ECI 146: Water Resources Simulation

Classes 1-2

Hand out 3

Review of concepts

Water resources

1) Water=life. Key to the development of civilization. Fresh water is very scarce (see table in Hand out 1)

2) "Resources" has two meanings:

a) Something we can profit from (obtain benefits for irrigation, drinking water, power generation, navigation, recreation, etc.)

b) Something we need to care about, because it is a finite resource. Sustainability of hydraulic designs

3) Water has an economic value:

a) Water stored in reservoirs is valuable because it can generate energy and produce money

b) Water is very expensive in some developing countries because it is scarce
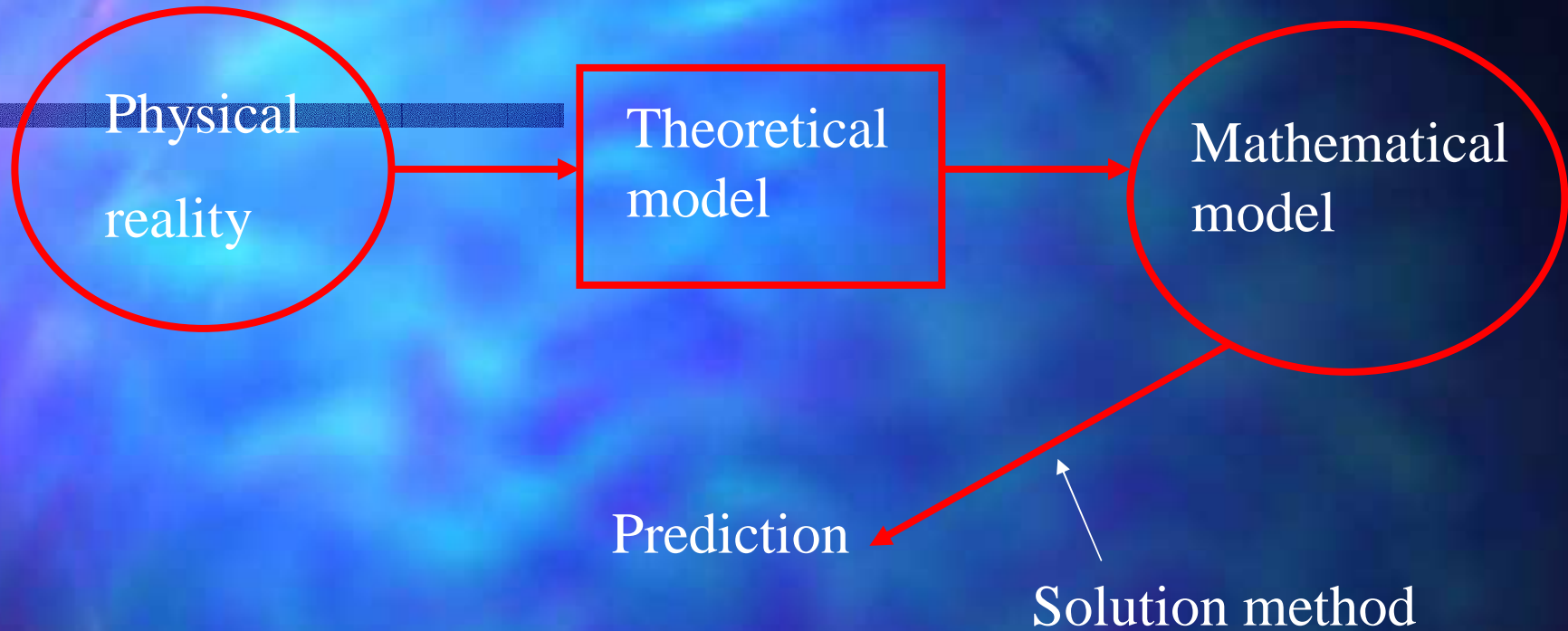
Review of concepts

Simulation

It is the analysis of a phenomenon under controlled conditions. The objective of the simulation is the study of the phenomenon and the prediction of its behavior.

Types of simulation

1. Experiments
    a) Full scale
    b) Small scale
2. Analogic solutions
3. Theoretical-numerical solutions

Review of concepts

Physical reality

Theoretical model

Mathematical model

Prediction

Solution method

Solution method:

a) Analytical

b) Numerical

Problems with water resources

1) Rivers:
   a) Floods
   b) Release of heated discharges from power plants
   c) Dispersion of pollutants by currents and velocity gradients (water quality)
   d) Density currents in low-velocity environments
   e) Bed changes
   f) Dam removal

2) Lakes:
   a) Dispersion of pollutants by currents and velocity gradients (water quality)
   b) Stratification: water layers with different density
   c) Eutrophication: incorporation of nutrients to the water body
   d) Sediment resuspension

Problems with water resources

3) Aquifers:
   a) Dispersion of pollutants by currents and velocity gradients (water quality)
   b) Phreatic-level depletion due to pumping

4) Wetlands:
   a) Dispersion of pollutants by currents and velocity gradients (water quality)
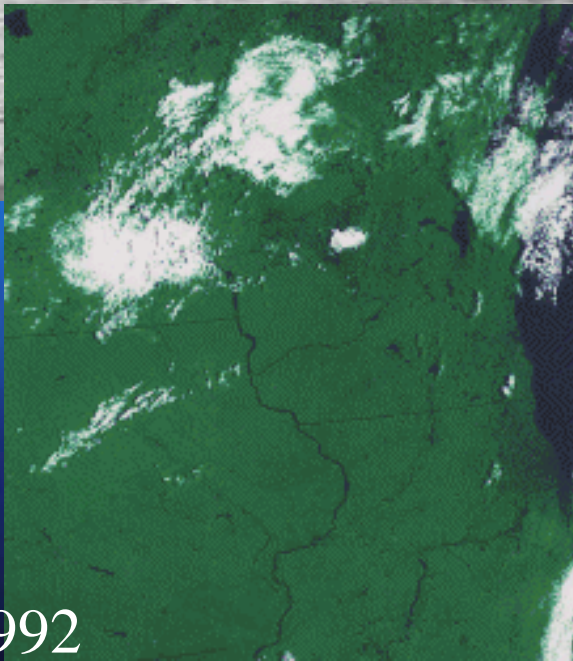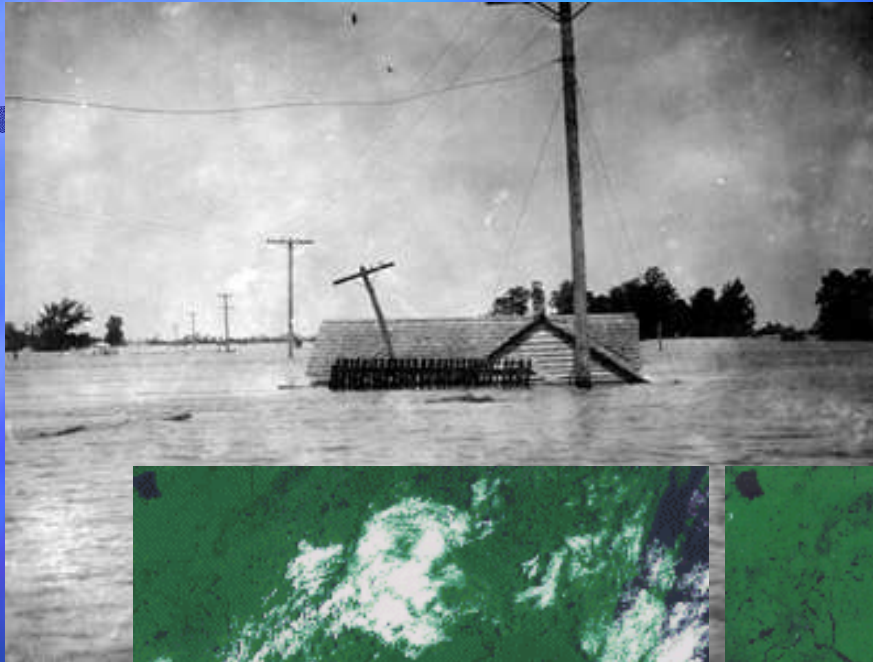   b) Sedimentation
   c) Sediment resuspension

5) Estuaries:
   a) Dispersion of pollutants by currents and velocity gradients (water quality)
   b) Sedimentation
   c) Sediment resuspension

6) Fjords

7) Seas and oceans

Rivers: Floods

Mississippi river
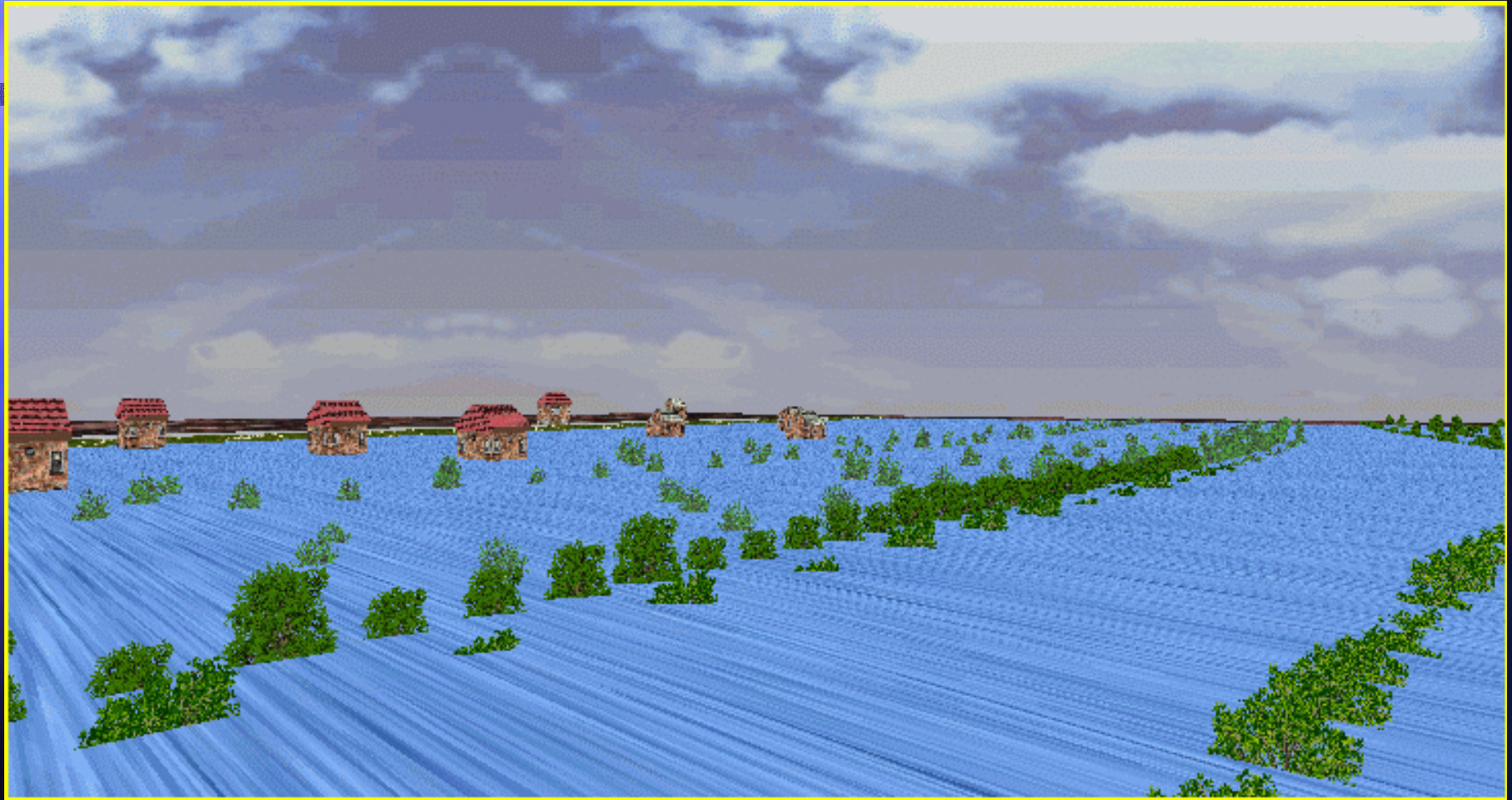

July 1992

July 1993

Rivers: Floods

Paraná River, Argentina, South America

Flood wave passes the reach in 2-3 minutes

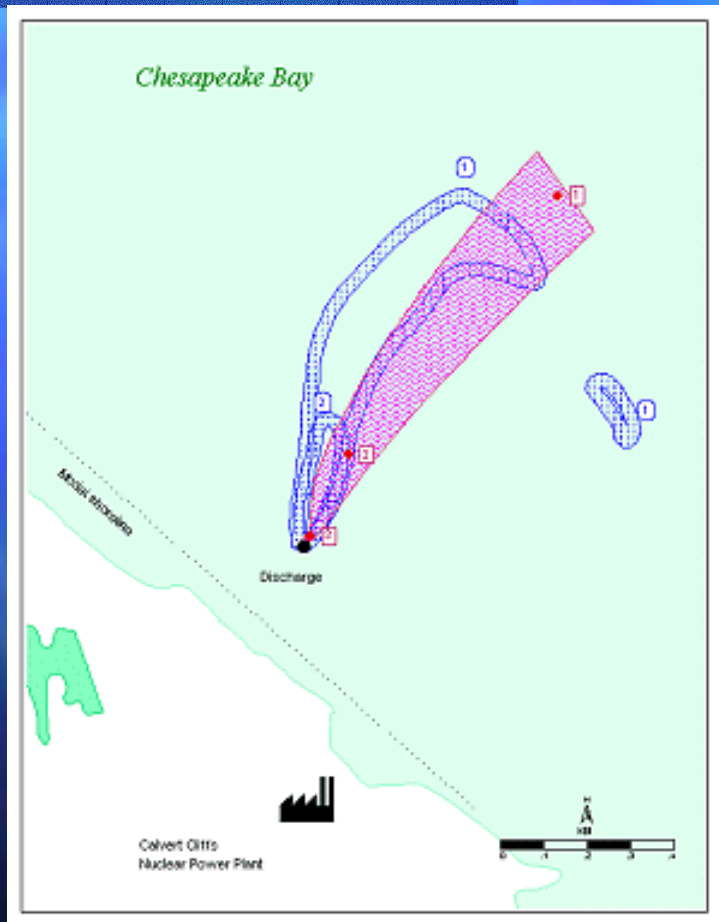# Rivers: Dam removal

Butte Creek, CA

- 6 to 12 ft in height
- 100 ft in length
- Water diversion

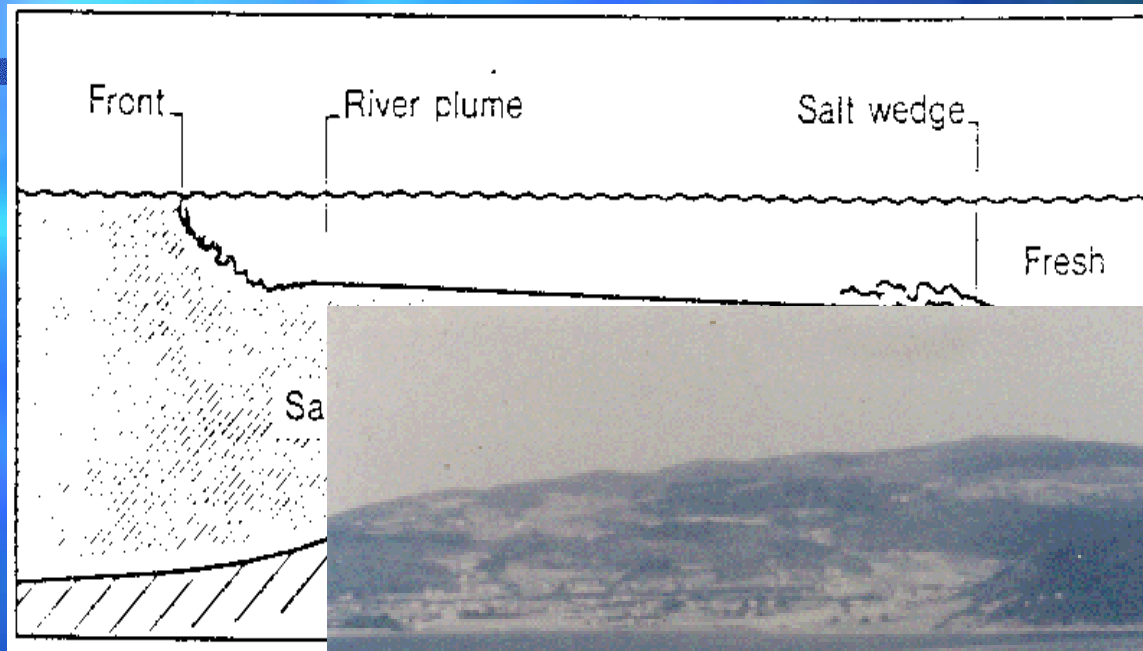- restored passage for the chinook salmon

Rivers: Discharge of heated water

The plume at Calvert Cliffs Nuclear Power Plant during ebb tide on May 12, 1978. Blue lines are 1°C delta-T measured isotherms with a 0.2°C uncertainty band. The red region is the thermal plume predicted by CORMIX. 1°C, 2°C and 3°C delta-T values are plotted for comparison

Estuaries: density currents

Front River plume Salt wedge

Fresh

Sa

Denser water-f