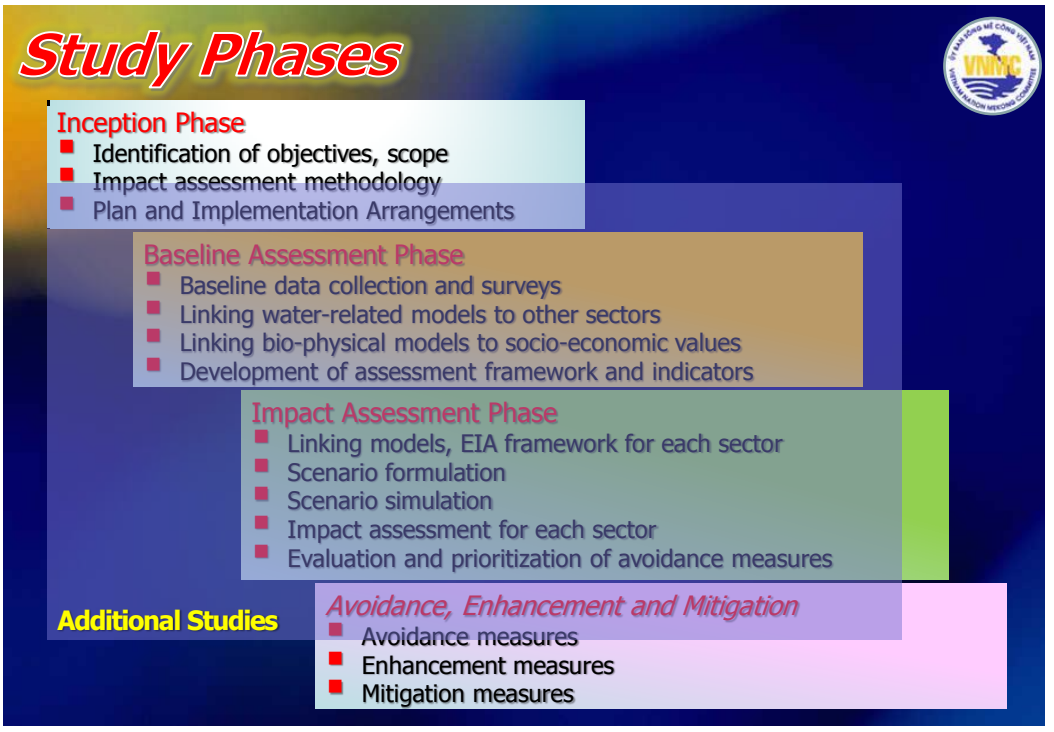
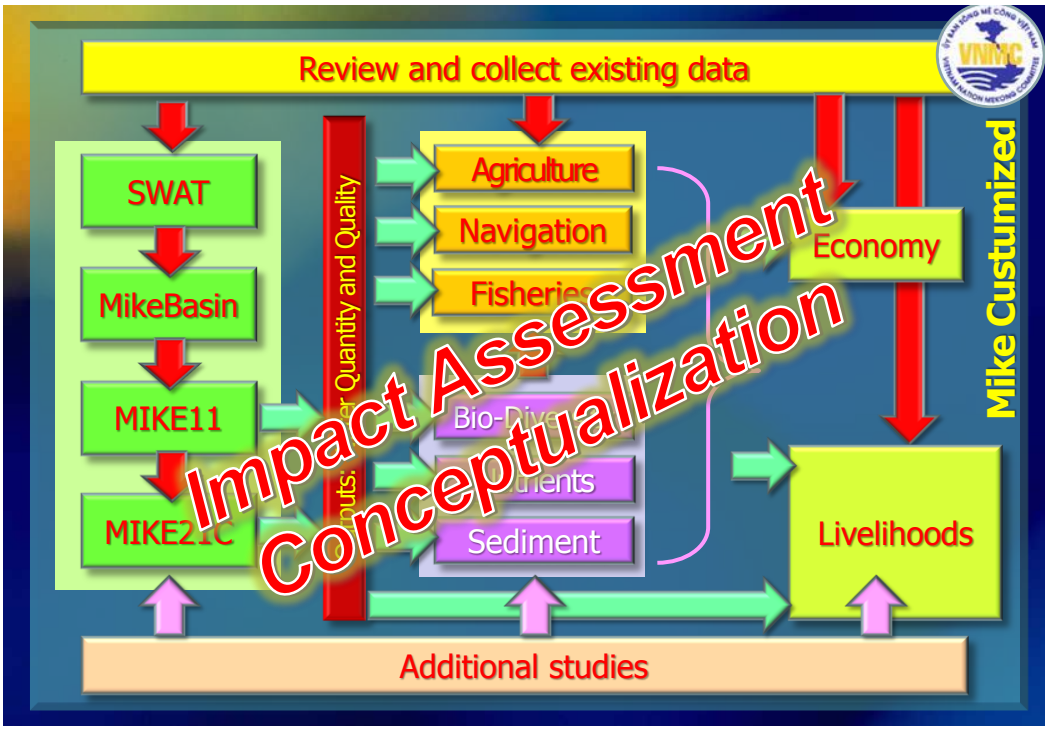
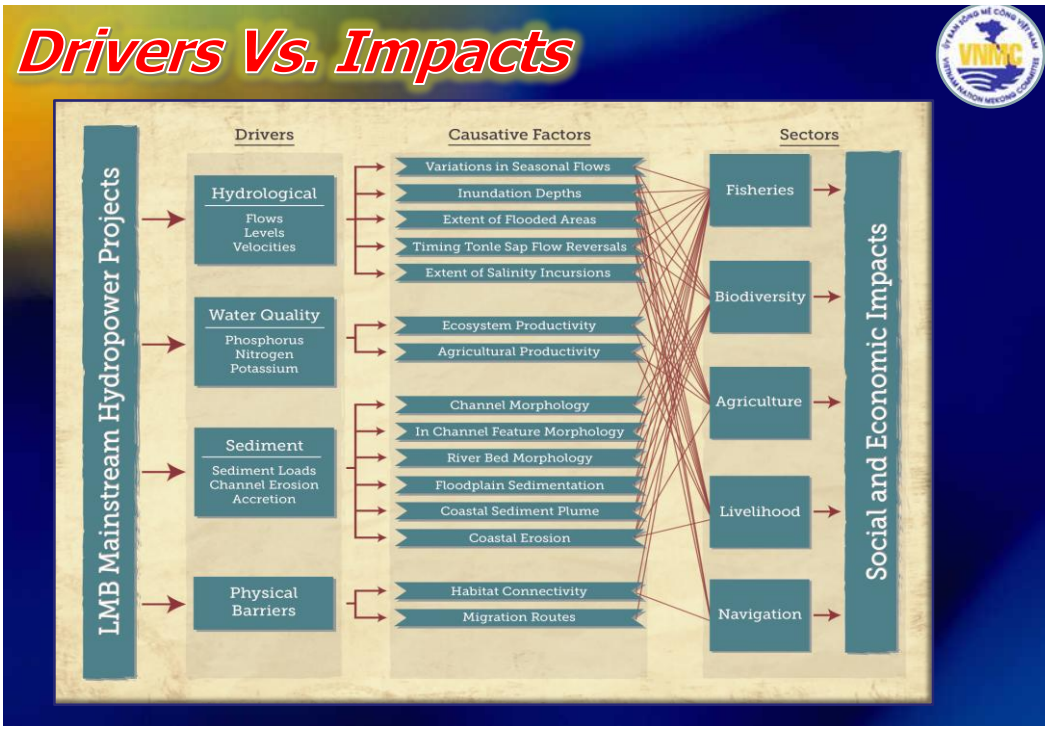
Study on the Impact of Mainstream Hydropower on the Mekong River

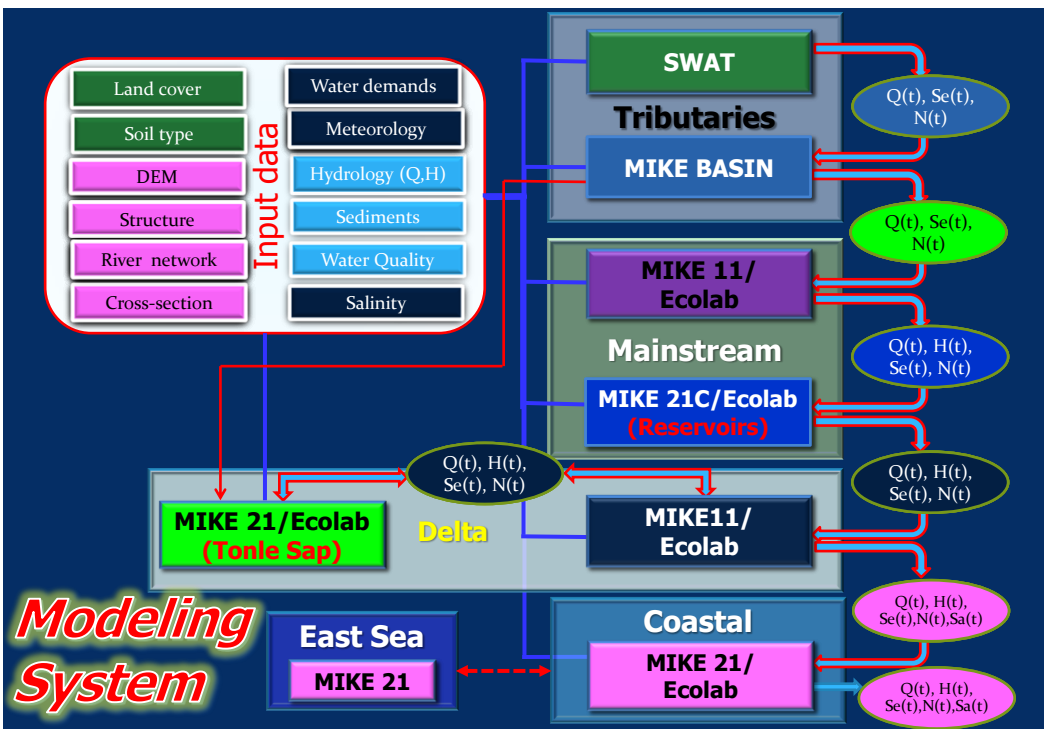
Objectives

1. *To develop a complete database on baseline conditions for the LMB, particularly the Mekong Delta (floodplains of Viet Nam and Cambodia).*
2. *To quantitatively assess impacts of proposed mainstream hydropower projects on the downstream system including (i) the flow regime, (ii) transport of sediments and nutrients, (iii) biodiversity, (iv) water-quality, (v) fisheries, (vi) navigation, and(vii) related socio-economic issues.*
3. *To facilitate achieving consensus on the results of impact assessment of the proposed mainstream hydropower projects on the Mekong Delta and determine avoidance, mitigation and enhancement measures through close consultation with relevant stakeholders.*

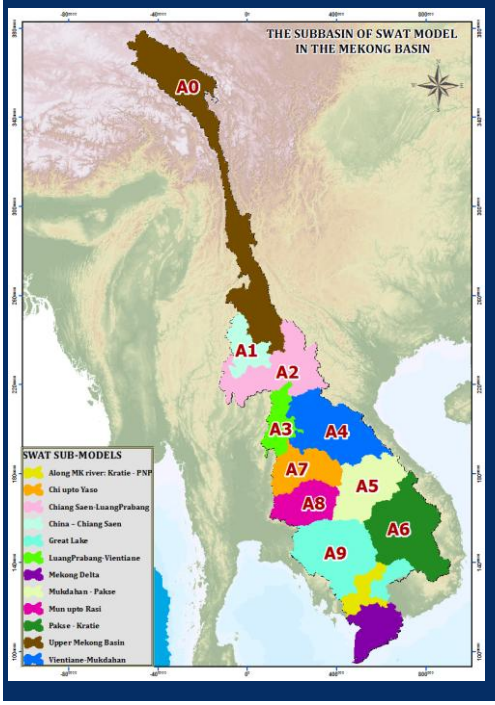

Study Phases
Inception Phase
Identification of objectives, scope
Impact assessment methodology
Plan and Implementation Arrangements
Baseline Assessment Phase
Baseline data collection and surveys
Linking water-related models to other sectors
Linking bio-physical models to socio-economic values
Development of assessment framework and indicators
Impact Assessment Phase
Linking models, EIA framework for each sector
Scenario formulation
Scenario simulation
Impact assessment for each sector
Evaluation and prioritization of avoidance measures
Additional Studies
Avoidance, Enhancement and Mitigation
Avoidance measures
Enhancement measures
Mitigation measures


Review and collect existing data
SWAT
MikeBasin
MIKE11
MIKE21C
Agriculture
Navigation
Fisheries
Bio-Div
ments
Sediment
Economy
Livelihoods
Mike Custumized
Additional studies
Impact Assessment
Conceptualization


Drivers Vs. Impacts
LMB Mainstream Hydropower Projects
Drivers
Causative Factors
Sectors
Hydrological
Flows
Levels
Velocities
Water Quality
Phosphorus
Nitrogen
Potassium
Sediment
Sediment Loads
Channel Erosion
Accretion
Physical Barriers
Variations in Seasonal Flows
Inundation Depths
Extent of Flooded Areas
Timing Tonle Sap Flow Reversals
Extent of Salinity Incursions
Ecosystem Productivity
Agricultural Productivity
Channel Morphology
In Channel Feature Morphology
River Bed Morphology
Floodplain Sedimentation
Coastal Sediment Plume
Coastal Erosion
Habitat Connectivity
Migration Routes
Fisheries
Biodiversity
Agriculture
Livelihood
Navigation
Social and Economic Impacts


Land cover
Soil type
DEM
Structure
River network
Cross-section
Input data
Water demands
Meteorology
Hydrology (Q,H)
Sediments
Water Quality
Salinity
SWAT
Tributaries
MIKE BASIN
Q(t), Se(t), N(t)
MIKE 11/ Ecolab
Mainstream
MIKE 21C/Ecolab (Reservoirs)
Q(t), H(t), Se(t), N(t)
MIKE 21/Ecolab (Tonle Sap)
Delta
MIKE11/ Ecolab
Modeling System
East Sea
MIKE 21
Coastal
MIKE 21/ Ecolab
Q(t), H(t), Se(t),N(t),Sa(t)

SWAT Model Set-up

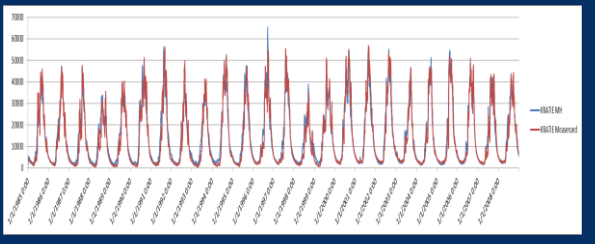


No	Name	Area	Sub-basin
1	A0	Upper Mekong Basin	190
2	A1	China – Chiang Saen	31
3	A2	Chiang Saen-LuangPrabang	70
4	A3	LuangPrabang-Vientiane	38
5	A4	Vientiane-Mukdahan	121
6	A5	Mukdahan - Pakse	66
7	A6	Pakse - Kratie	140
8	A7	Chi upto Yaso	62
9	A8	Mun upto Rasi	58
10	A9	Great Lake	94
11	A10	Mekong Delta	120
12		MK river: Kratie - PNP	8
Total			998

Mike Basin Model Set-up

No.	Nodes	Number
1	Flow to Mike11 Model	247
2	Flow from SWAT	453
3	Hydropower	37
4	Water Demands	420
5	Irrigation	366
6	Linking	125

Model Calibration: 2001-2009;
Verification: 1985 - 2009



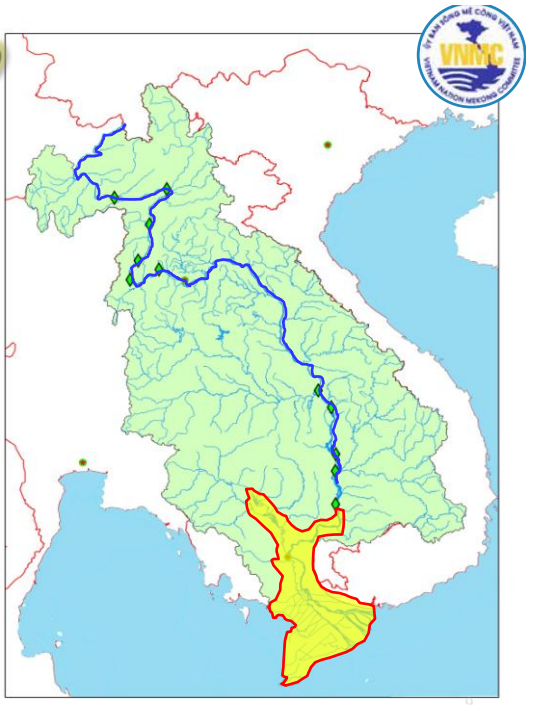
Mike 11 Model Set-up

1. Mainstream Model (Cheang Sen-Kratie):

- *1737 km of length.*
- *573 cross-sections*
- *11 Mainstream Dams*

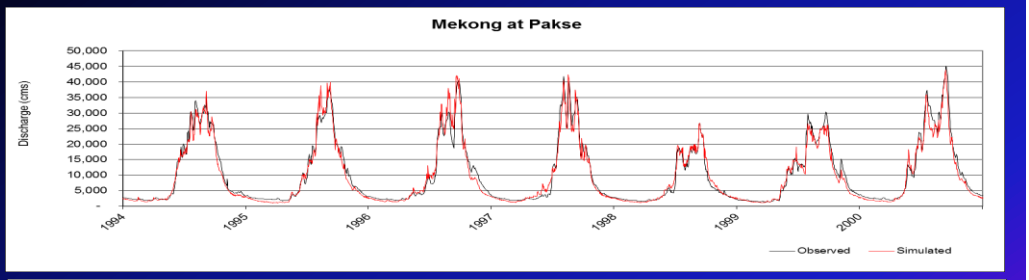
2. Delta Model

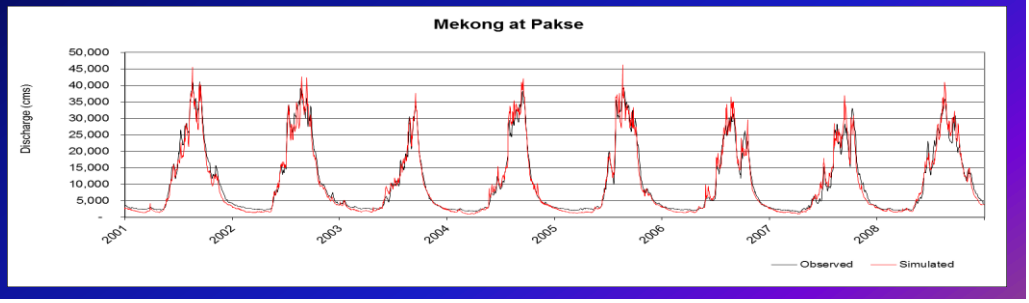
- *2253 canals.*
- *2928 cross-sections*
- *More than 100 structures (dams, gates, sluices)*



Mike 11

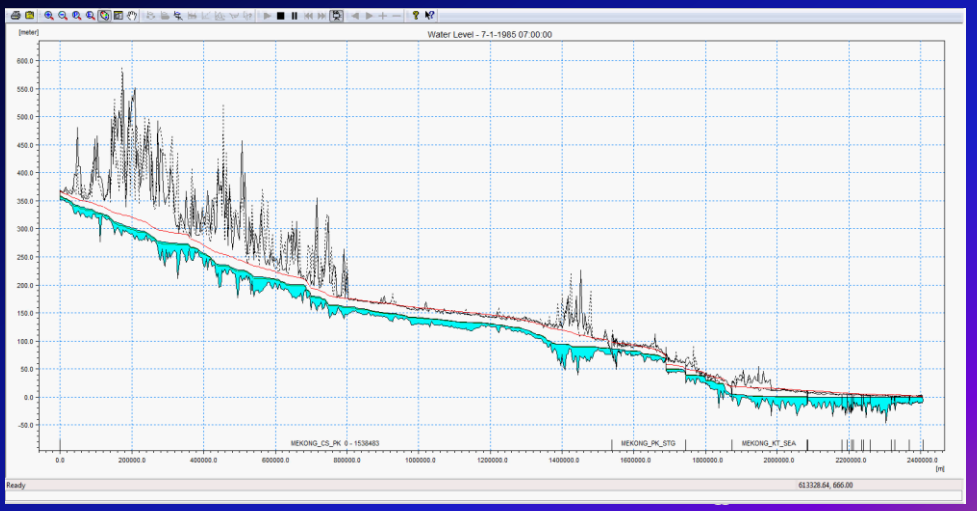
Mike 11 Mainstream





Mike 11

Mike 11 Mainstream

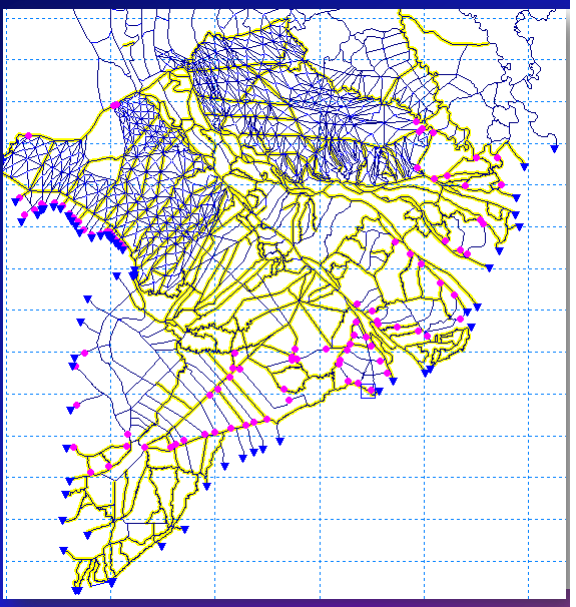


Mike 11

Mike 11 Delta

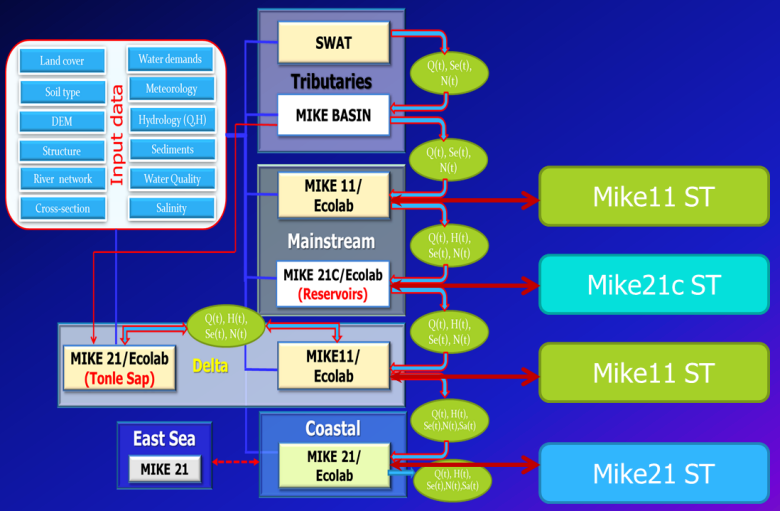
Model Setup:

- 2253 river branches
- 2928 river cross-sections
- 100 strutures

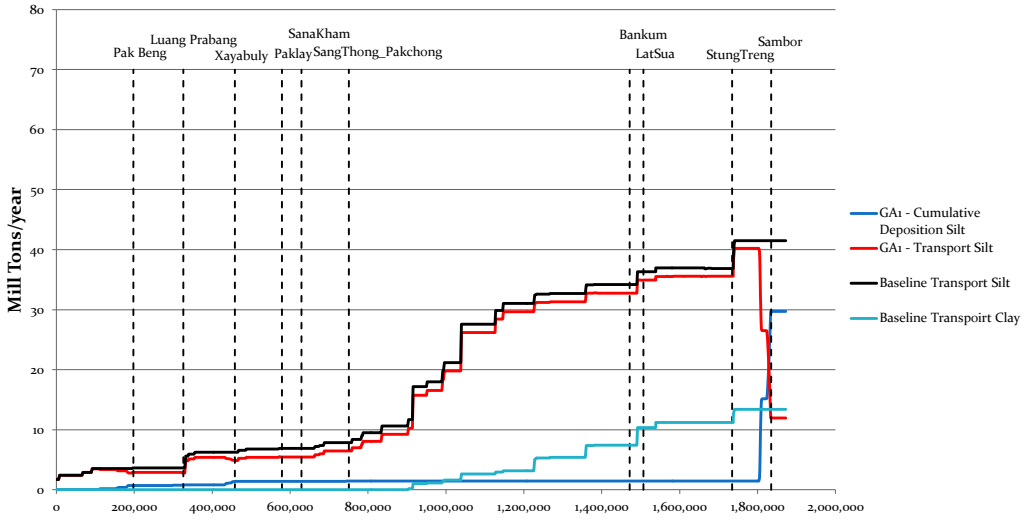


Mike 11

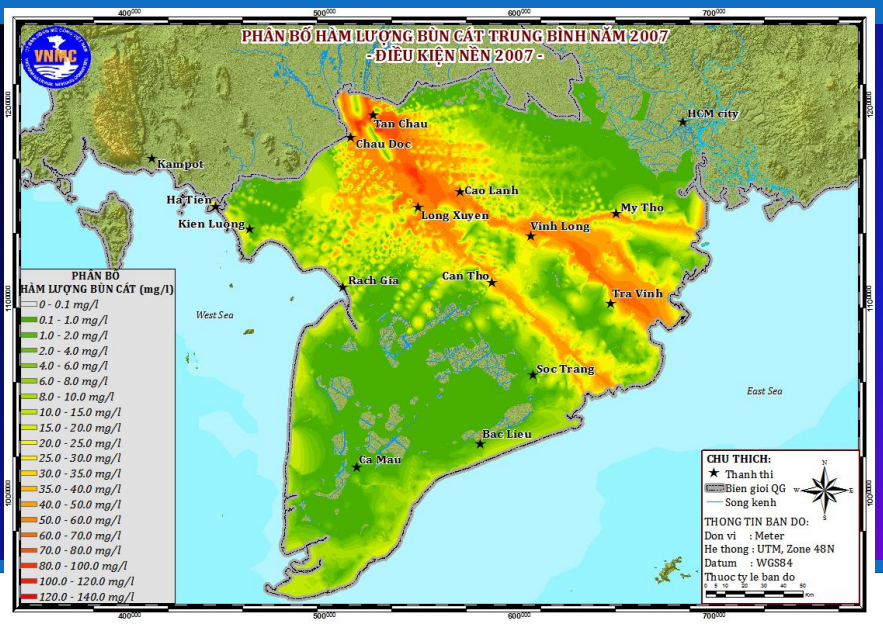
Mike11 ST

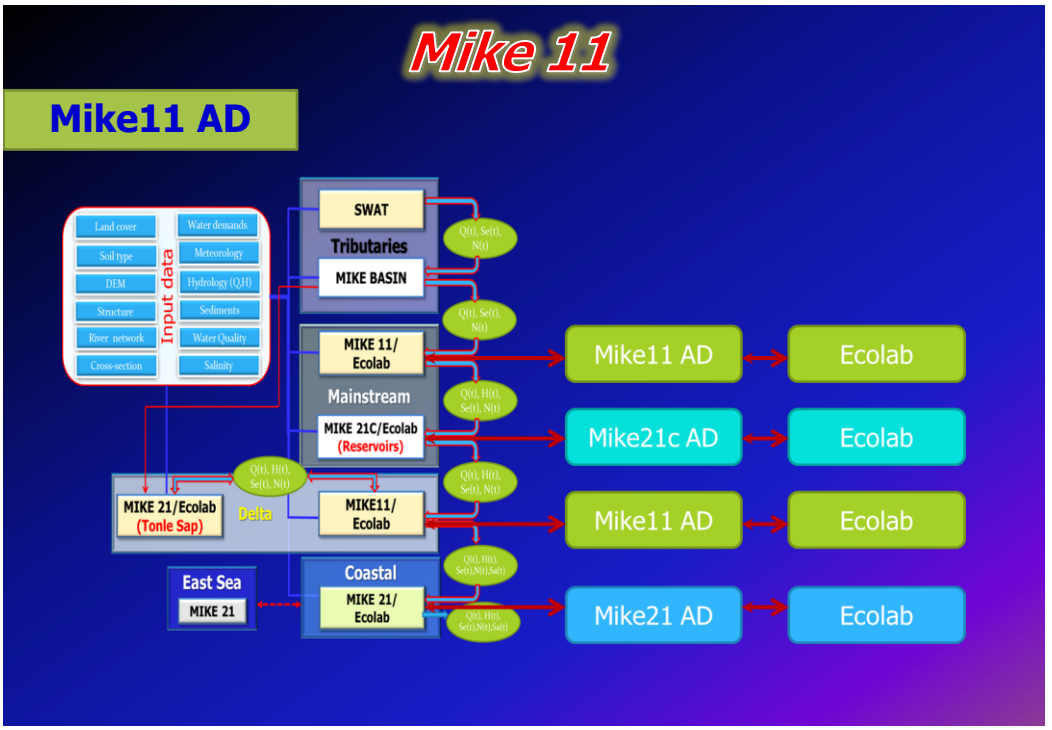


Sediments - Silt

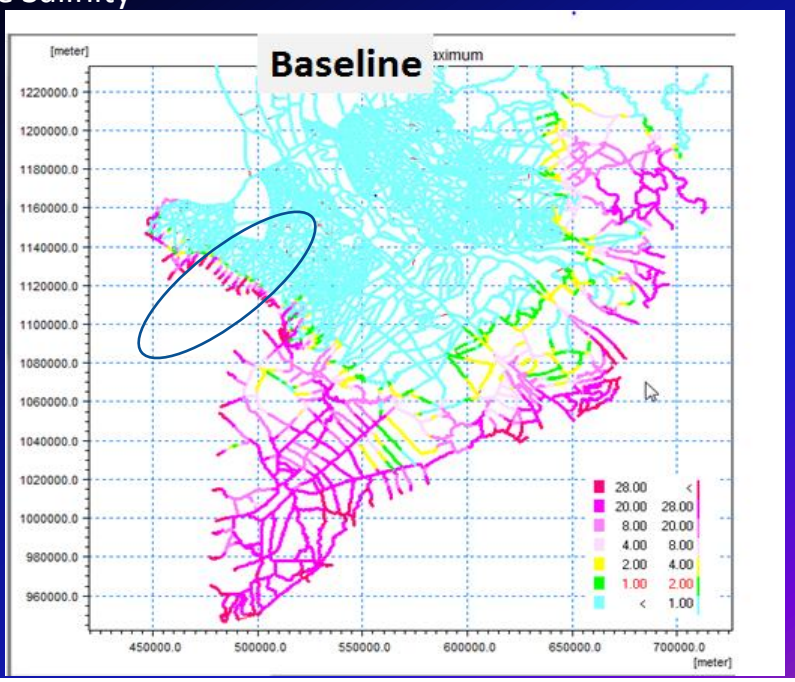


Sediment Distribution on the Delta



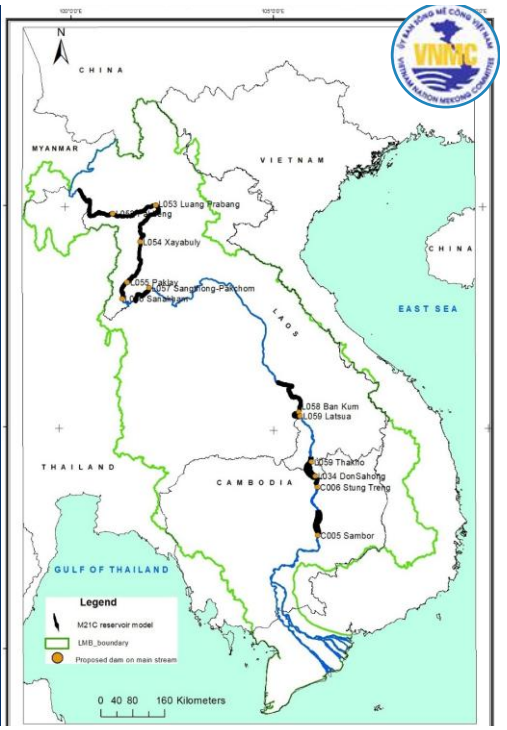


Baseline Salinity

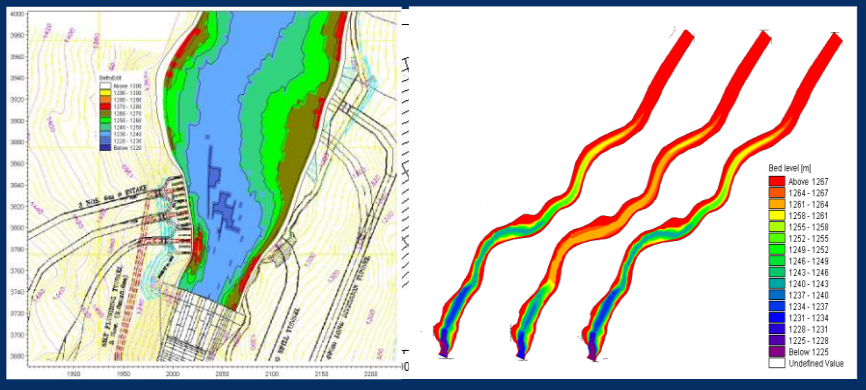


Mike21C Model Set-up

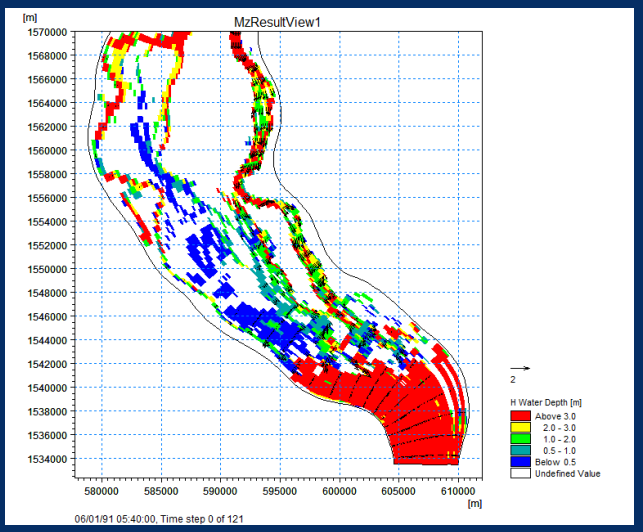
No	Name of dam	Full Supply Level (FSL) in masl	MIKE21C Model domain length (Km)
1	Pakbeng	345	158
2	Luang Prabang	310	128
3	Xayabury	275	132
4	Paklay	240	121
5	Sanakham	215	51
6	Pakchom	192	60
7	Bankum	115	133
8	Latsua	97.5	36
9	Donsahong	75.45	58
10	Stung Treng	NA (Spill way Sill: 40, crest :59)	31
11	Sambor	40/38	136
		Total (km)	**1044**



Mike 21C

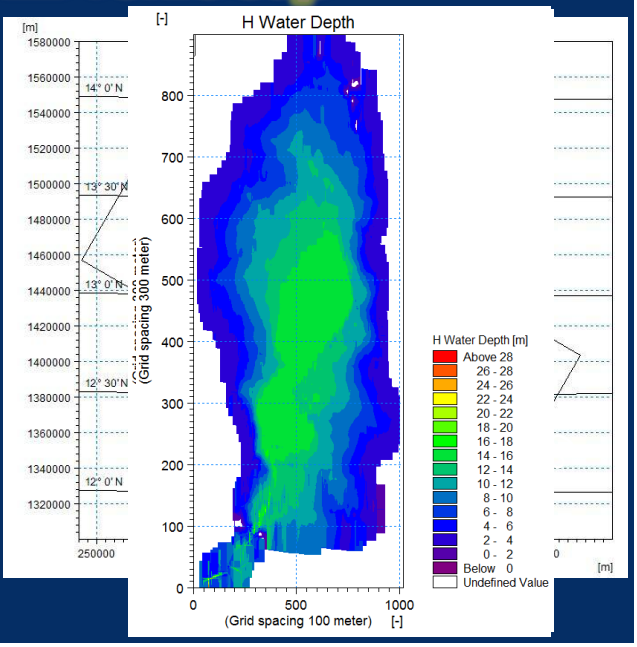


Mike 21C



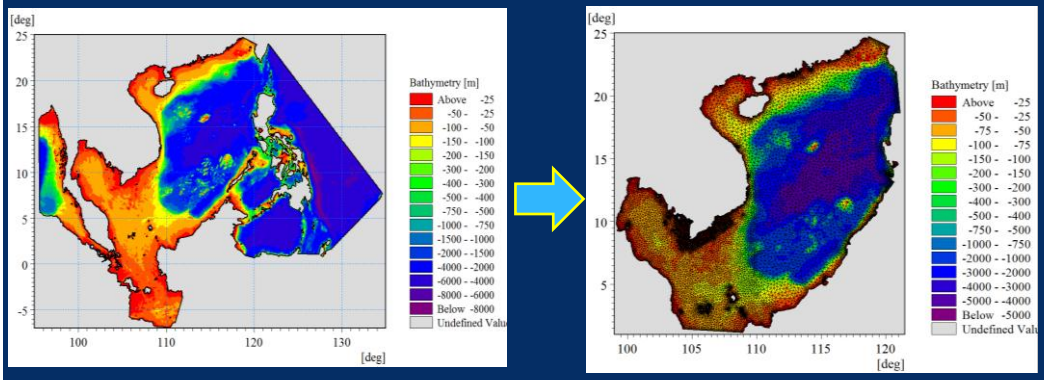
Mike 21 Tonle Sap

- Model Setup: 27.900 km^2
- Grid size: 100 x 300 m
- Number of cells:
  - X: 900
  - Y: 1020



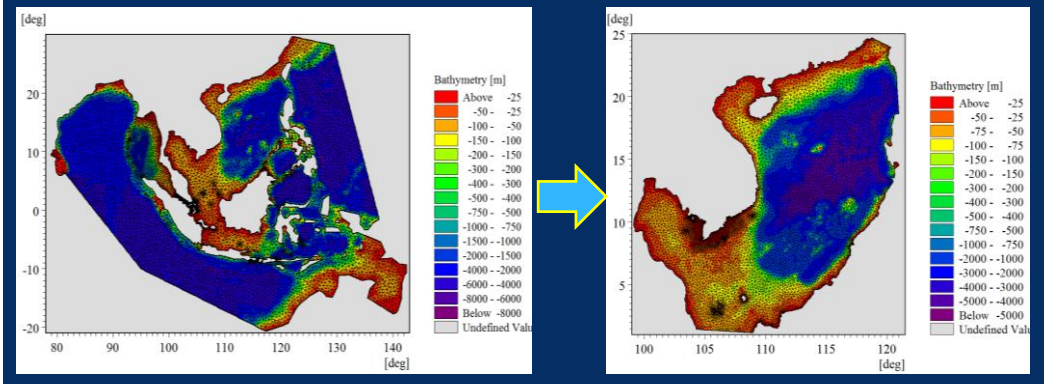
Mike 21 Coastal

Regional Mike 21 HD FM (DHI Singapore)



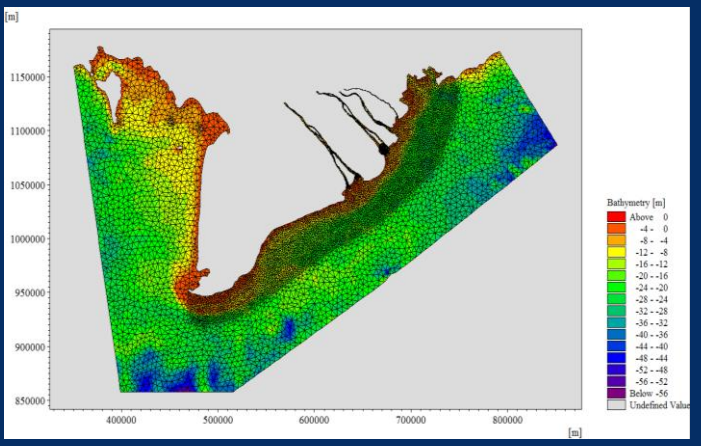
Mike 21 Coastal

Regional Mike 21 SW (DHI Singapore)



Mike 21 Coastal

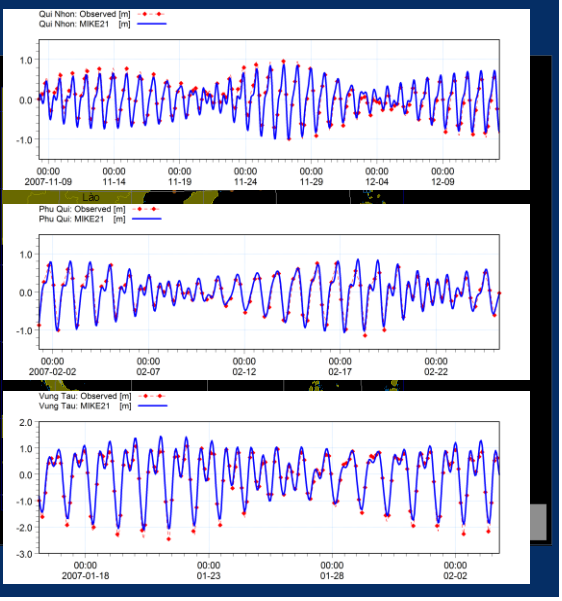
Local Mike21 HD & SW model



Mike 21 Coastal

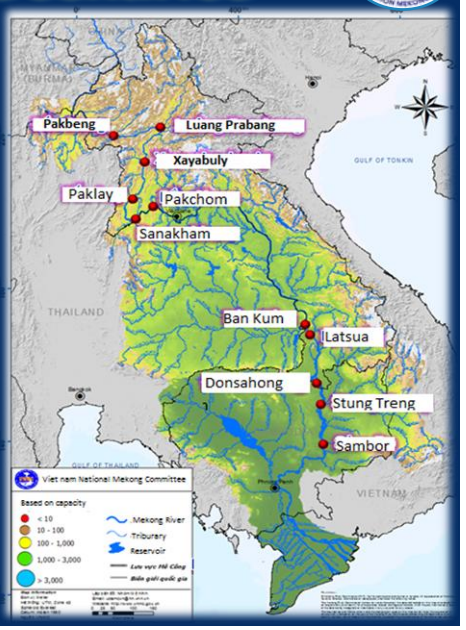
Model Calibration

Moritoring Stations	Time-Series
Vũng Tàu	2007-2012
Qui Nhơn	2008-2013
Bintulu (Malaixia)	1992-2011
Cendering (Malaixia)	1985-2011
Currimao (Philipin)	2009-2013
Côn Đảo	2007
Phú Quí	2007
An Thuận	2004-2008
Bến Trại	2004-2008
Gành Hào	2004-2008
Mỹ Thạnh	2004-2008
Ông Đốc	2004-2008
Vàm Kênh	2004-2008
Kolak (Thái Lan)	2008-2012
Phú Quốc	2005-2008

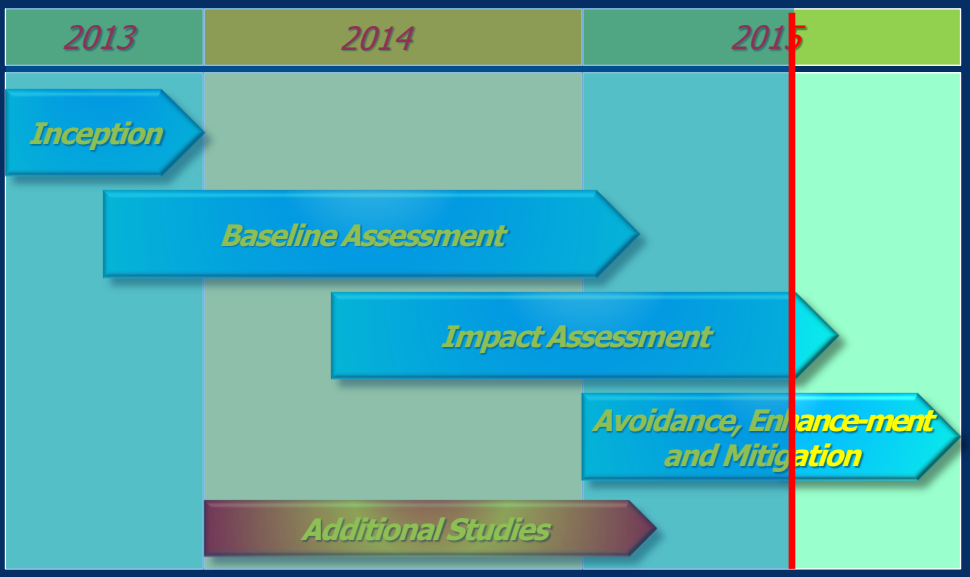


Impact Assessment Scenarios

1. *Baseline Scenario: 1985-2012*
2. *Impacts of LMB Hydropower cascade; combinations of dams covering different levels of impacts; operations and dam-break*
3. *Cumulative impact with others: Chinese cascade of reservoirs, hydropower development in tributaries, water abstraction/ diversion in the catchments, basin changes (hydrology and water demands) climate change etc.*
4. *Assessing levels of impacts of development activities to the Mekong Delta*



Work Plan


2013
2014
2015
Inception
Baseline Assessment
Impact Assessment
Avoidance, Enhance-ment and Mitigation
Additional Studies


Thank you!
30