

MRC – DECISION SUPPORT FRAMEWORK (DSF)

THE 2019 MEKONG RESEARCH SYMPOSIUM
SESSION 8: INTEGRATING PRIORITIES FOR INFORMED DECISION SUPPORT
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Contents of Presentation



OVERVIEW OF
MRC DSF



APPLICATIONS



OVERVIEW OF MRC-DSF



Introduction

MRC Decision Support Framework (DSF)

Knowledge Base (KB)

Planning and monitoring data such as:

- hydrological records
- physical data
- socio-economic and environmental data
- scenario description data
- simulation model input data
- simulation model results

DSF User Interface and Tools

Basin
Simulation
Modelling
Package

SWAT

IQQM

ISIS

Impact Analysis Tools (IAT)

Reporting Tools



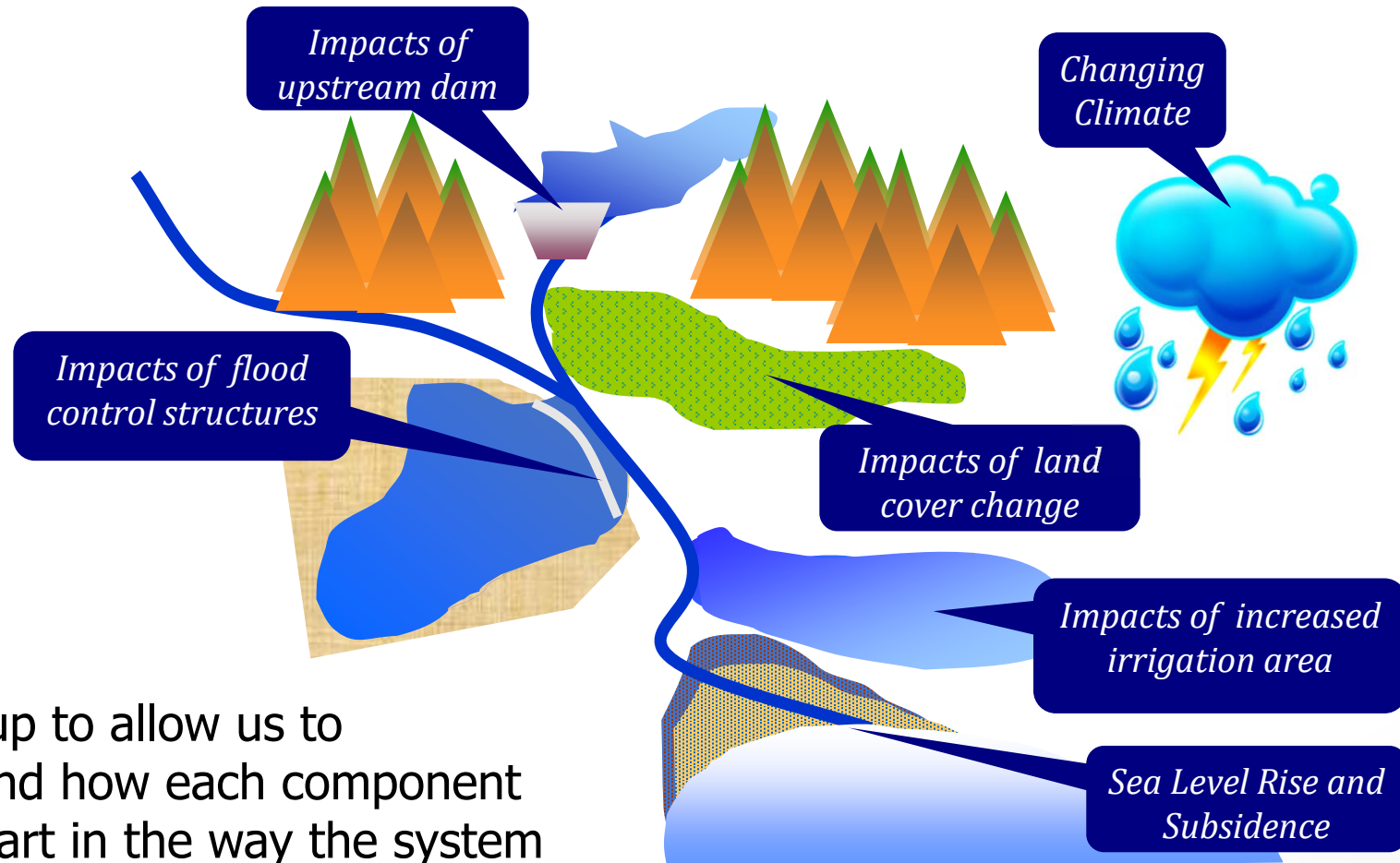
The Decision Support Framework (DSF) has been approved by the MRC Joint Committee in 2004 and it has been used by each of the MRC member countries to support decision for Water Use and Development Plan, also others studies and implementation on all MRC procedures.

In 2004, the DSF model for MRB has been completely set-up and calibrated for period 1985 – 2000 and used year 2000 as baseline situation.

In 2013, simulation period was updated to be 1985 – 2008 and used year 2007 as new baseline situation for flow simulation.

In 2016, water quality simulation (Sediment, N and P) was added in baseline situation.

Why should MRC need a DSF?



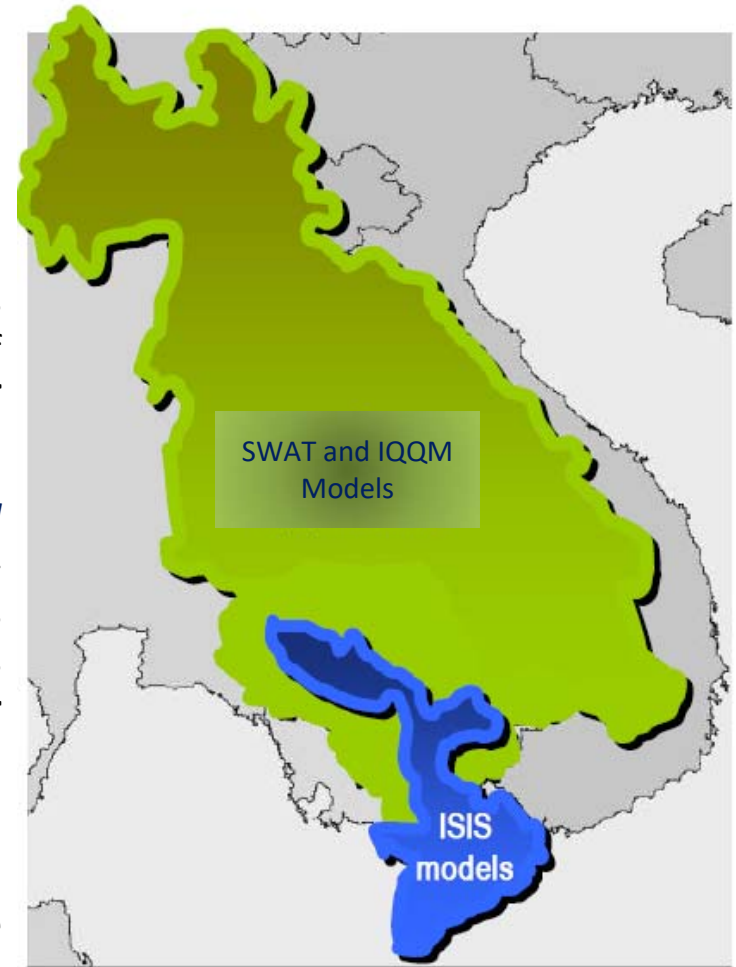
DSF set up to allow us to understand how each component plays a part in the way the system functions

DSF model package

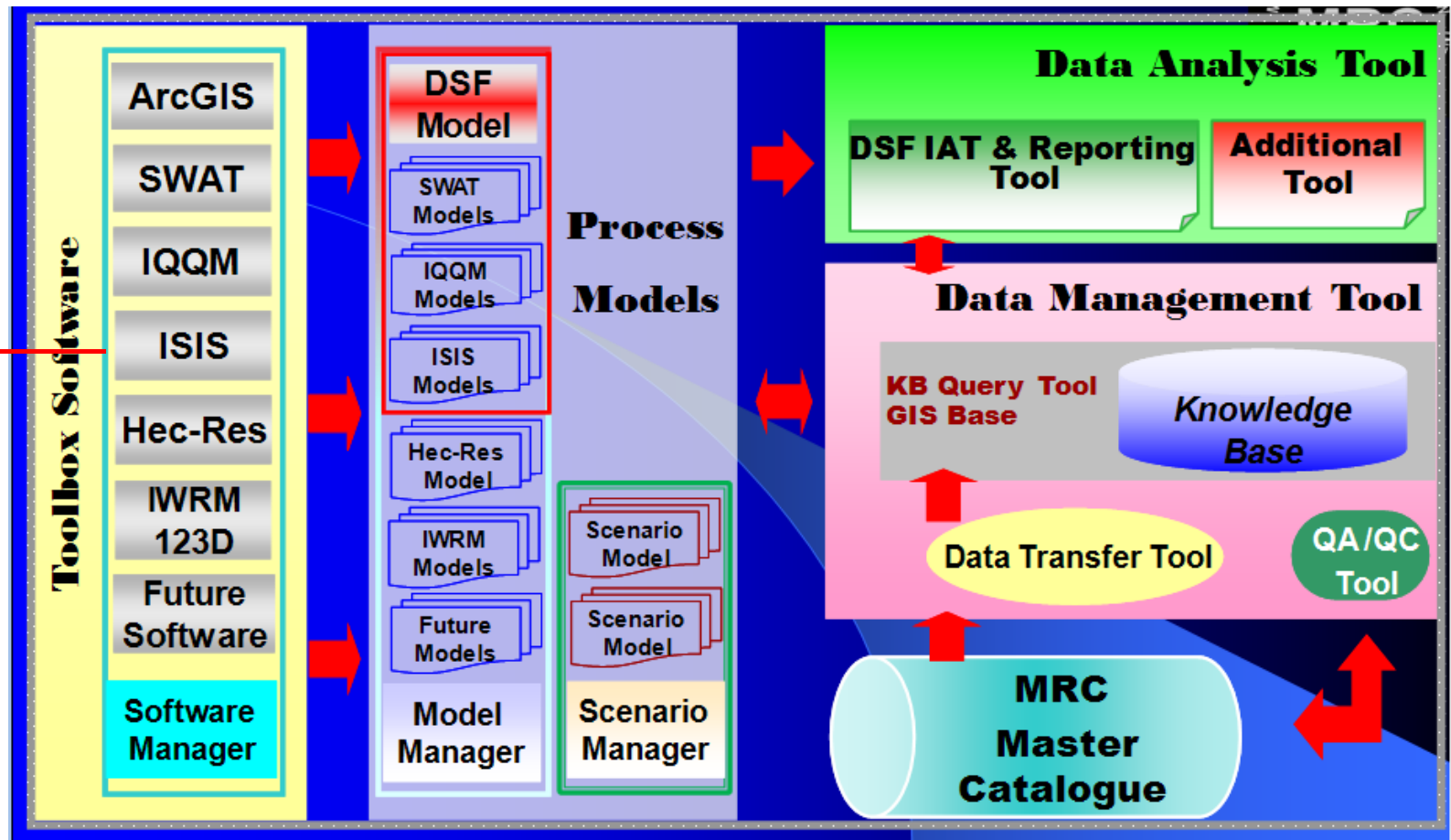
A package of simulation models that enable the prediction of *impacts of changes in conditions within the basin on the river system* compose of SWAT, IQQM and iSIS model.

- The *SWAT (Soil and Water Assessment Tool)* developed by the United States Department of Agriculture has been set-up to generate subbasin runoff from rainfall and climate data. **(currently run with ArcGIS, while QSWAT from QGIS is under development and being used widely)**
- The basin simulation models that are based on the *IQQM (Integrated Quantity and Quality Model)* software originally developed for the Murray-Darling Basin in Australia. The simulation models route catchment flows through the river system, making allowance for control structures such as dams and irrigation abstractions. **(not able to deal properly with water quality module, and no more development)**
- A hydrodynamic model, based on *iSIS software* developed by HR Wallingford and Halcrow, is used to simulate the river system downstream part of the basin including Great Lake and Delta. **(limitation for users with dongle requirement).**

Delta Mapper is a tool to support iSIS which is used for mapping and processing water level, water quality data, generating flood depth/duration and water quality maps.

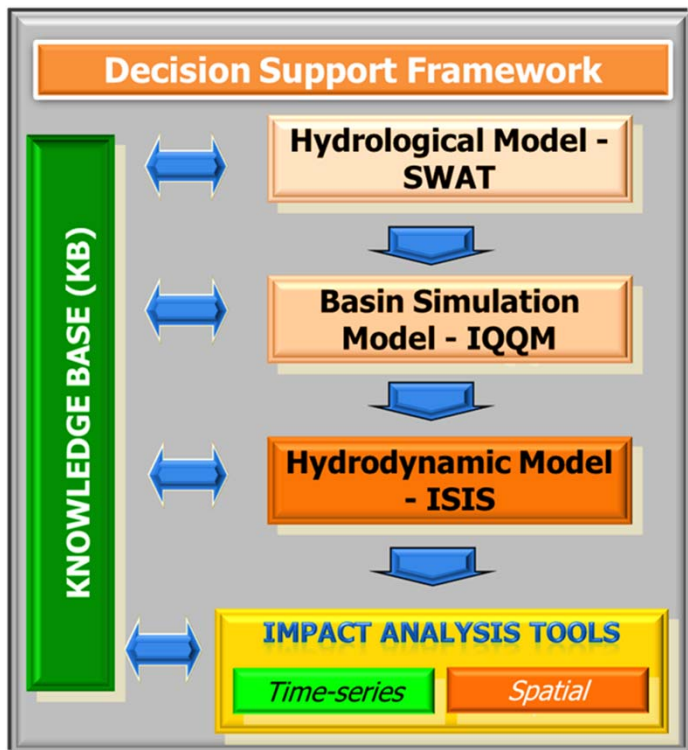


MRC DSF STRUCTURE



Existing Impact Analysis Tools in MRC-DSF

1. Time-series analysis
2. Spatial analysis



Planning Software

201 Country & Province Boundaries

Environmental & socio-economic impact analysis tools

Main categories of tools	First Level	Tool Sub-categories	Third Level	Accessed through
		Second Level		
TIME-SERIES ANALYSIS TOOLS	Time-Series Plotting Tool	Time-Series Plots	101 Raw Data	DSF
			102 Means of Raw Data	
			103 Moving Means of Raw Data	
	Flood Event Analysis Tool	Annual Flood Frequency Analysis	111 Ranked Flood Events	
			112 Mean Daily Flows (between years)	
			113 Fitted Frequency Distributions	
		Flood Threshold Analysis	121 Flood Start Date	
			122 Flood End Date	
			123 Flood Peak Date	
			124 Rate of Flood Rise	
			125 Rate of Flood Fall	
			126 Flood Duration	
	Probability Exceedence Analysis Tool	Cumulative Probability - all data at site	127 Flood Consistency by Event	DSF
			128 Flood Consistency - Cumulative	
		Cumulative Probability Distribution over Year	131 Daily or Monthly	
			132 Daily or Monthly	
	Low Flow Analysis Tool	Low Flow Events	141 Start Date	DSF
			142 End Date	
			143 Duration	
			144 Minimum Flow Value & Date	
		Low Flow Variability	151 Start Date	User own software
			152 End Date	
			153 Duration	
			161 Start Date	
	Tonle Sap Flow - Reversal Analysis		162 Peak Date	
			163 End Date	
			163 Duration	
Catchment Averaged Rainfall Generator (MQUAD)	170 Catchment averaged rainfall			

op types, etc

ocio-

DSF

& Features

i-sections

Analysis

ges Over

ArcView
provided
with DSF

DSF

DSF

User own
software

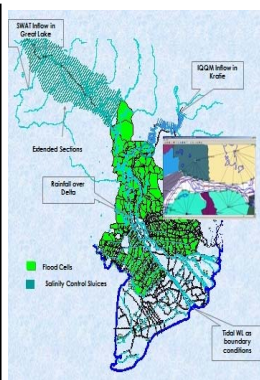
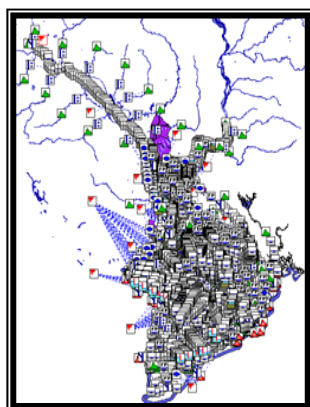
Model Schematization

The MRC Toolbox provides the capability to investigate the environmental and socio-economic impact of changes in the quantity and quality of flows in the Lower Mekong River system.



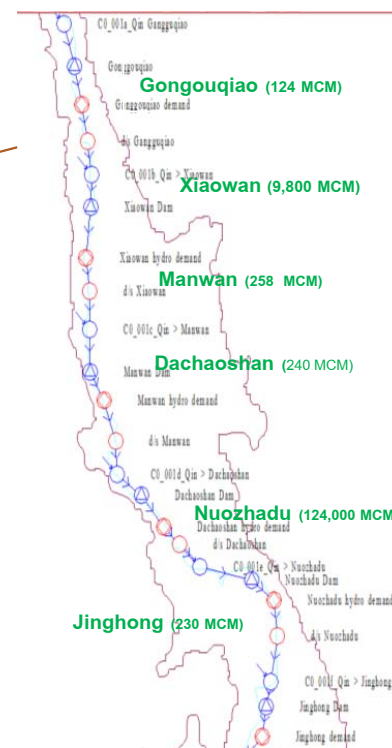
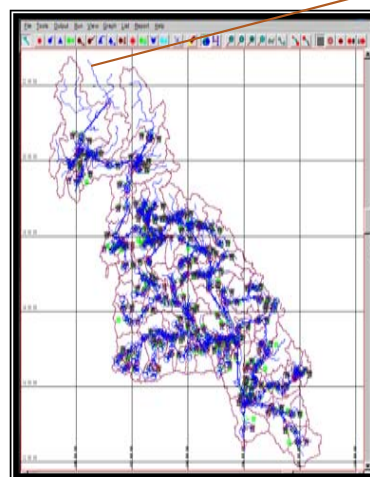
Area	number of subbasin
Area 0 (Upper Mekong)	190
Area 1 (China - ChiangSaen)	31
Area 2 (ChiangSaen - LuangPrabang)	70
Area 3 (LuangPrabang - Vientiane)	38
Area 4 (Vientiane - Mukdahan)	121
Area 5 (Mukdahan - Pakse)	66
Area 6 (Pakse - Kratie)	140
Area 7 (Kratie - Yasothorn)	62
Area 8 (Mun - Rasisalai)	58
Area 9 (GreatLake/Cambodia)	94
Total	870

SWAT Model Configuration



Schematization of Hydrodynamic Model

IQQM Model Configuration



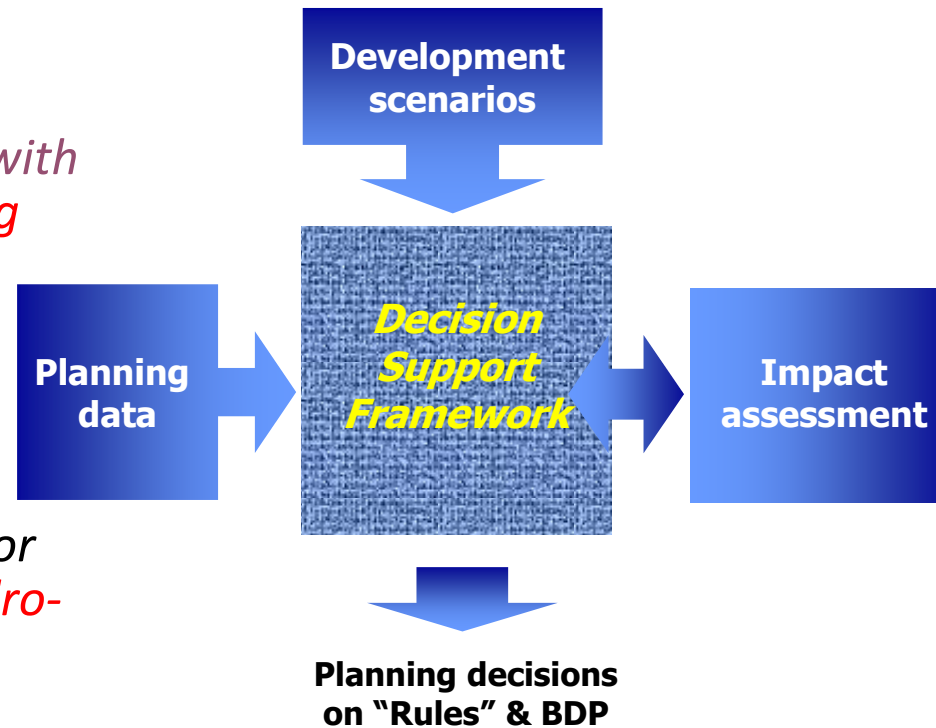


APPLICATIONS OF MRC-DSF



Purpose of the DSF

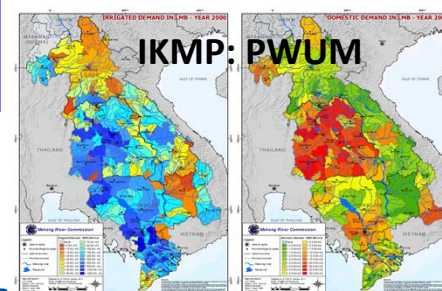
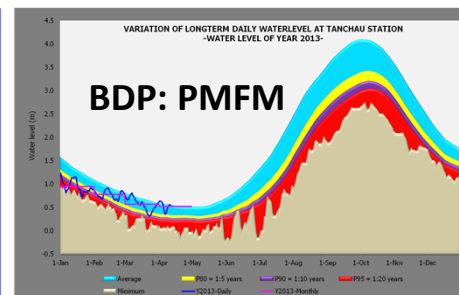
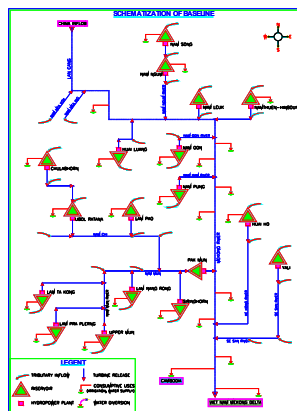
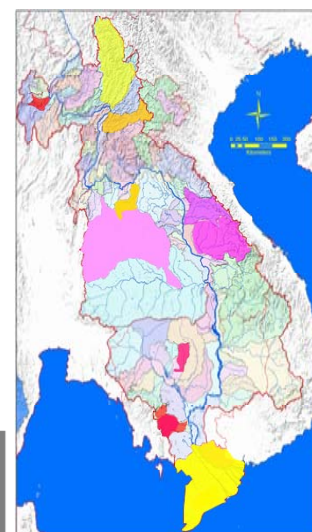
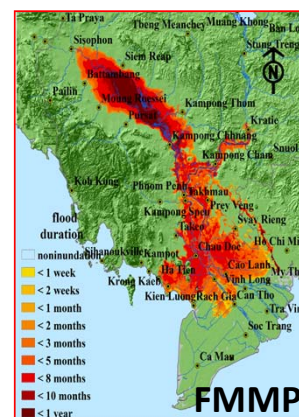
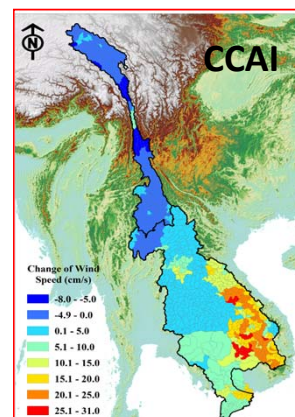
- Support *basin development plan* with basin-wide *planning tools*
- Support “*Rules Formulation*” in *analytical tools*
- Support other sector programs with *hydro-meteorologic information*



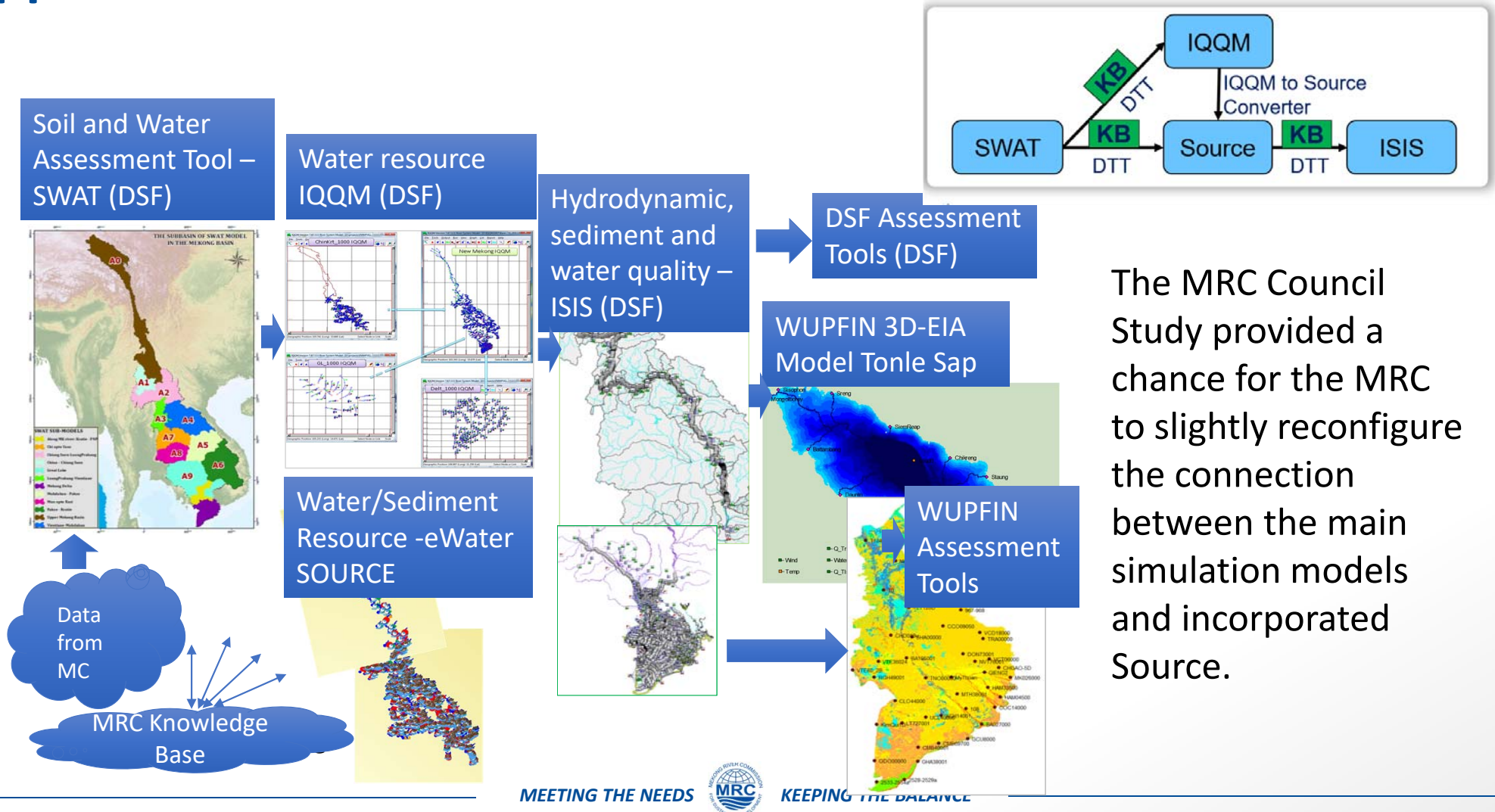
- *Simulation of development scenarios*
- *Analysis of changes in water conditions*
- *Platform for impact assessment*
- *Stores acquired knowledge*

Application – DSF support to MRC

- ❑ **Applied in various National Projects**
- ❑ **Support Climate Impact:** impacts of climate change on flow regime under various scenarios
- ❑ **Flood Modelling:** flood risk assessment and planning
- ❑ **Support Basin Development Plan** on PMFM implementation
- ❑ **Support MRC Procedures:** PMFM, PWUM, PNPCA
- ❑ **Support Council Study**
 - Provide model outputs for thematic assessments (impacts on water quantity and quality from the changes in landuse, irrigation development, hydropower development, flood protection infrastructure, domestic and industrial water use)

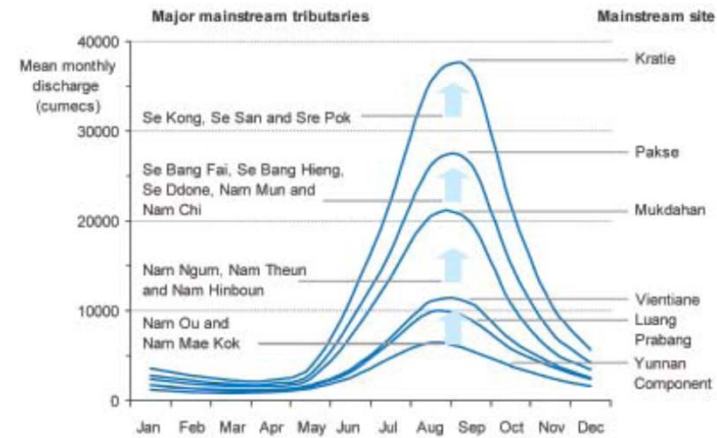


Applications of DSF to the MRC Council Study



The MRC Council Study provided a chance for the MRC to slightly reconfigure the connection between the main simulation models and incorporated Source.

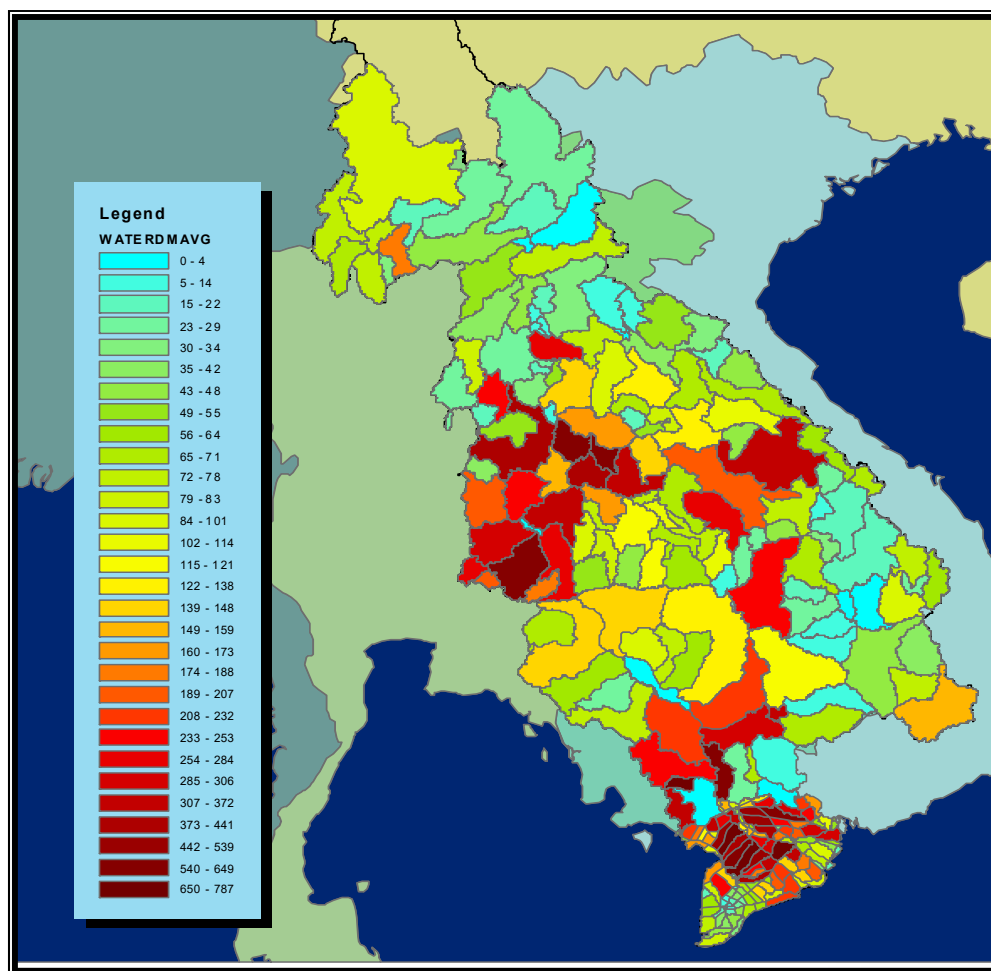
ESTIMATION OF FLOW CONTRIBUTION FOR PLANNING



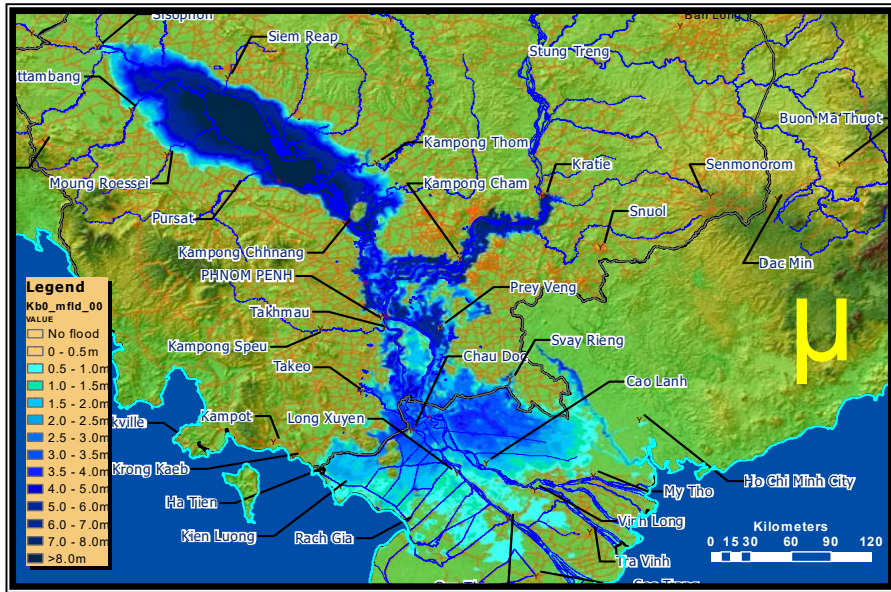
Flow contribution

OUTPUT FROM SIMULATION

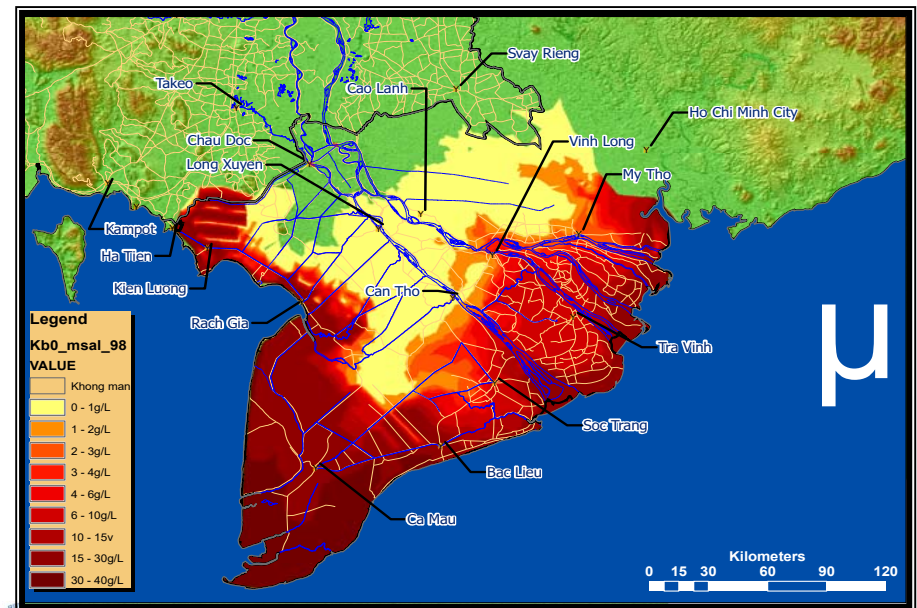
**Average
Water
Demand**



OUTPUTS FROM SIMULATION



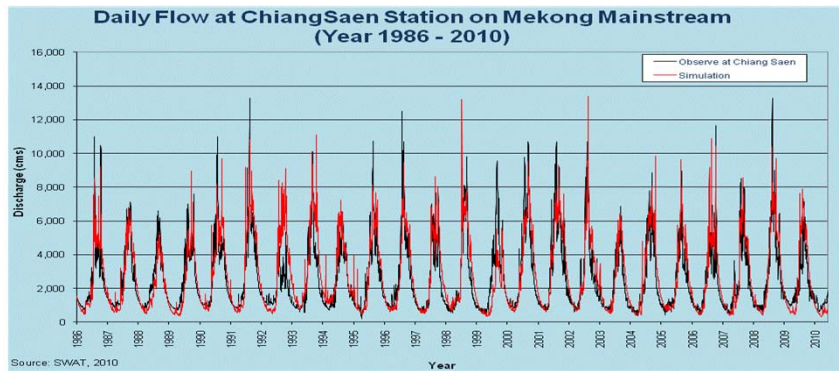
ISIS Model Output –
Maximum Flood
(ISIS + Delta Mapper Tool)



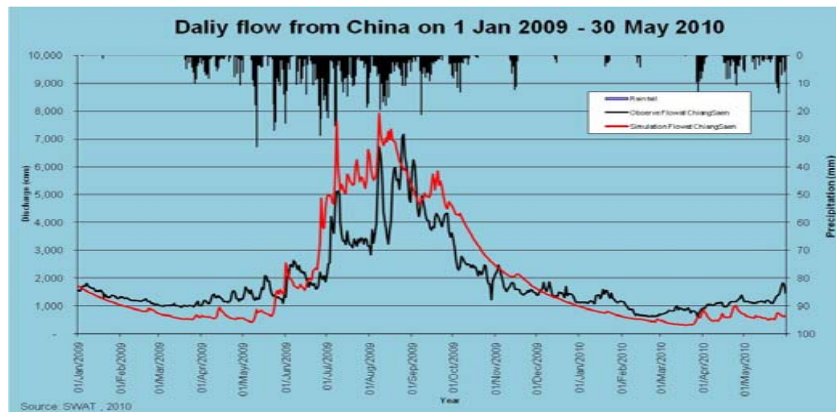
ISIS Model Output –
Salinity Intrusion
(ISIS + Delta Mapper Tool)

MODEL ASSESSMENT

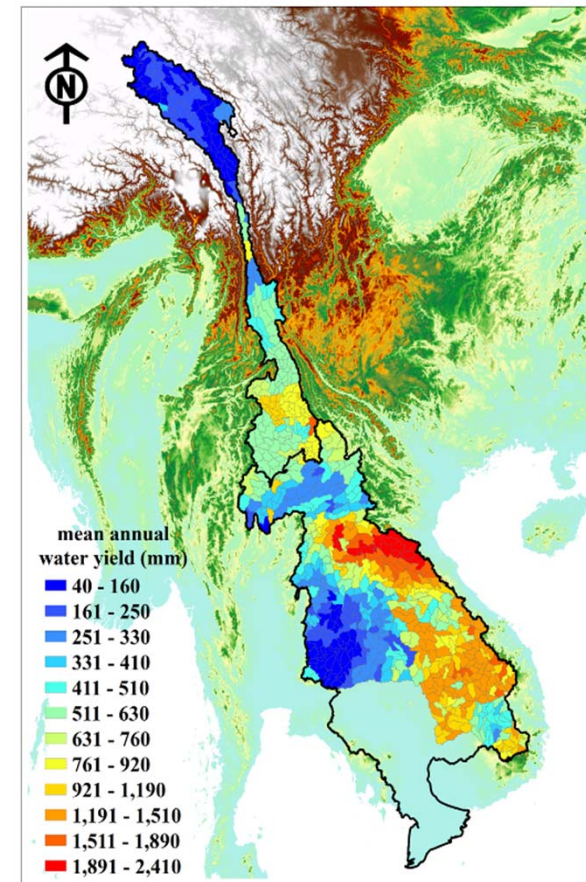
Estimation of Daily Flow at Chiang Saen Station in Thailand compare with observed flow in 1985- 2008



Runoff Simulation from Upper Mekong for Drought Situation



SWAT Model application for Climate Change Scenario



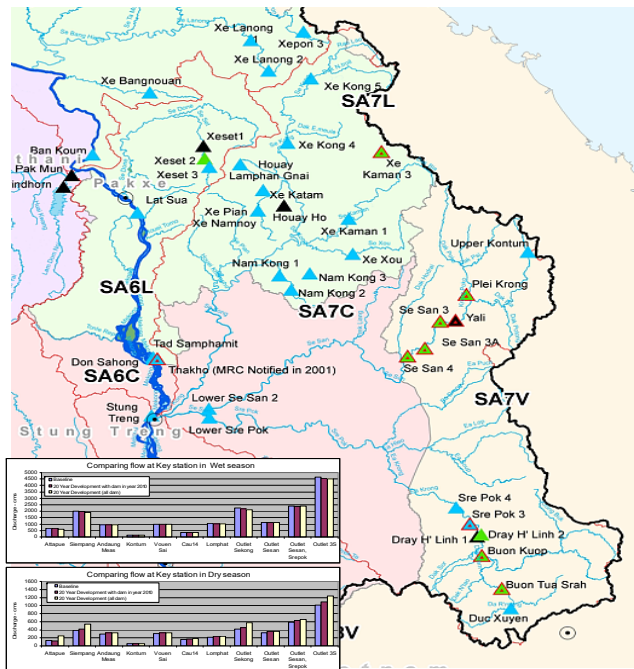
MEETING THE NEEDS



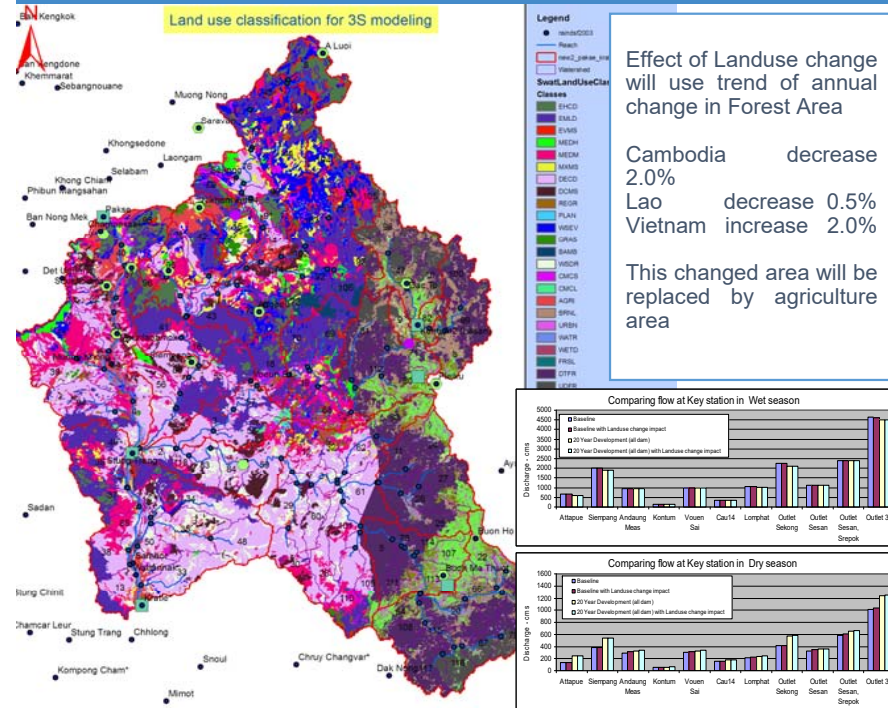
MODEL ASSESSMENT

Scenario Assessment for 3S River Basin

Impact of flow from Cascade Hydropower *Dam Development Scenario*



Impact of Landuse Change under Hydropower Dam Development Scenario





THANK YOU

One Mekong. One Spirit.