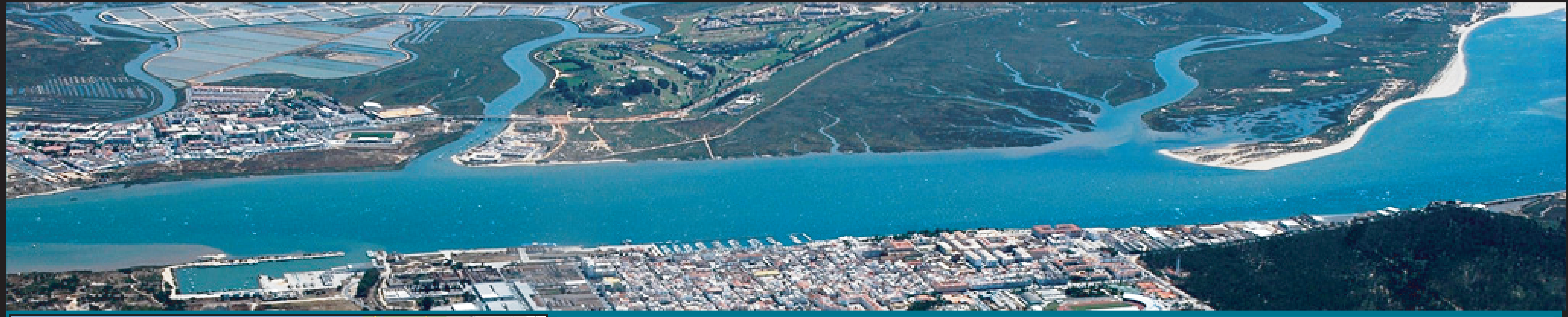


SSA 11 : Guadiana Estuary: Portugal and Spain : System Formulation

The most relevant Policy Issues indicated by stakeholders
a) Increasing untreated wastewater discharges (and)
b) Decreasing freshwater discharges from dam (lead to)
c) Decreasing impact estuarine water quality

Our goal
To develop a management tool able to simulate reliable eco-socio-economic scenarios for imposed conditions on: dam discharge regimes and/or wastewater treatment efficiency

The Rationale of our approach
An estuary is a 3-D body composed by an infinite number of cells. Given the characteristics of EXTEND, a 3-box approach was adopted. The Guadiana Estuary was divided in the upper, the middle, and the lower sectors which were assumed to be homogenous in chemical terms.

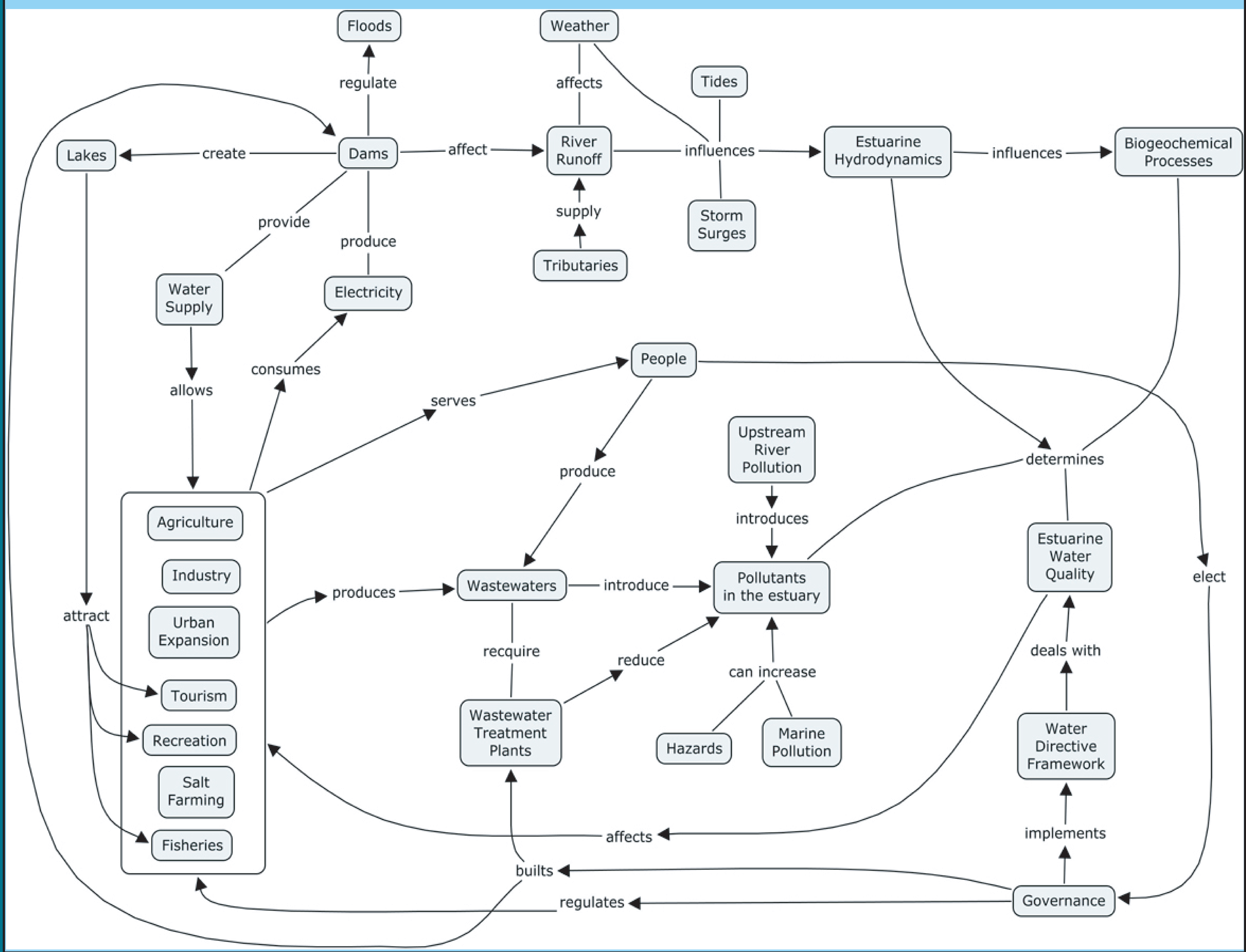
Freshwater discharge from dams and wastewater treatment efficiency are directly manageable variables which were considered as the key variables for the model. Nutrient and pollutant concentration were selected as model outputs to provide a diagnostic of the estuarine water quality.

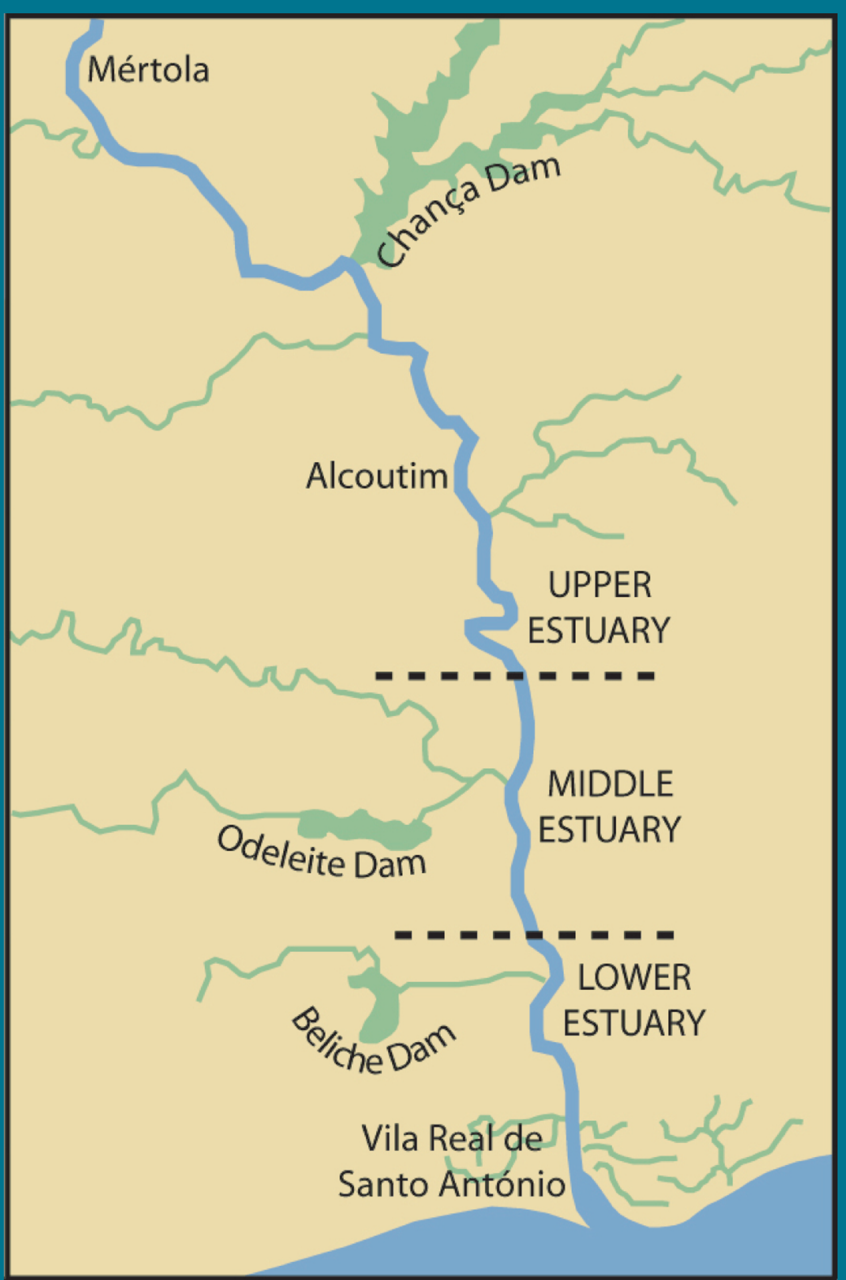
The biogeochemical processes affecting nutrients and pollutants were not modelled. We assumed that their influence is contained within the real data used in calibration.

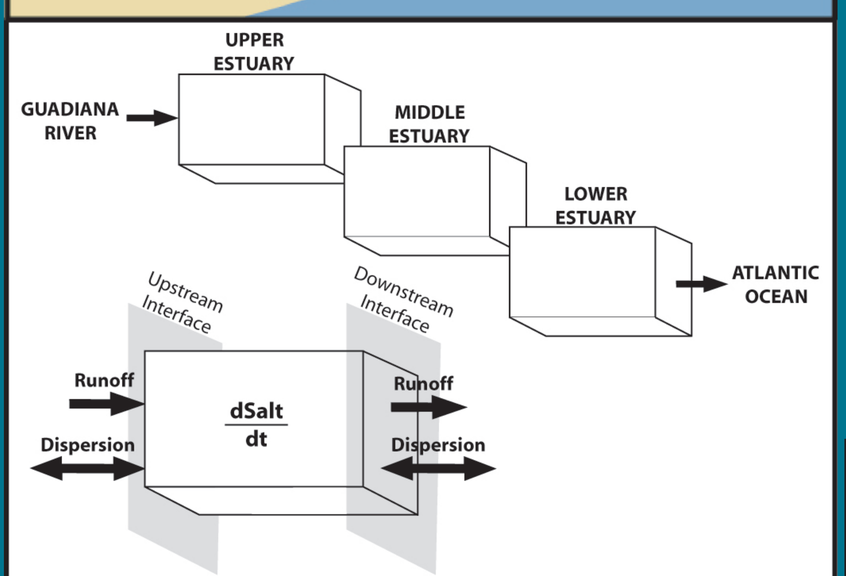
The salinity model defines advection and diffusion components for solute transport. Historical data were gathered from existing datasets. In the middle estuary sector, salinity was obtained through interpolation.

The Optimizer functionality of EXTEND was employed to calibrate the salinity model against real data. The advection and diffusion coefficients obtained were used to model the transport of other relevant solutes (nutrient or pollutant).

A conceptual diagram for our Policy Issue

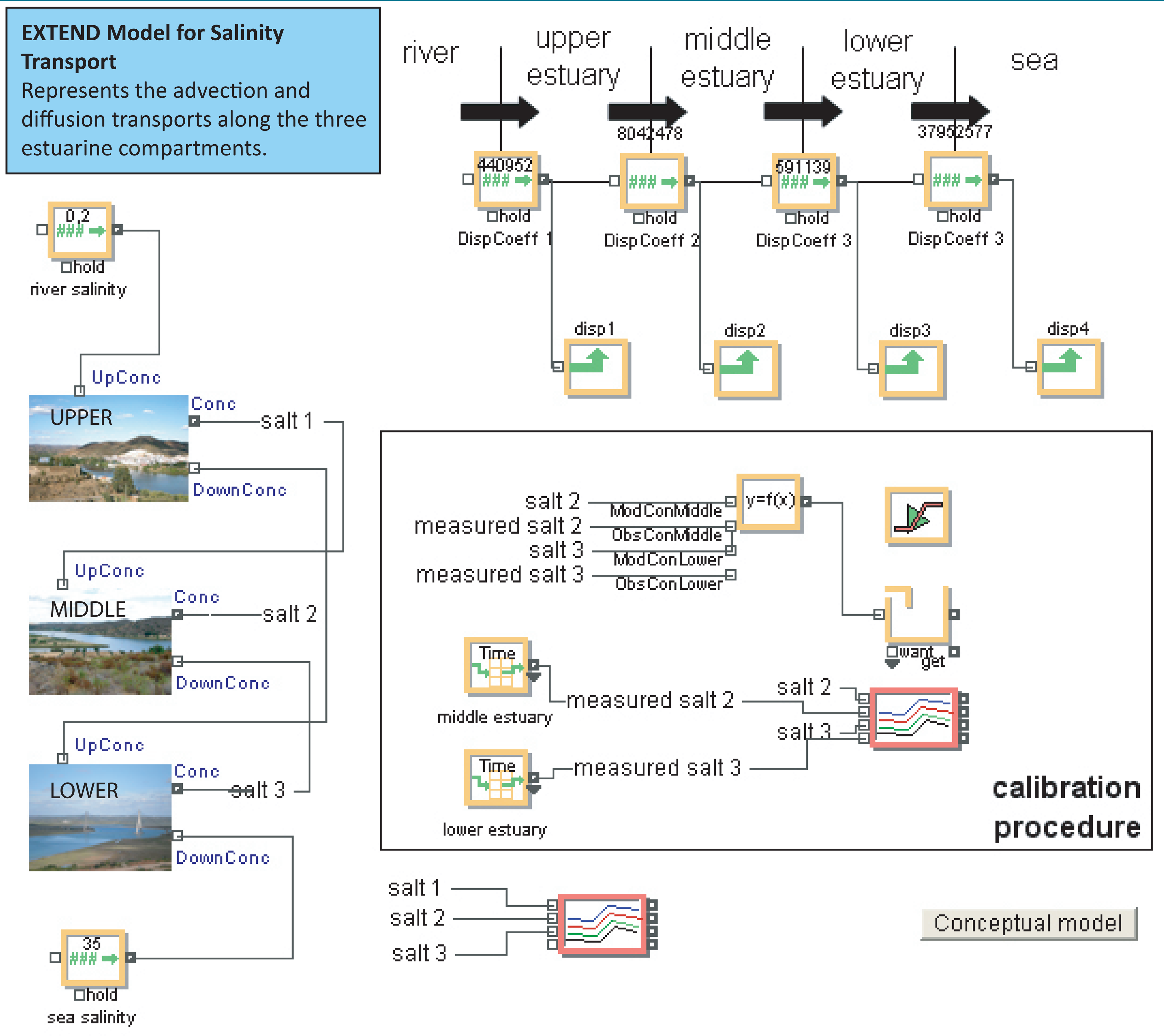




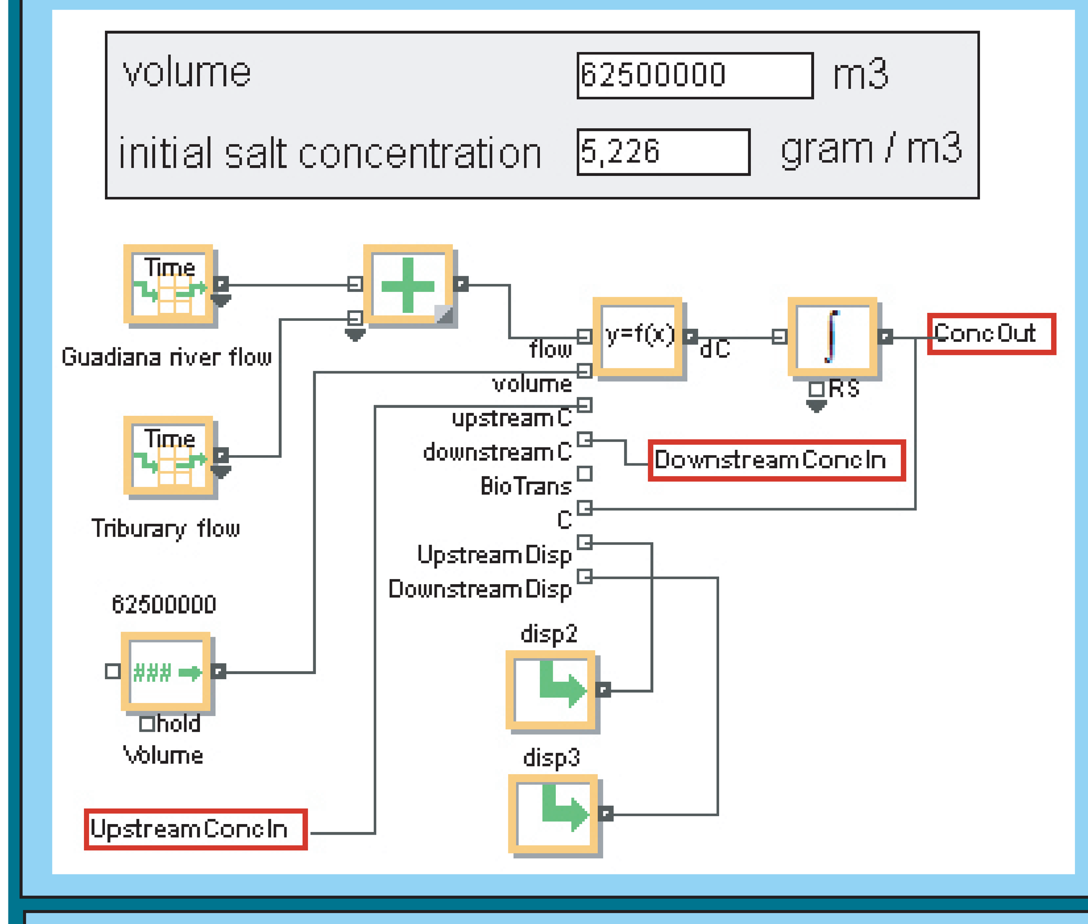


$$\frac{dSalt}{dt} = -\,flow\,\frac{\partial C}{\partial x} + dispersion\,\frac{\partial^2 C}{\partial x^2}$$

EXTEND Model for Salinity Transport
Represents the advection and diffusion transports along the three estuarine compartments.



Inside the Middle Sector Block
River and tributaries flows are summed. Upstream and downstream salinit are used to model the local salt concentration:
UpstreamFlux = flow x upstreamC + UpstreamDisp x (upstreamC-C)
DownstreamFlux = flow x C + DownstreamDisp x (C - downstreamC)
dC = (UpstreamFlux - DownstreamFlux)/Volume



Inside the Calibration Procedure

The Optimizer tool uses the expression

Output = (ModConMiddle-ObsConMiddle)2 + + (ModConLower-ObsConLower)2

to calibrate the model data against the real data in order to reach a better adjustment with more accurate coefficients.

Application to Dissolved Nutrients or Pollutants

The model can be easily adapted by following the same procedure and adding new data inputs for the sources of nutrients/pollutants inside each of estuary sectors.
For a in-depth explanation please contact Tiago Garcia (tgarcia@ualg.pt)

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