Coastal Hydrogeology

Today's agenda

- Aquifer Project Presentations
- Coastal hydrogeology continued

Salinization processes in MA

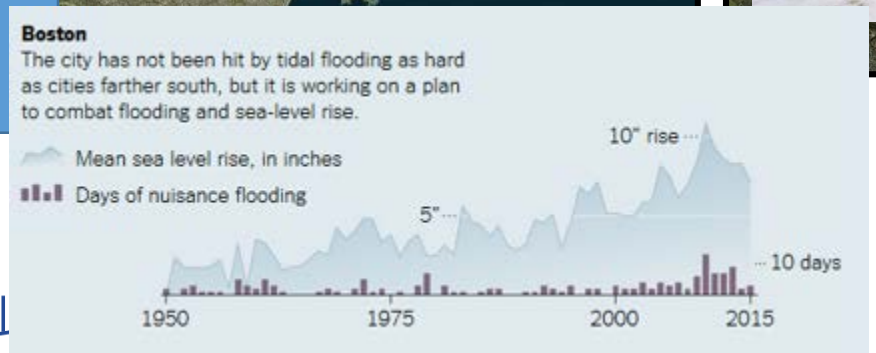
Boston, MA

Nuisance flooding

Storm surge overtopping

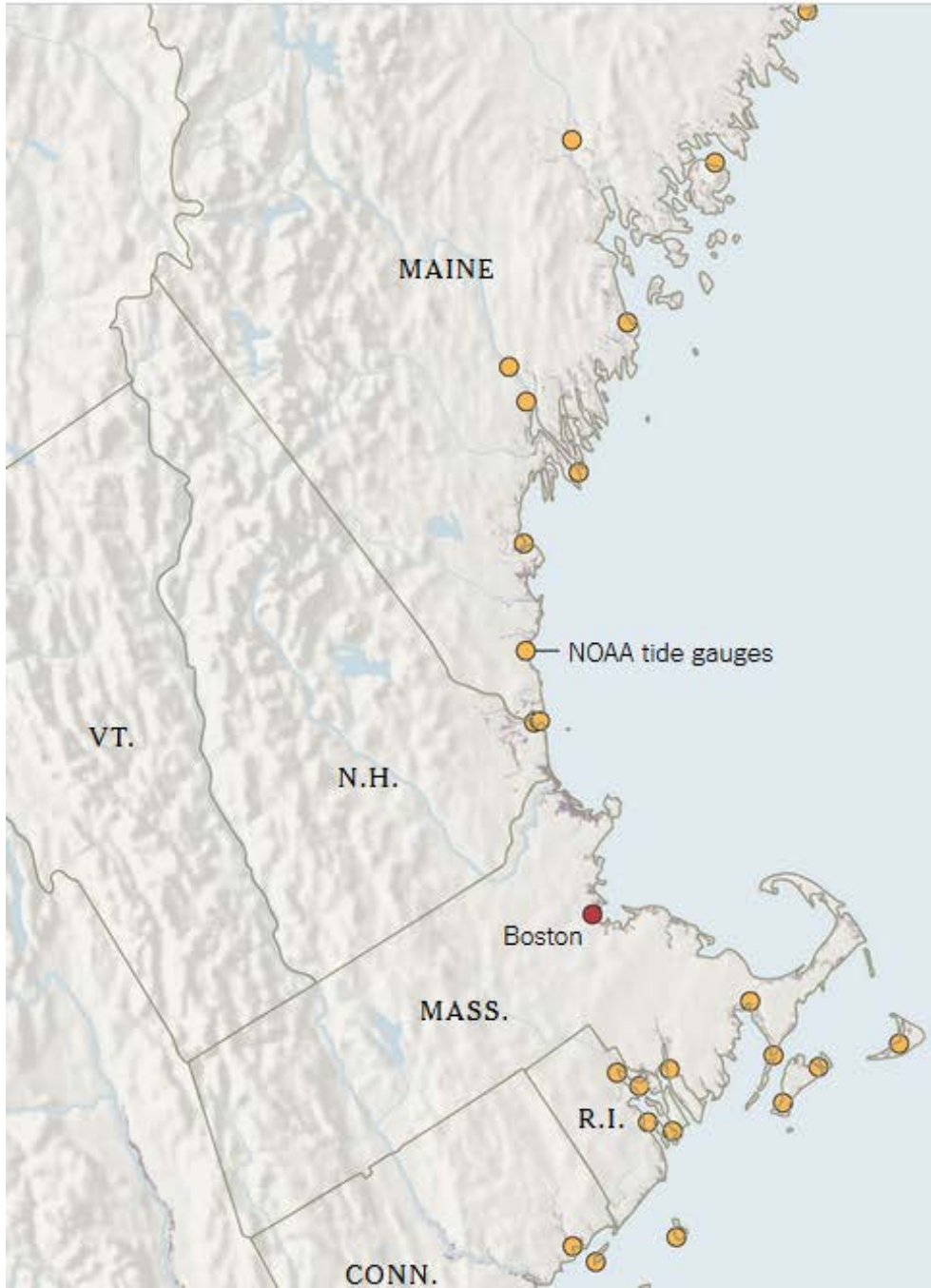
Sea level [m

Time



www.climatecentral.org/

The New York Times



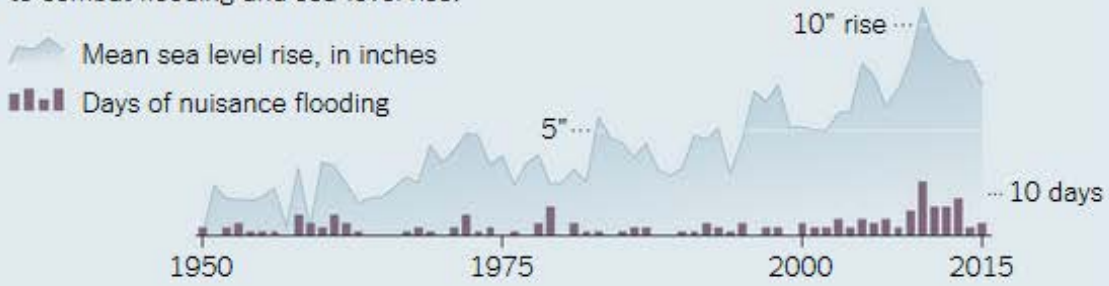
A Sharp Increase In ‘Sunny Day’ Flooding

By JONATHAN CORUM SEPT. 3, 2016

Global warming and rising seas are increasing the amount of tidal flooding on the Atlantic and Gulf Coasts. Flood levels are different from city to city, but the trends are similar.

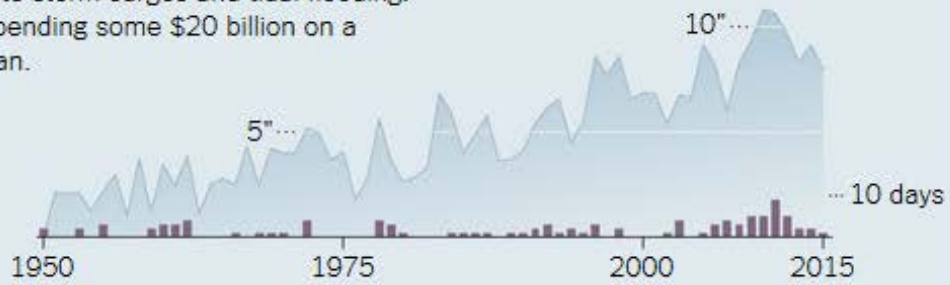
Boston

The city has not been hit by tidal flooding as hard as cities farther south, but it is working on a plan to combat flooding and sea-level rise.



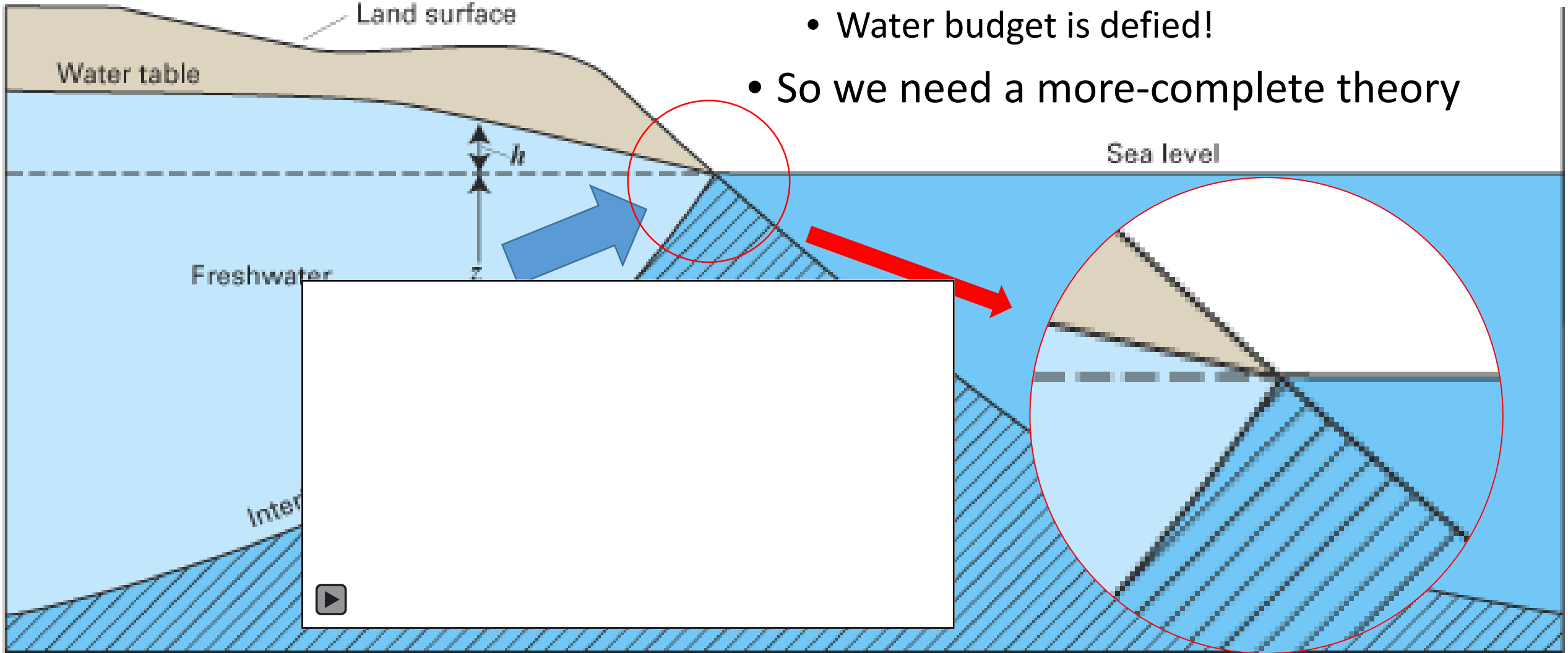
The Battery, New York City

In 2012, Hurricane Sandy laid bare the city’s vulnerability to storm surges and tidal flooding. The city is spending some $20 billion on a resilience plan.



Outflow Gap?

- Ghyben Herzberg predicts what happens when water is not moving
  - (notice the lack of any outflow gap)
  - This means no SGD
  - Water budget is defied!
- So we need a more-complete theory

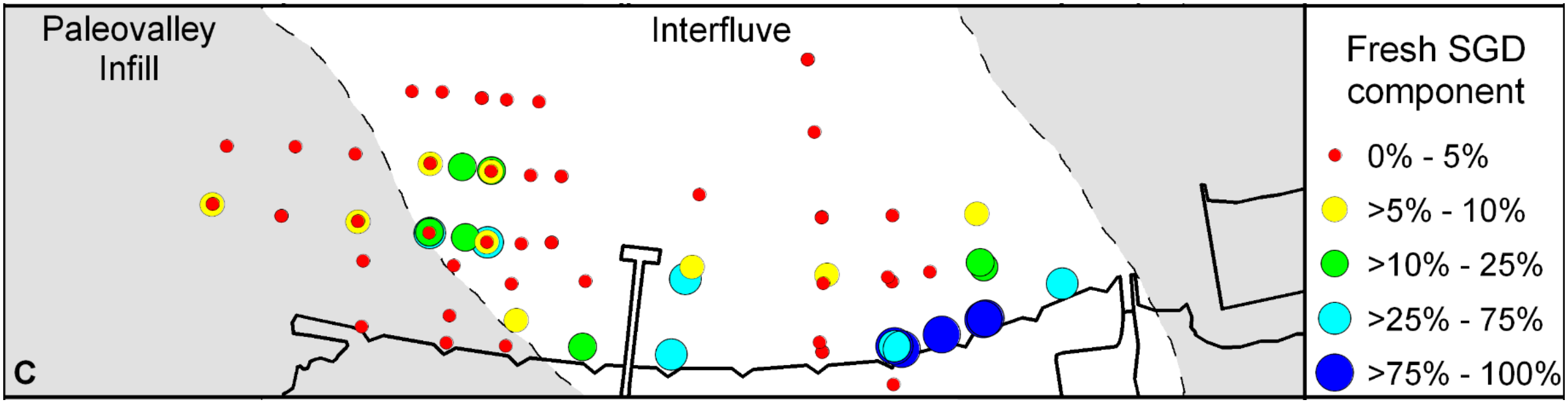


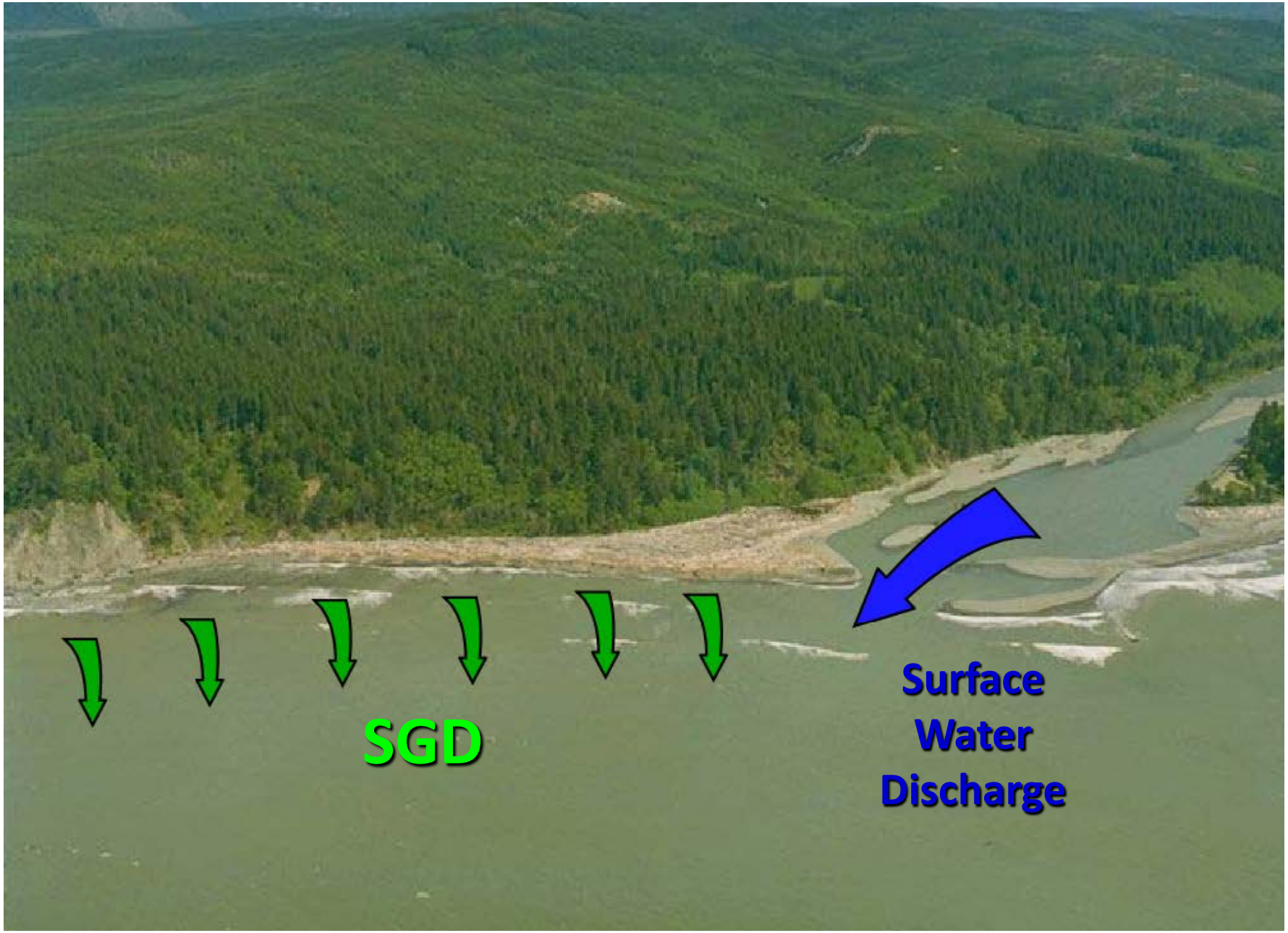
Outflow Gap

Land surface
Water table
Sea
1-D Dupuit sharp interface
Fresh water
Salt water
H_{sea}
$(H_{sea})' = H_{sea} - z_o$
2-D flow sharp interface

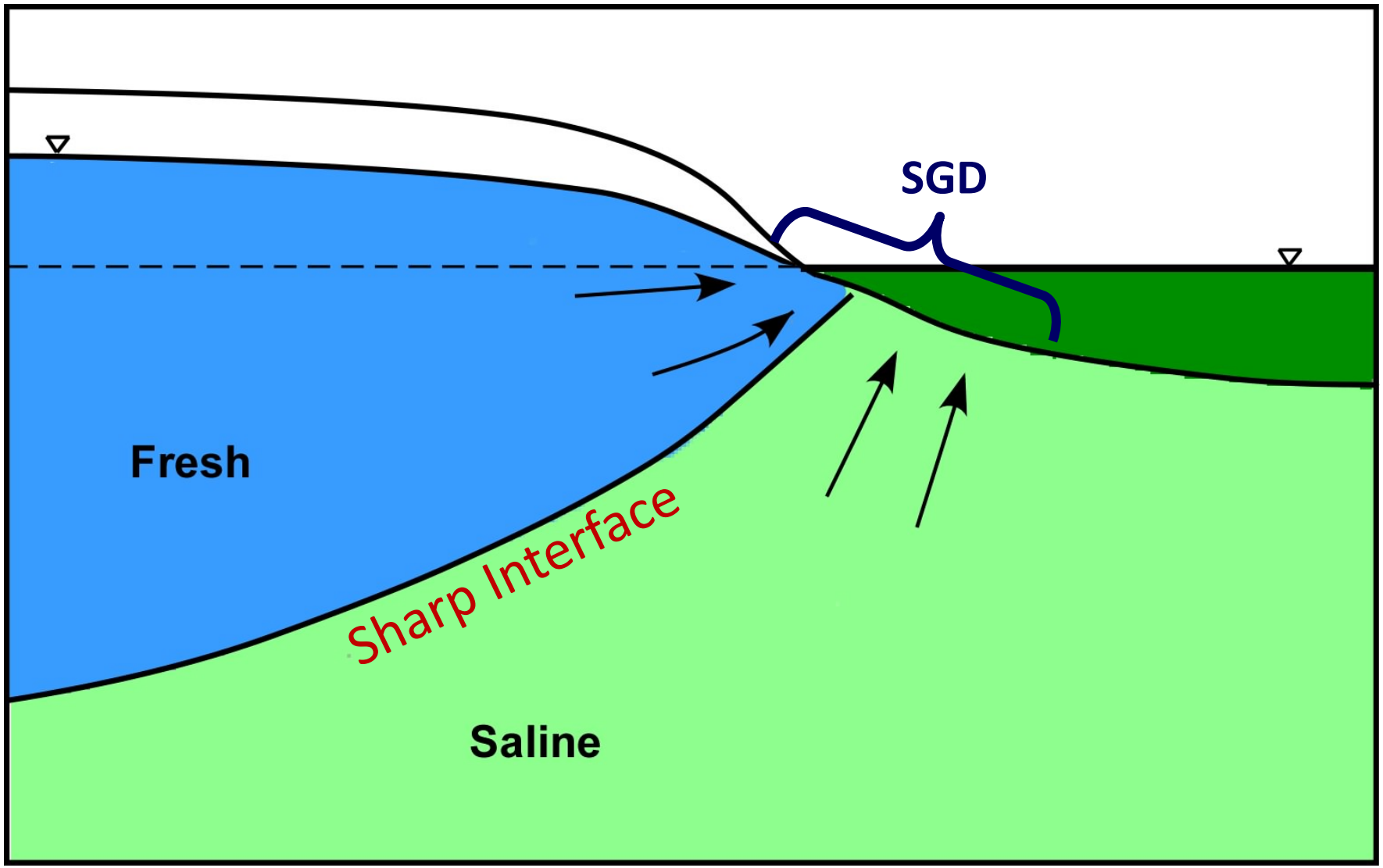
Outflow Gap?

Russoniello et al., 2013

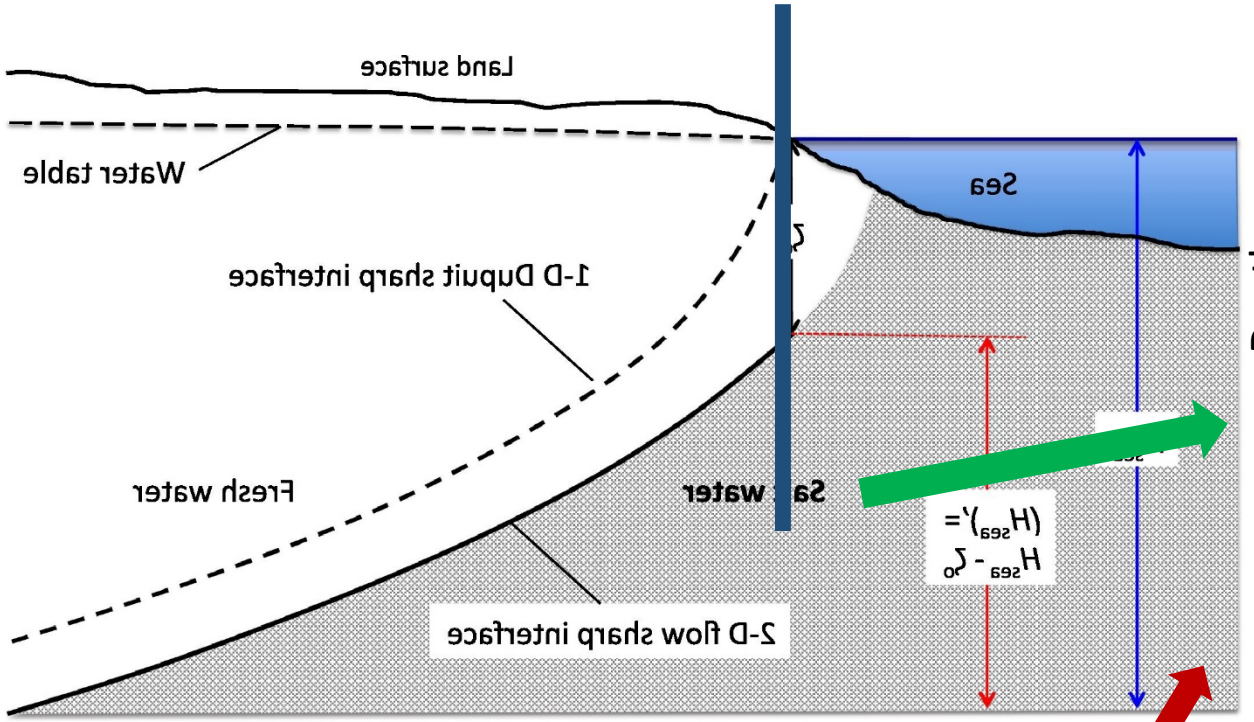



SGD
Surface
Water
Discharge

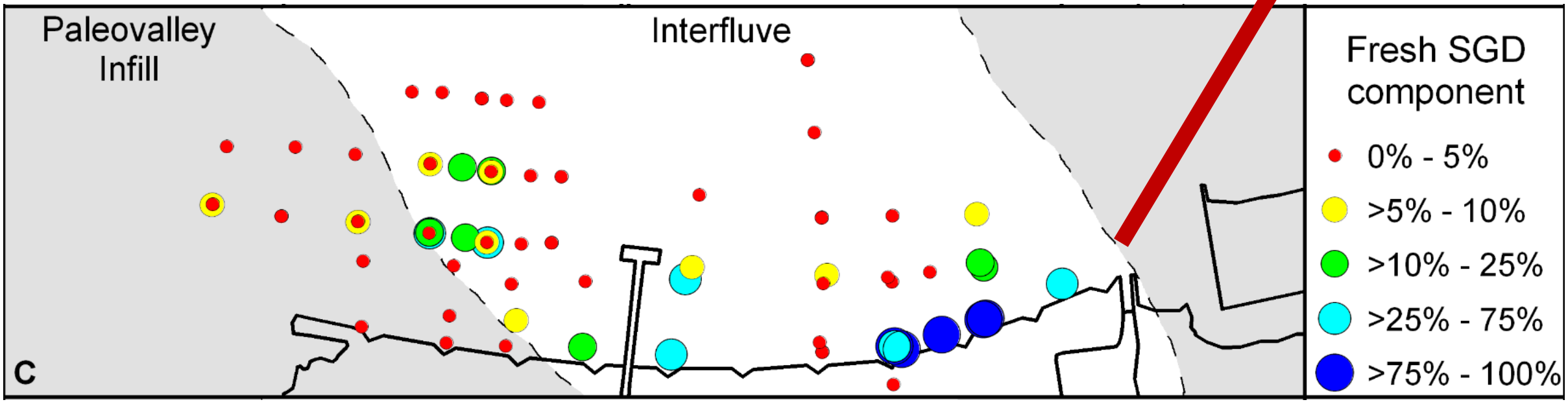
Submarine Groundwater Discharge (SGD):



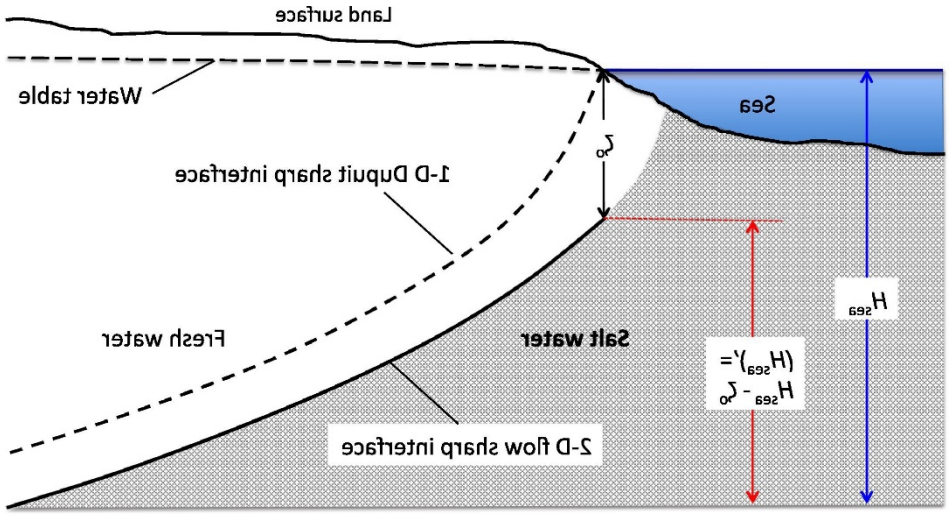
Dispersed Interface & Saline discharge?



Russoniello et al., 2013



Sharp Interface?



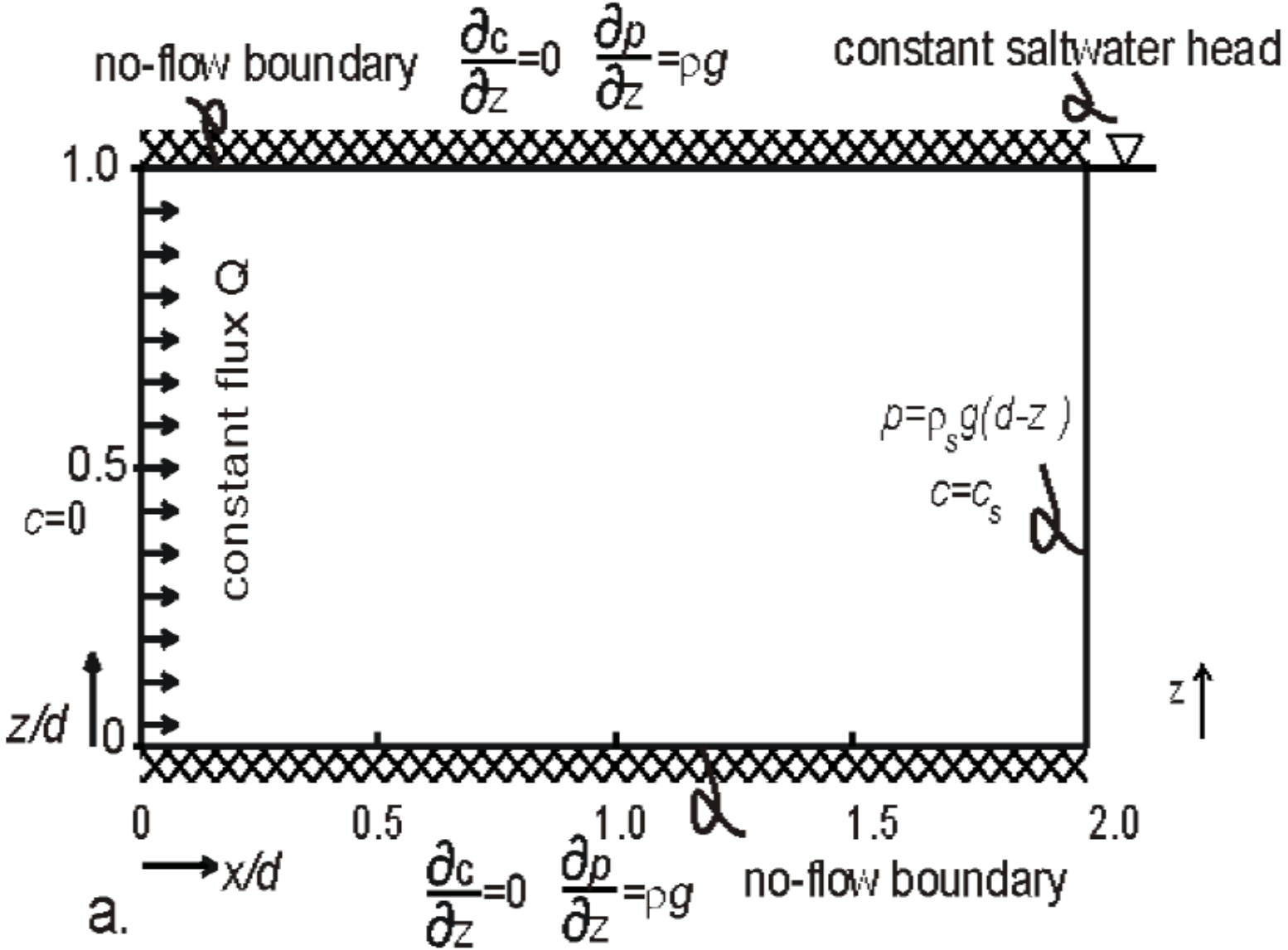
- USGS Water Supply Paper 1613c
  - 4 papers - Cooper, Kohout, Glover, & Henry
- Cooper
  - “It is the thesis of this paper that where a zone of diffusion exists, the saltwater is not static, but flows perpetually in a cycle from the floor of the sea into the zone of diffusion and back to the sea.”
  - “This flow tends to lessen the extent to which the salt water occupies the aquifer.”

Can we model it?

- What do we need for modeling?
  - Initial conditions
  - Boundary conditions
  - Governing equation – groundwater flow equation?

Can we model it?

- USGS Water Supply Paper 1613c
  - 4 papers - Cooper, Kohout, Glover, & Henry
- "Henry's problem"
  - First variable density numerical model



Wells in coastal Aquifers

Upconing!

Sea Level R
Run to SS

Sea Level R
Adjust B.C.