

Managing Water Scarcity in a Transboundary Basin: The Nile Basin Decision Support System



*The Nile River at the Bujagali Falls, Uganda.
(Photo: Courtesy of J.K.Lørup, 2006)*



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DHI

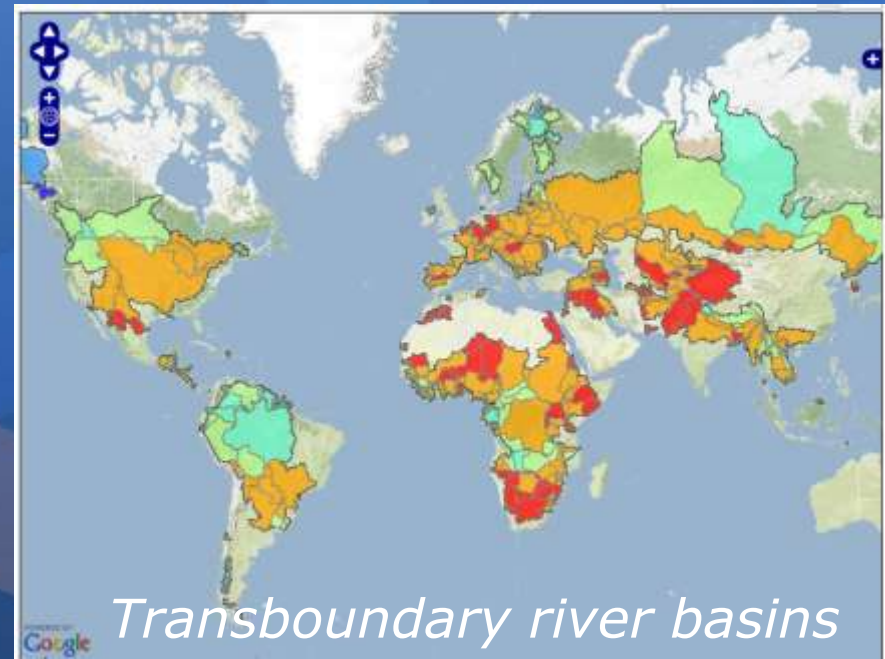
Transboundary River Basins



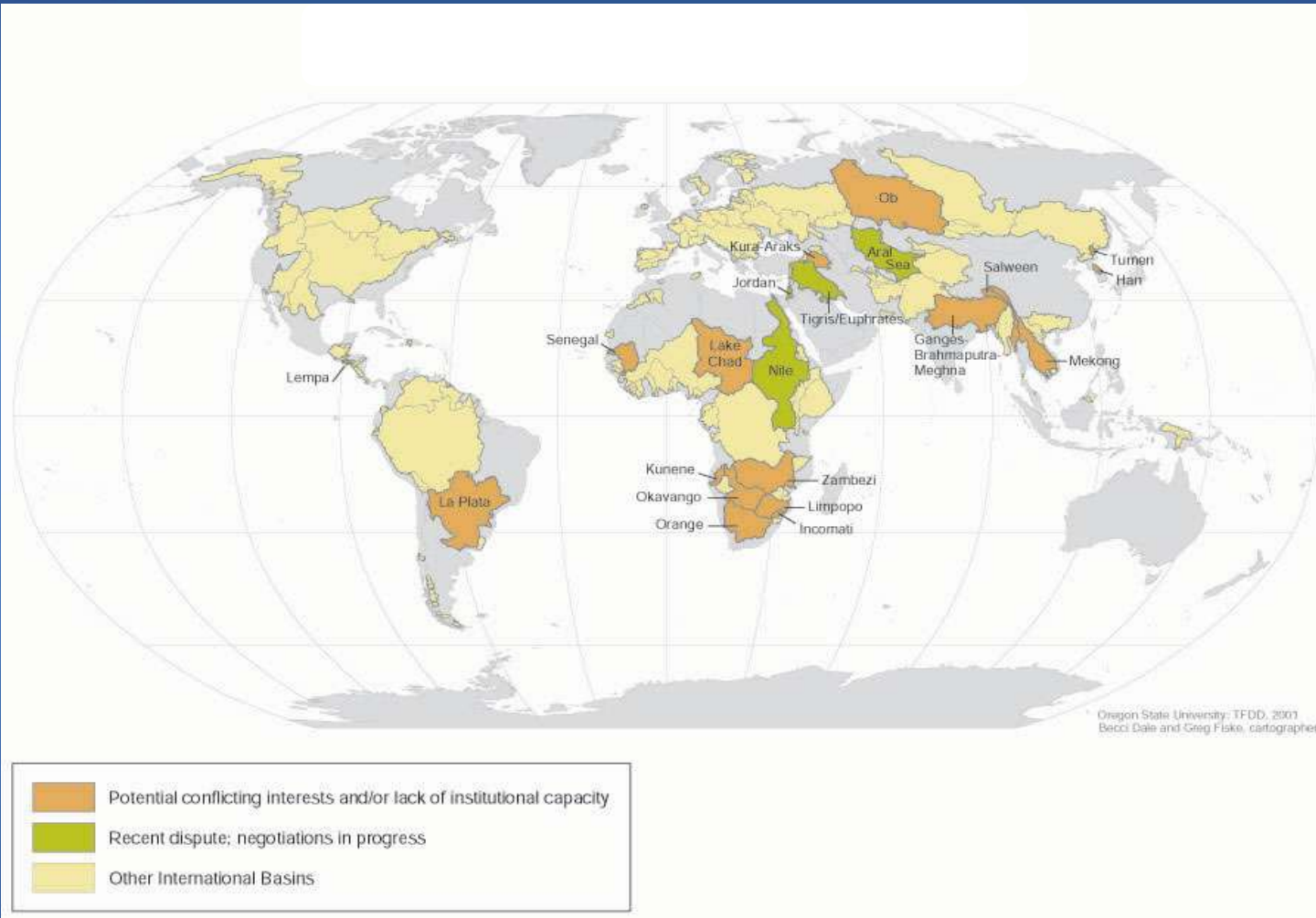
- 261 major watersheds cross country boundaries
- 45% of the land surface
- 40% of the world's population
- 60% of the global river flow
- 145 nations



<http://www.transboundarywaters.orst.edu>



Transboundary Water Conflicts



Approach:

Focusing on “sharing benefits” rather than “sharing water”.

A much broader approach that leads to increased opportunities and room for negotiations



Examples:

Nile river basin (Nile Basin Initiative)

Mekong river basin (Basin Development Plan)

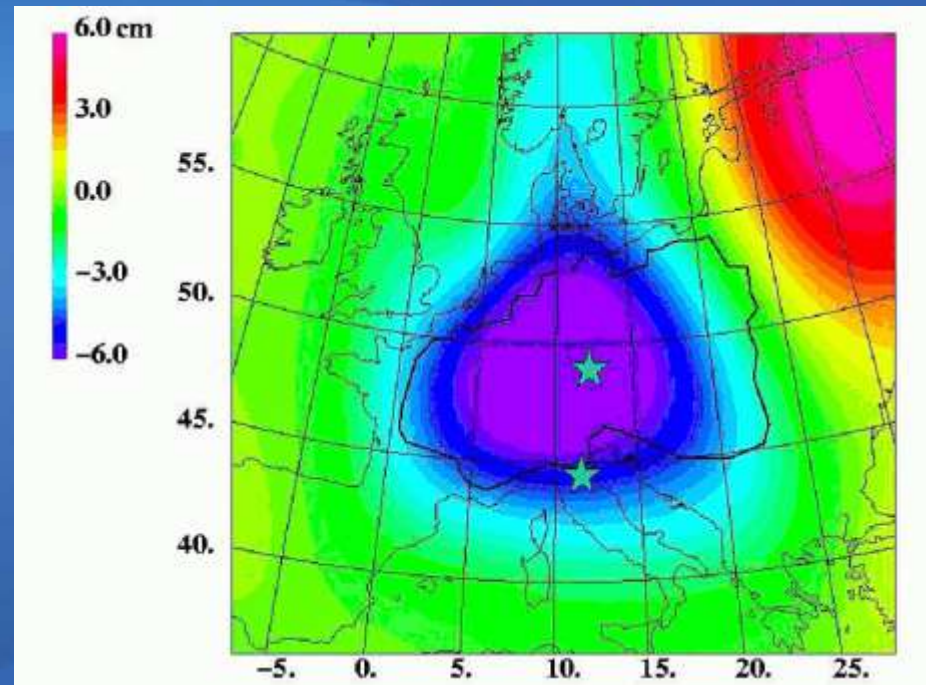
Droughts:

Droughts can be considered as a temporary decrease of the average water availability.

Linear inter-annual Terrestrial Water Storage trend in Europe from GRACE. Negative means less water in 2003 than 2002.

Andersen et al (2005)

GRACE-derived terrestrial water storage depletion associated with the 2003 European heat wave
GEOPHYSICAL RESEARCH LETTERS, VOL. 32, L18405, doi:10.1029/2005GL023574, 2005



Water scarcity:

Water scarcity refers to long-term water imbalances, combining low water availability with a level of water demand exceeding the natural recharge

The Nile Basin

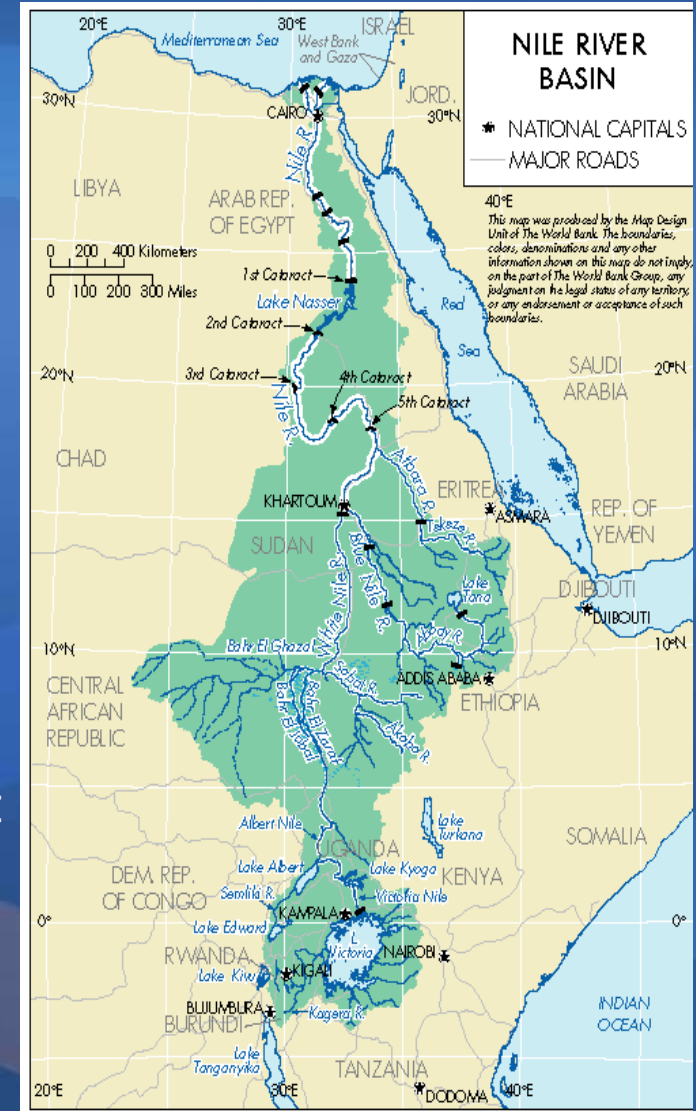


The Nile River Basin is shared by 10 river basin countries

- Burundi,
- Democratic Republic of Congo (DRC)
- Egypt
- Eritrea
- Ethiopia
- Kenya
- Rwanda
- Sudan
- Tanzania
- Uganda

One of the most diverse, critical & important shared water basins in Africa.

Many different water use requirements including hydropower and irrigation.



“Development and Deployment of the Nile Basin Decision Support System” (2009 – 2012)

Client : Nile Basin Initiative

Funding : Multi Donor Trust Fund administered by the World Bank

“Assessing the impact of climate change on the water resources in the Nile Basin” (2009 - 2011)

DHI Client : UNEP

Final Client: Ministry of Water Resources and Irrigation, Egypt

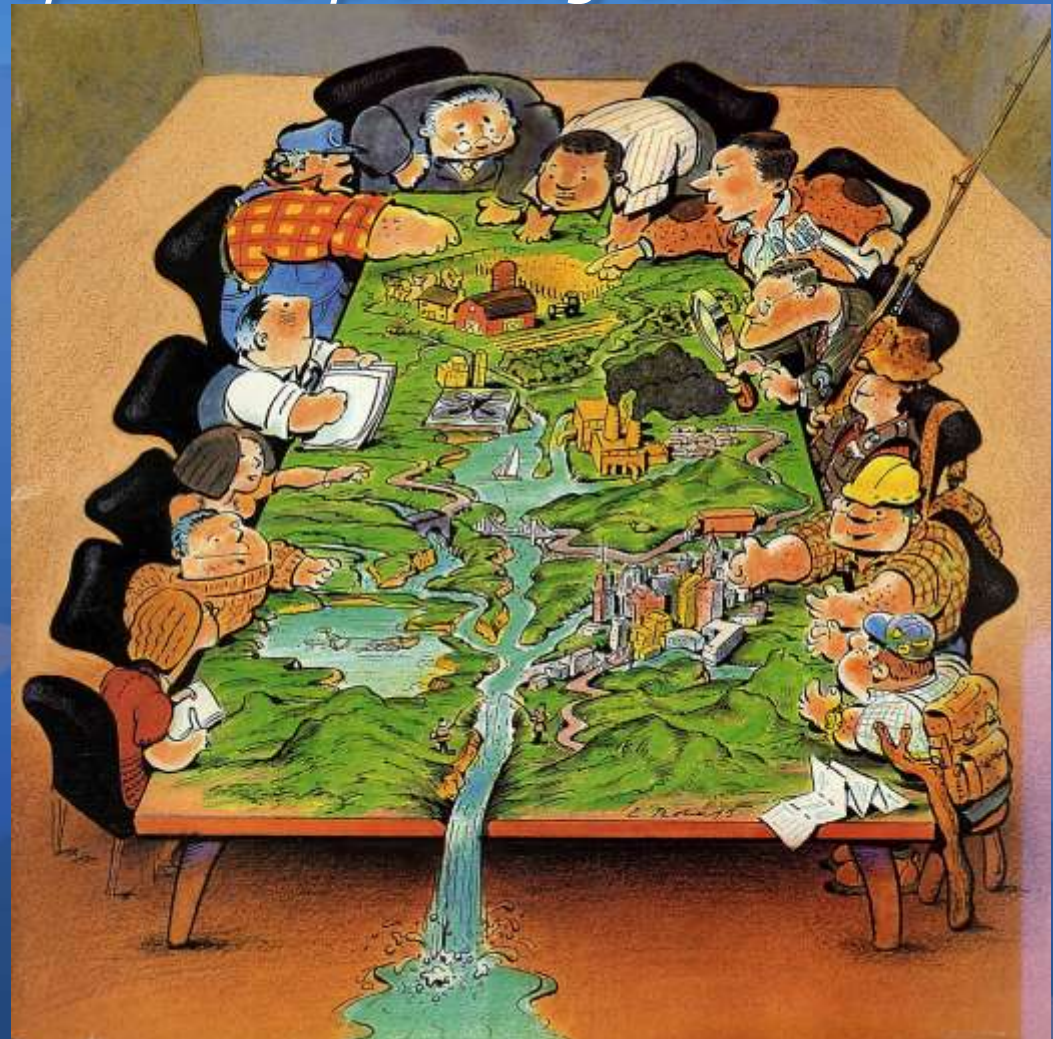
Funding: Joint Programme on “Climate Change Risk Management in Egypt”

- **Involves 6 UN organisations, 5 Egyptian Ministries and the Egyptian Cabinet of Ministers**
- **3-years programme financed by the Spanish Government and managed by the Ministry of Environment, Egypt**

Why a Nile Basin DSS?



To serve as a shared knowledge base, provide analytical capacity and support stakeholder interaction for co-operative planning and management



Priority Concerns



Water resources development:

Focus on infrastructure (e.g. new dams)



Coping with floods:

focus on flood protection and impacts



Optimal water resources utilization:

Focus on optimal use (e.g. reservoir operation rules)



Rain-fed and irrigated agriculture:

focuses on crop-production and irrigation



Energy development (hydropower):

focus on development of hydropower potentials

Navigation:

Focus on impacts on river navigation

Coping with droughts:

Focus on drought management



Watershed and Sediment Management:

Focus on land-use, soil erosion, sediment loads



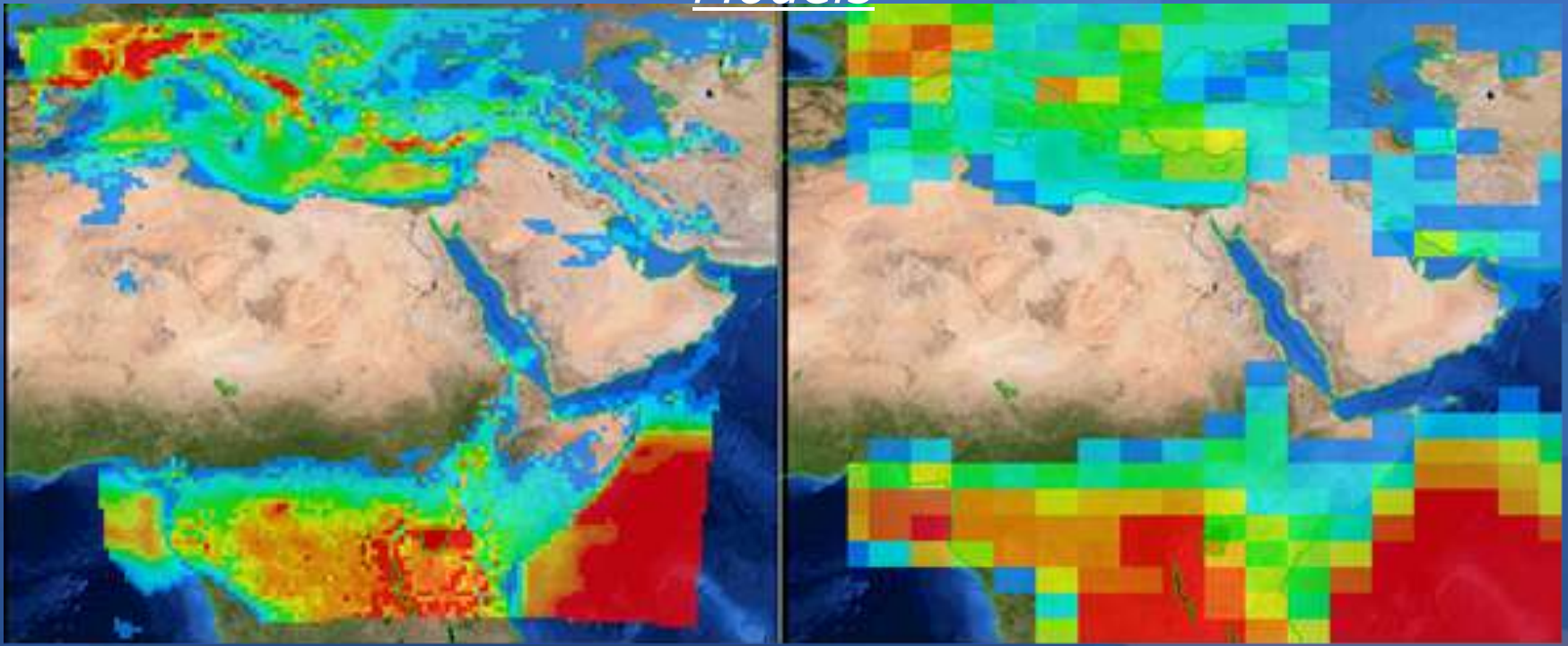
Cross cutting issues :
Climate change and Water quality

Assessing the impact of climate change on the water resources in the Nile Basin

Key objectives:

- Construct climate scenarios for the Nile Basin to assess the impact of climate change on the water resources in the Nile Basin with focus on the inflow to the High Aswan Dam (HAD)

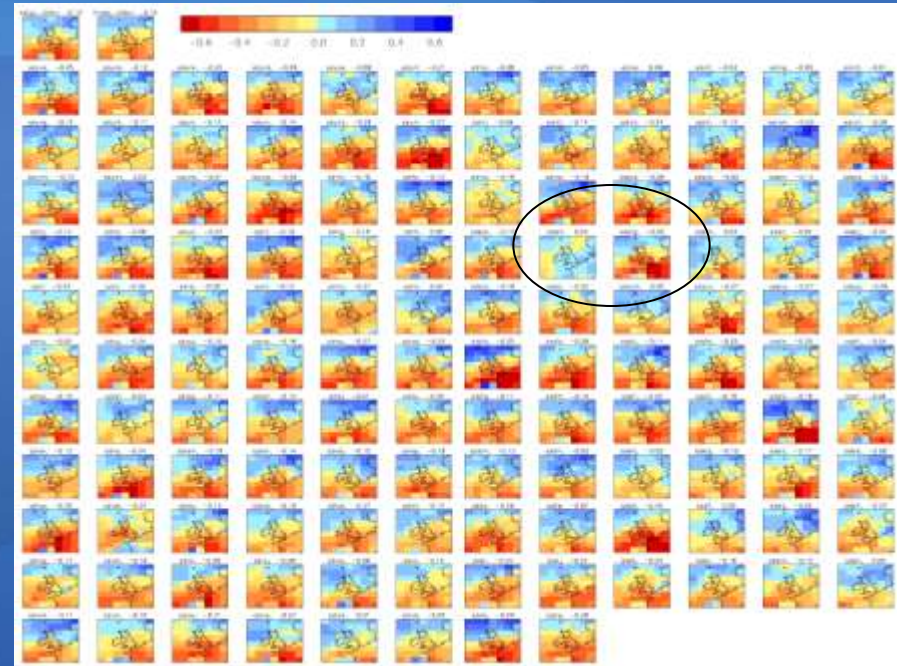
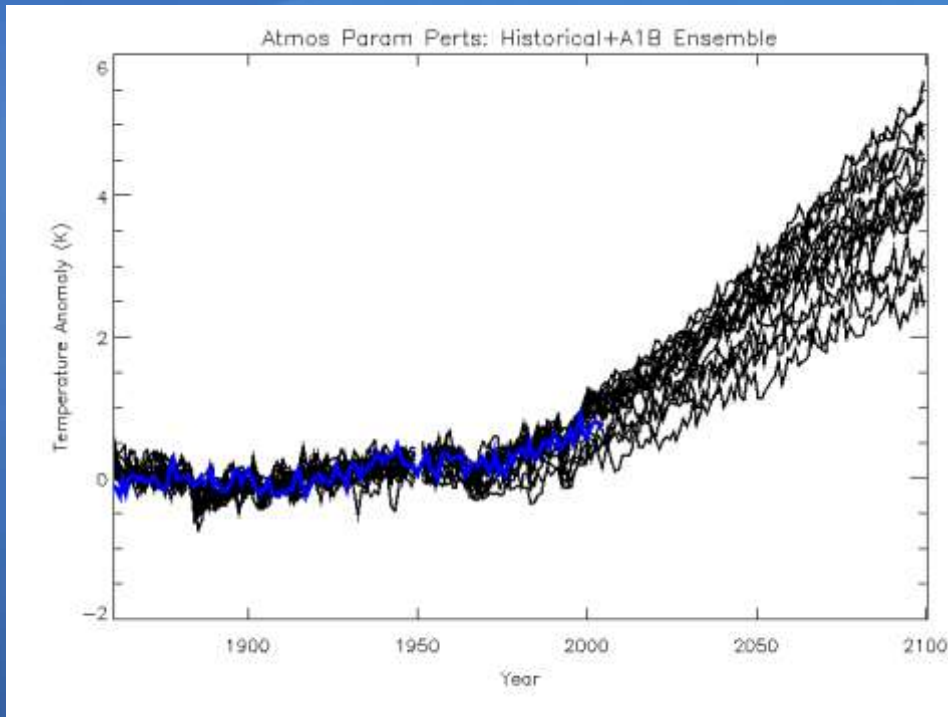
RCM Hadley Center Climate Models GCM



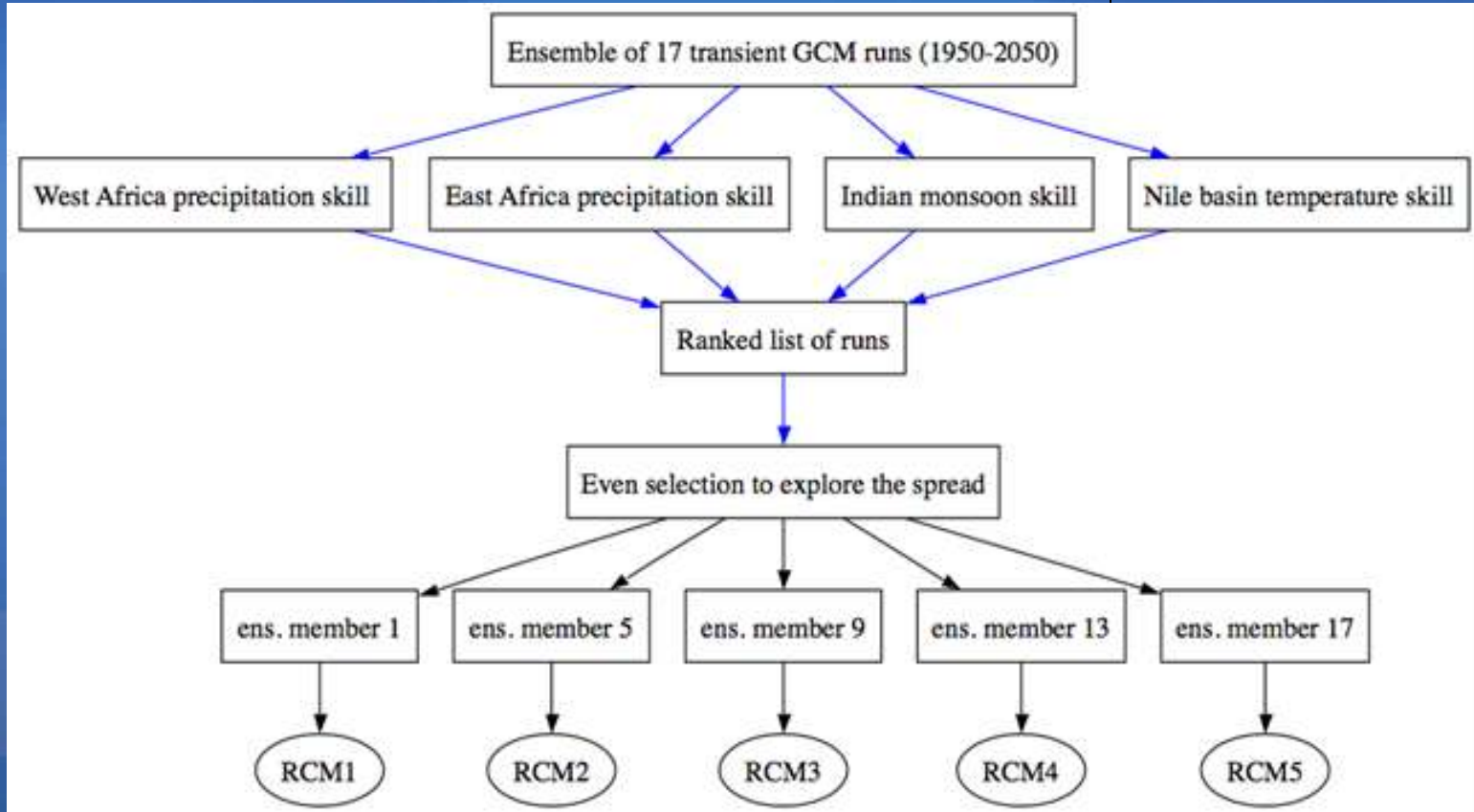
Atmosphere-Ocean ensembles



Model ensembles Hadley Centre



Selection of ensembles



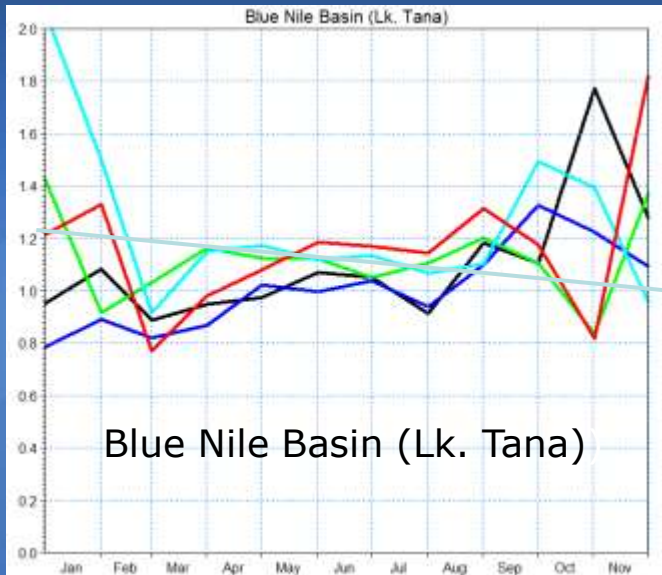
Hadley Centre HdCM3/PRECIS models

Climate Change

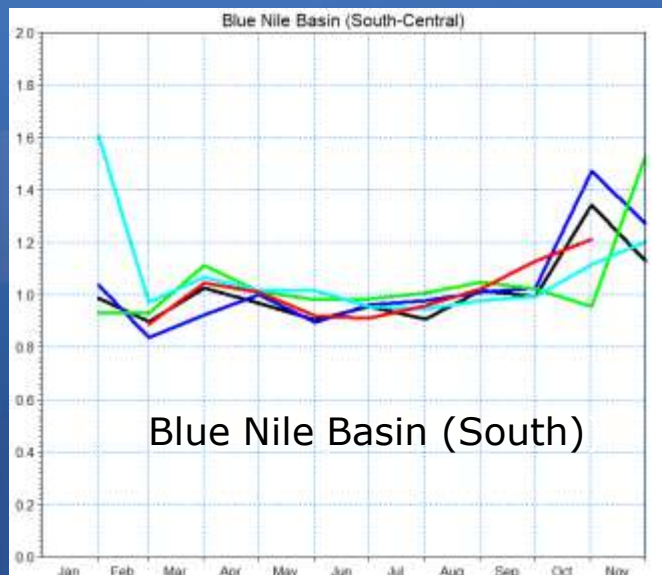


Delta-Change Factors (Rainfall)

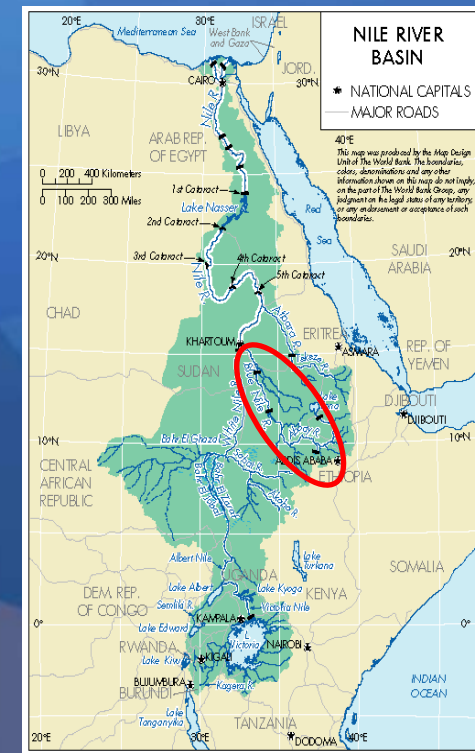
UNEP Project:
UK Hadley Center
HdCM3/PRECIS models



Zero change



Zero change



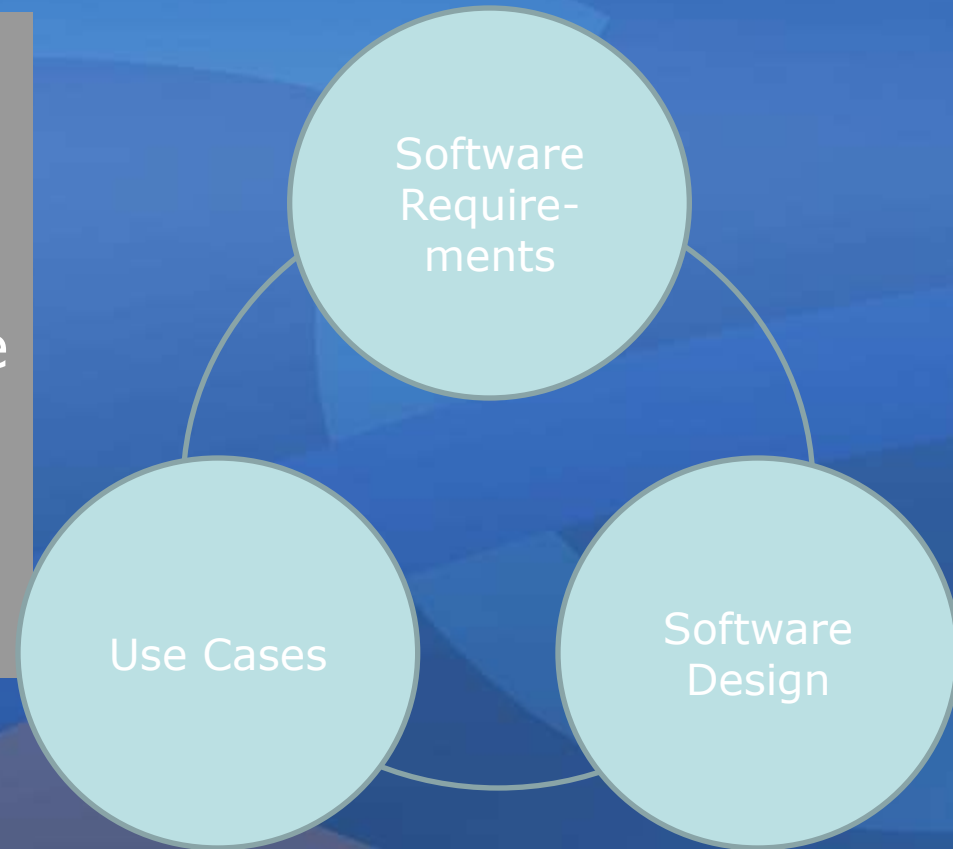
Designed by the Client for the Client
(NBI)

Rooted in real use-cases

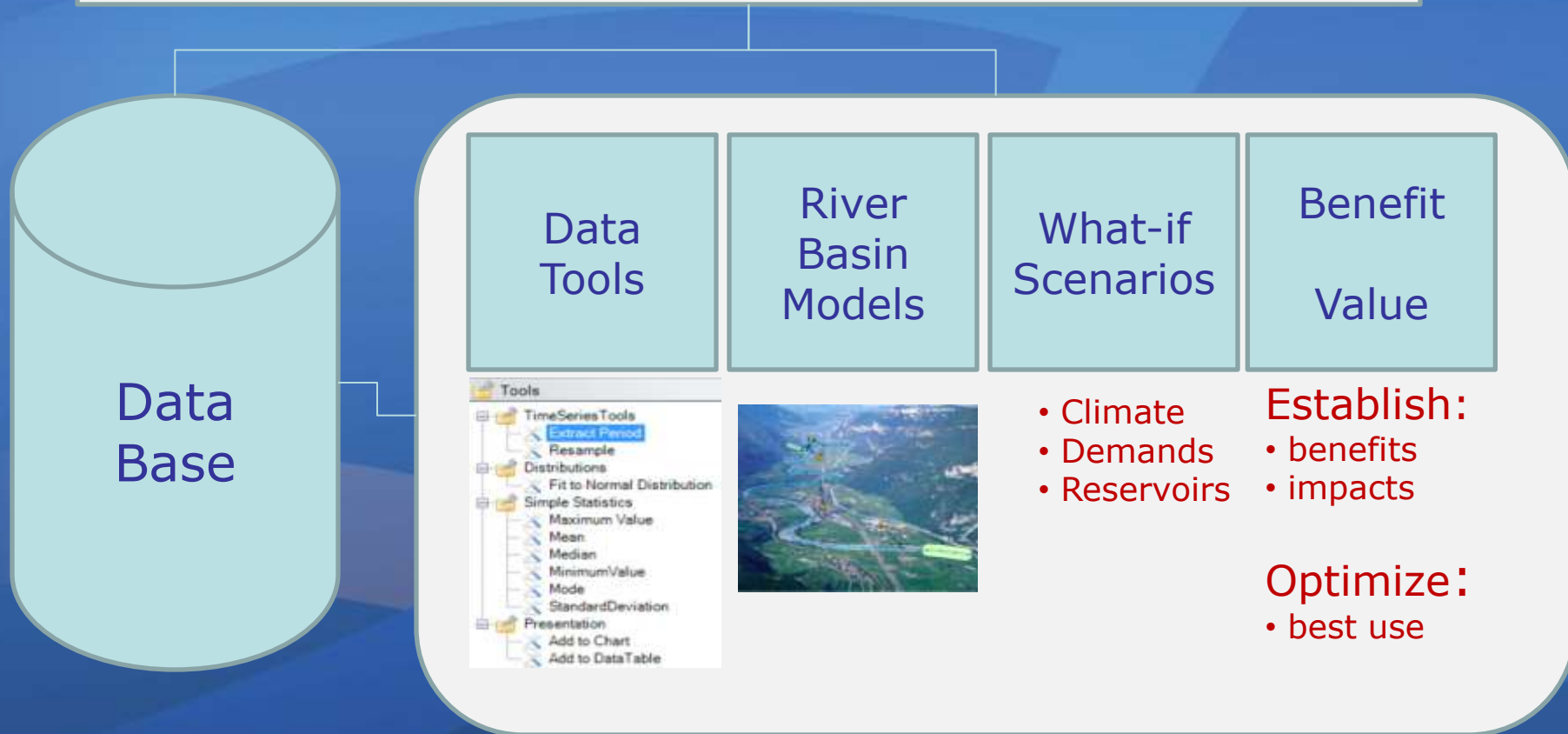
Designed to address real use-cases

Use Case Examples:

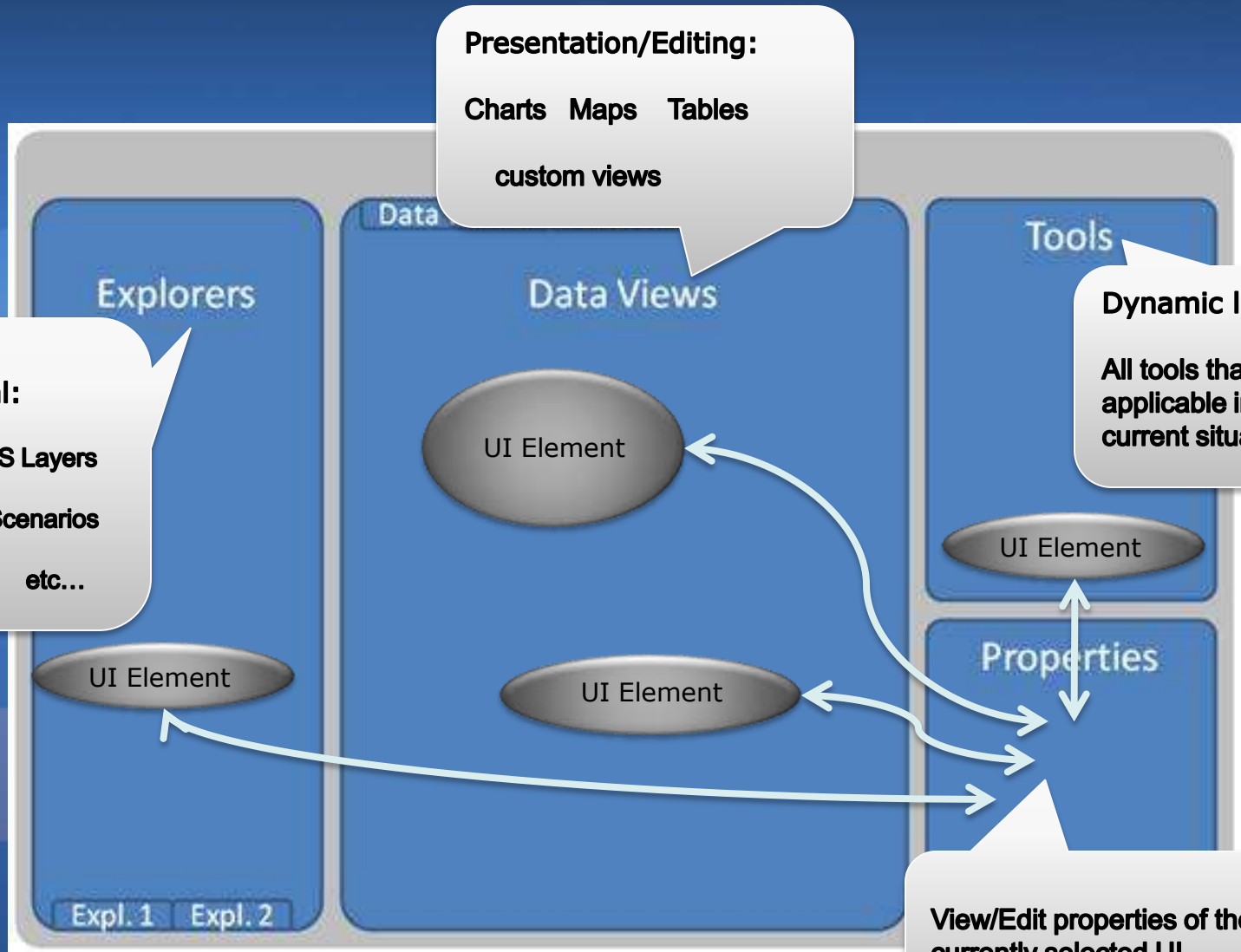
- Joint Multi-Purpose Project on the Blue Nile
- Declining water levels in Lake Victoria.
- Best option for Jonglei Canal (Sudd bypass)



Graphical User Interface (technicians -> decision makers)



Structure of the DSS Platform User Interface



Data retrieval:

Time series GIS Layers

Tables data Scenarios

Meta Data etc...

Presentation/Editing:

Charts Maps Tables

custom views

Dynamic list:

All tools that are applicable in the current situation.

View/Edit properties of the currently selected UI element(s)

User interface



DHI Solutions

File View Tools

Timeseries Explorer

Name: []

Add Criteria - Associated TimeSeries

- Database
 - TS3
 - Dummy alternative-13/01/2010 12:32:58
 - Input
 - Group 3
 - N100rflow from Catchment 16 [Catchment]
 - Dummy alternative-13/01/2010 12:29:26
 - Output
 - TS4_RMSA_m3PerSec
 - Input
 - TS4_RMSA_m3PerSec
 - Dummy alternative-12/01/2010 17:16:56
 - Output
 - TS4_RMSA_m3PerSec
 - Input
 - TS4_RMSA_m3PerSec
 - Dummy alternative 07/01/2010 17:57:12
 - Output
 - TS4_RMSA_m3PerSec
 - Input
 - TS4_RMSA_m3PerSec

My Favorites Timeseries Explorer

Layer Explorer

Search Layer []

Name []

Add Criteria -

- Database
- External ShapeFiles
 - Countries02.shp
 - Major_Rivers.shp
 - WorldCapitals.shp

Layer Explorer Scenario Explorer

User: jw | UI Level: Standard | Status: Ready

ThinkGeoMap1

Active Layers Countries02.shp - Clear Selection Countries02.shp

Legend

- WorldCapitals.shp
- Major_Rivers.shp
- Countries02.shp

Tools Explorer

- Tools
 - Time Series Processing
 - Duration Curve Tool
 - Extract Time Period
 - Moving Average
 - Resample
 - Distributions
 - Fit to Normal Distribution
 - Simple Statistics
 - Maximum Value
 - Mean Value
 - Median Value
 - Minimum Value
 - Mode
 - Standard Deviation
 - Presentation
 - Add to Chart
 - Add to DataTable
 - Stored Sequence

Current Sequence

Properties

ChartTimeSeries-TS2

- Chart Style
 - Chart Type: FastLine
 - Line Style: Solid
 - Marker Style: None
- Color Settings
 - Marker Color: []
 - Primary Color: []
 - Secondary Color: []
- Line Settings
 - Line width: 3
- Marker Settings
 - Marker Size: 5
 - Marker Step: 1

Chart1

Advanced Charts - Select Chart Type

ChartArea2

ChartTimeSeries-TS2

Chart Style

Chart Type: FastLine

Line Style: Solid

Marker Style: None

Color Settings

Marker Color: []

Primary Color: []

Secondary Color: []

Line Settings

Line width: 3

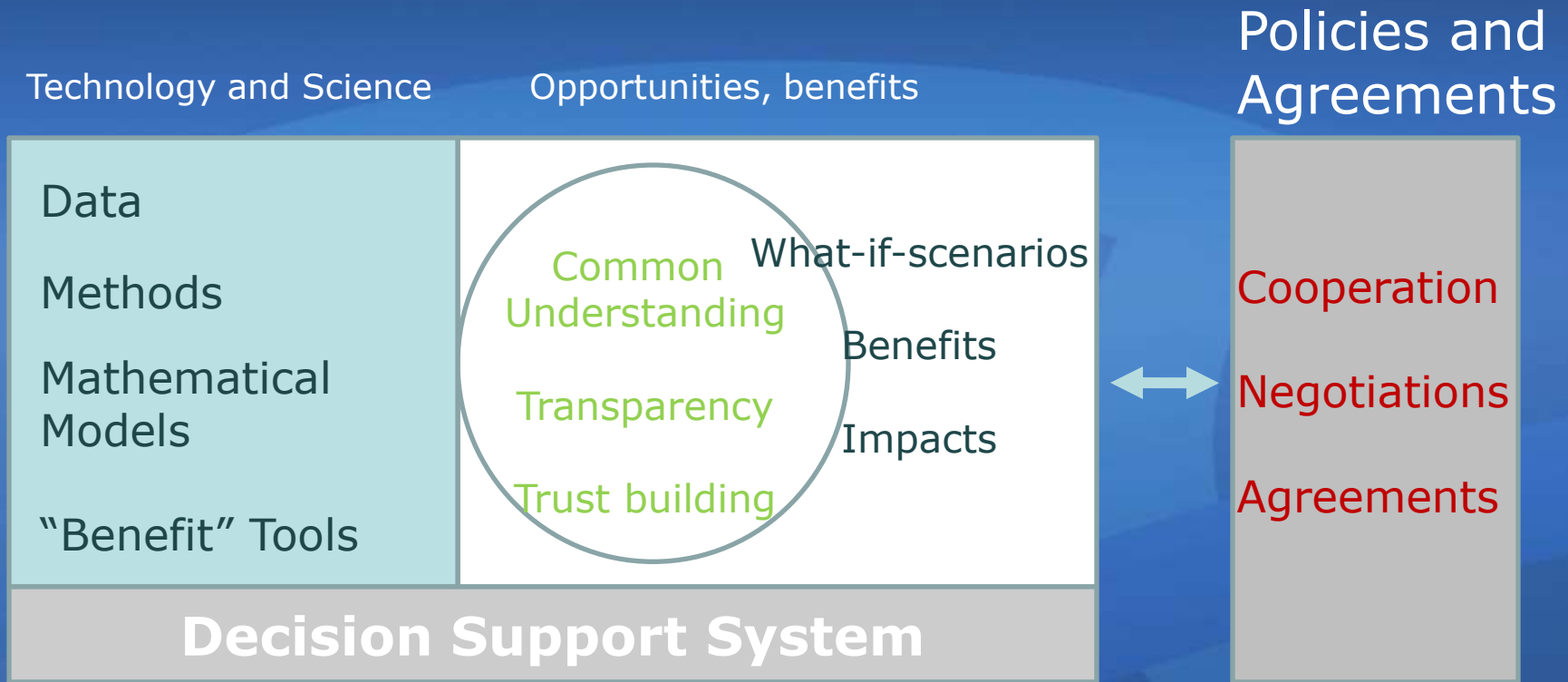
Marker Settings

Marker Size: 5

Marker Step: 1

Tool Settings Properties

DSS supporting Policy and Cooperation



Acknowledgements



Nile Basin Initiative:

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