 2012-2015 due to the 2 largest dams completion and water storing process.
- The dry flow increases slightly in the mid-dry season. It should be due the dam operation for electric generation.
- The dam operation strongly affects on water releasing downstream and so as salinity intrusion in Vietnamese Mekong Delta
- The salinity intrusion tends to start and reach the peak sooner than previous years
- Information about dam operation and hydrological/meteorological data upstream should be transparent sharing for preparedness downstream, especially in the context of climate change and sea level rise.



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