

Simulating Mangrove Succession and Recovery After Tsunami

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Hardwood Hammocks

- Forest of evergreen trees;
- Hold leaves most or all of the year;
- Example: gumbo limbo, Poisonwood;
- Low tolerance of salinity.

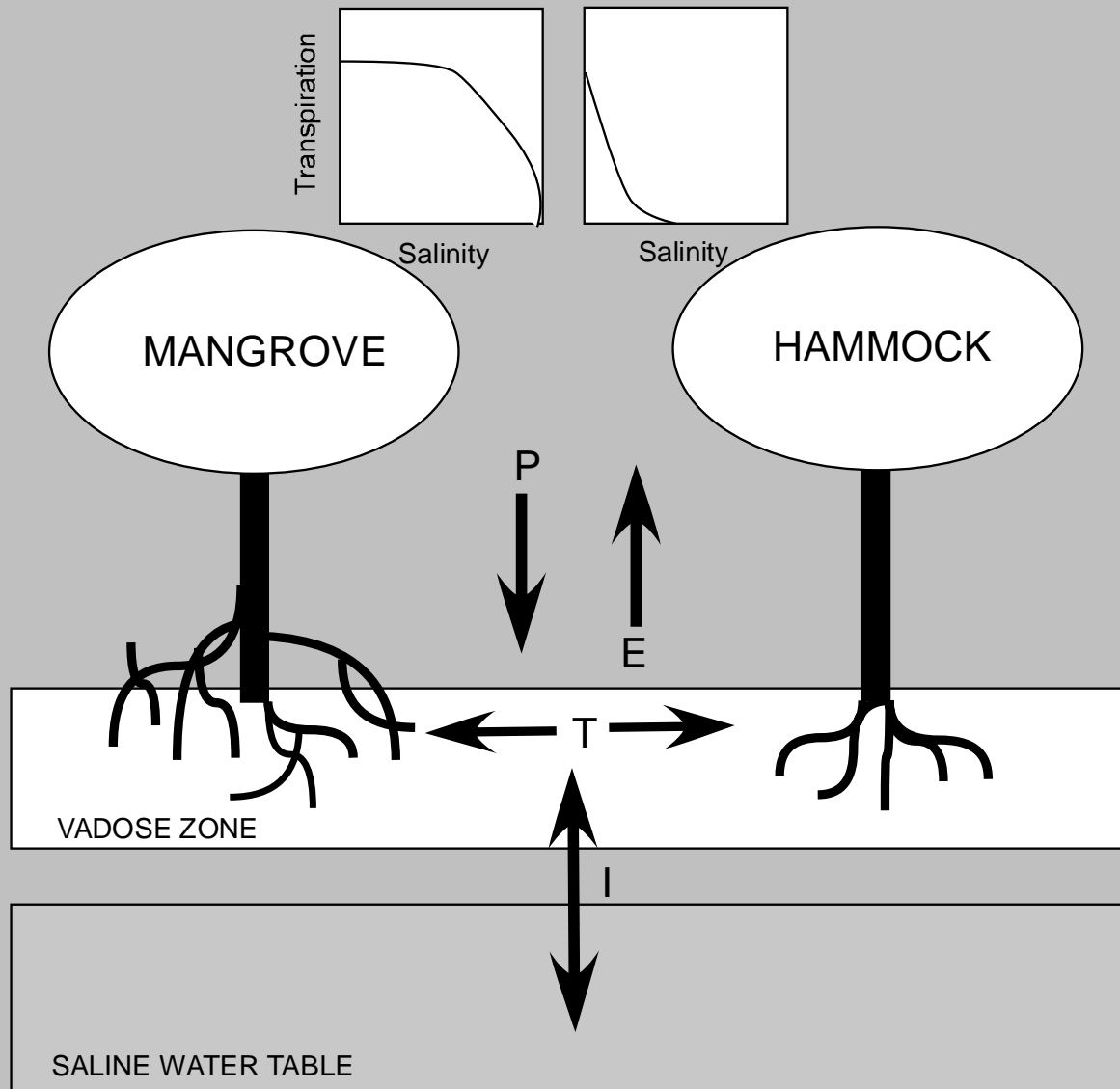


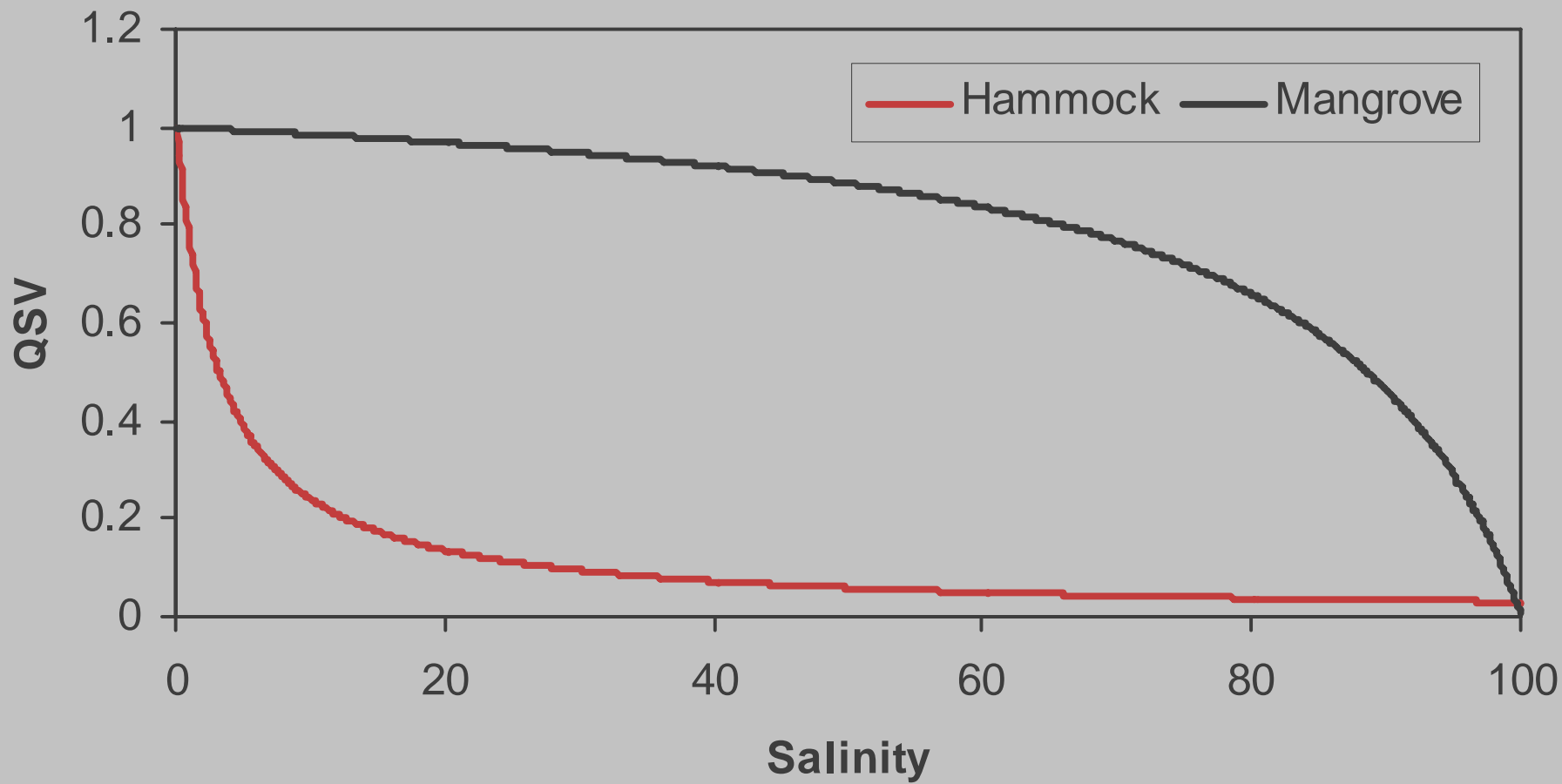
Mangrove

- Trees and shrubs that grow in saline coastal habitats;

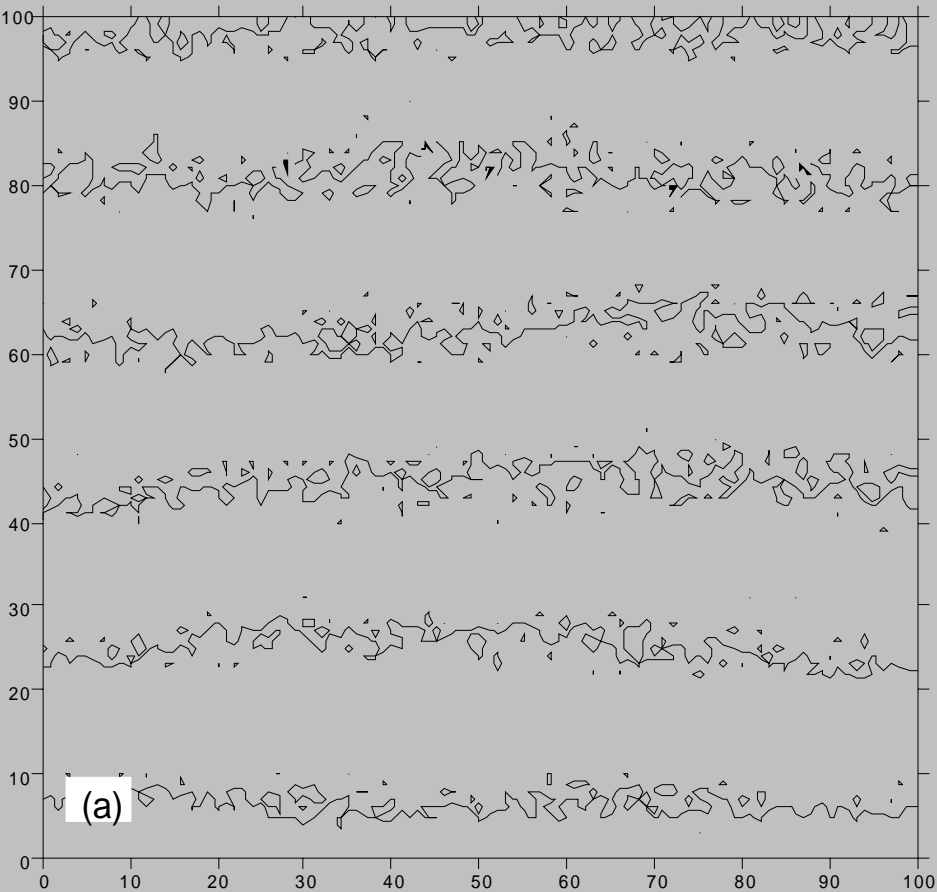


Man.-Ham. transpiration vs. vadose layer salinity

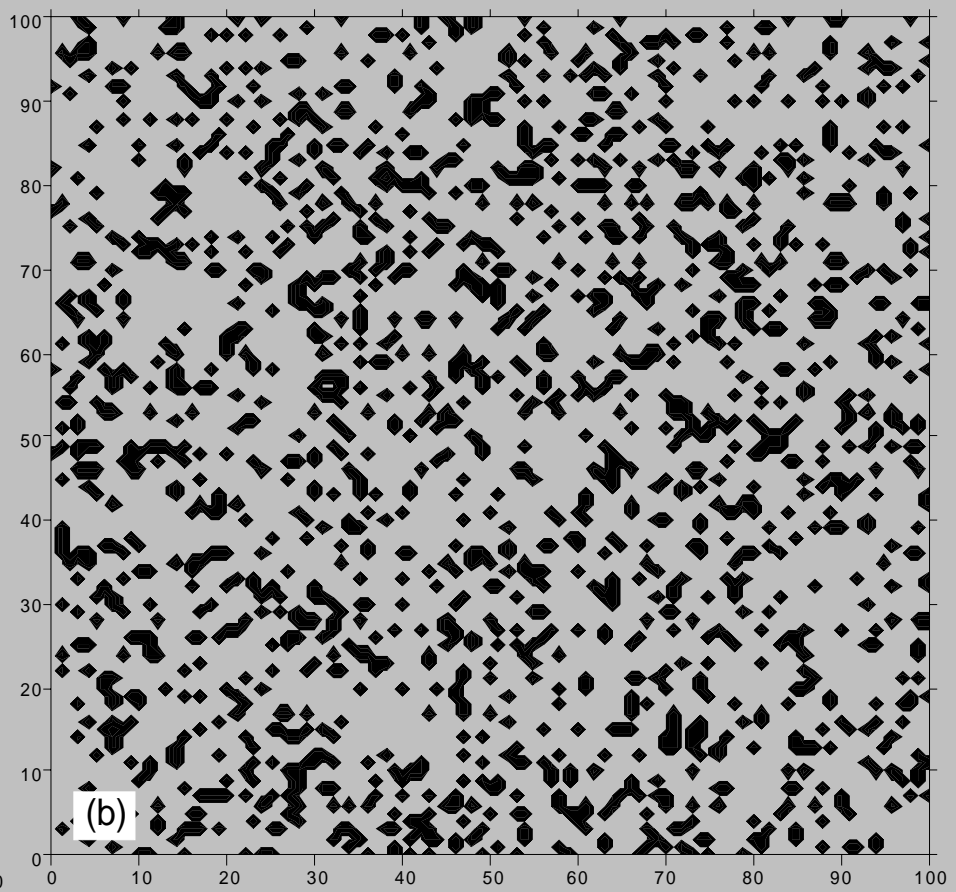




Topography

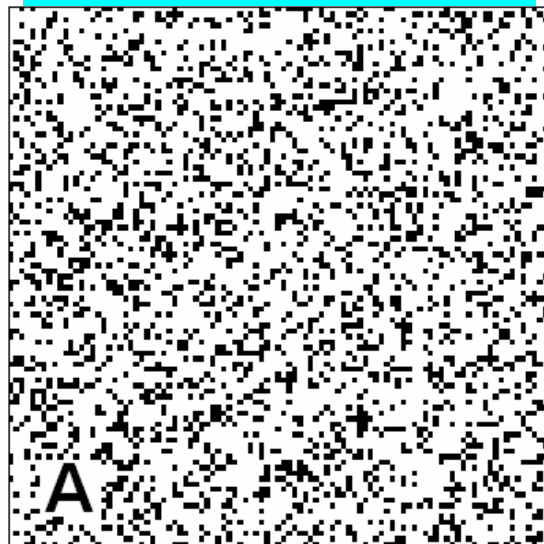


Initial random distribution



Man (white) & Ham (black)

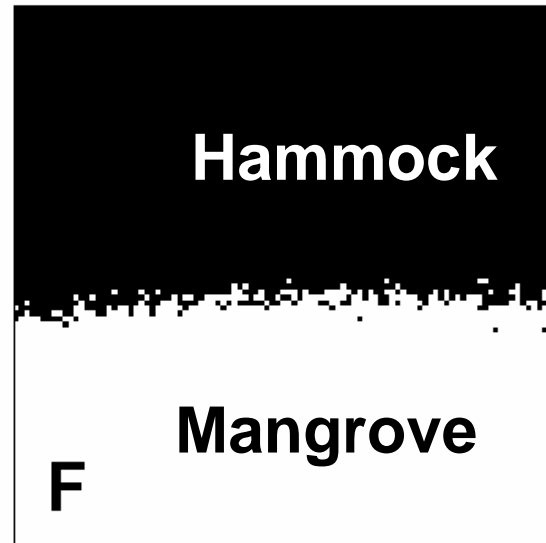
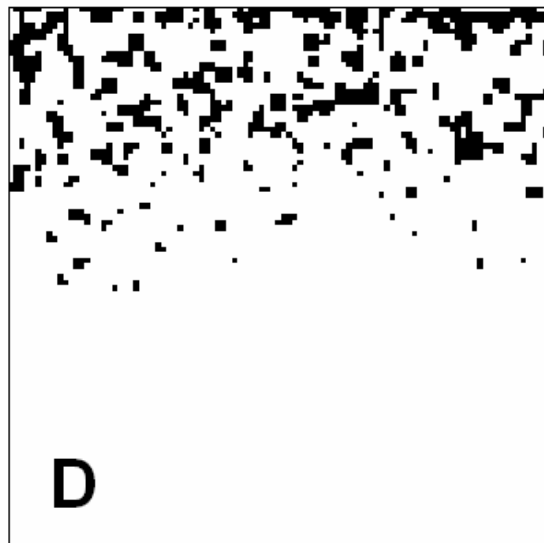
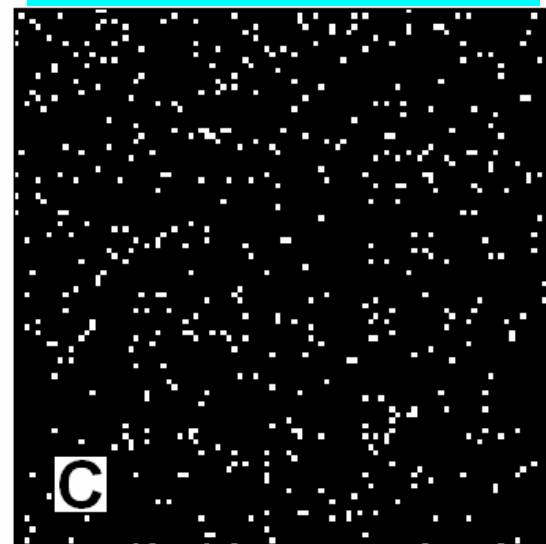
(a) Ham = 25 %



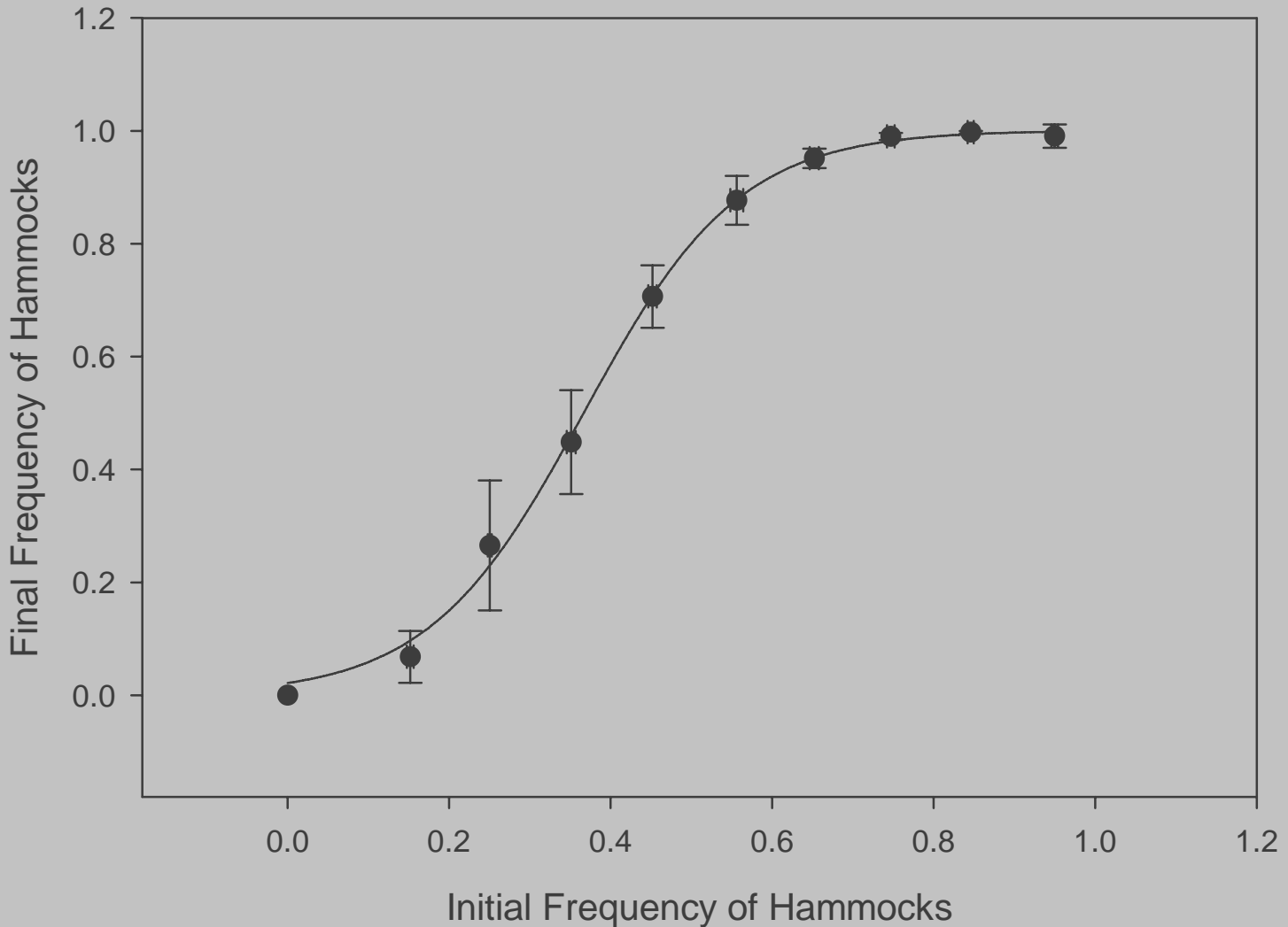
(b) Ham = 55 %

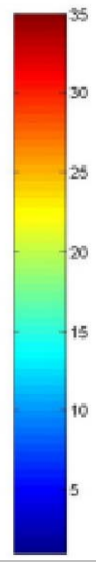
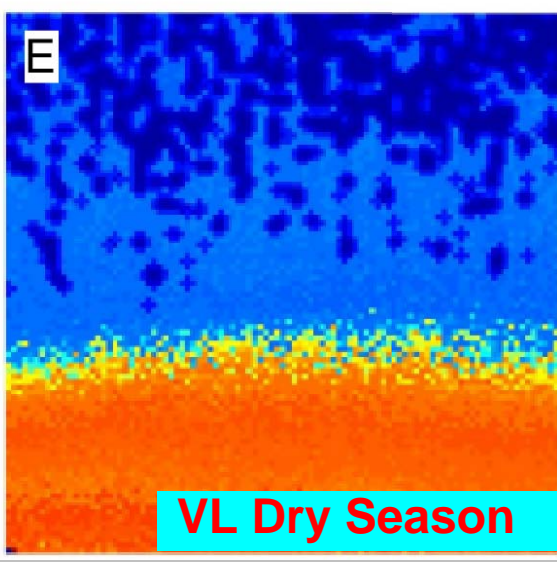
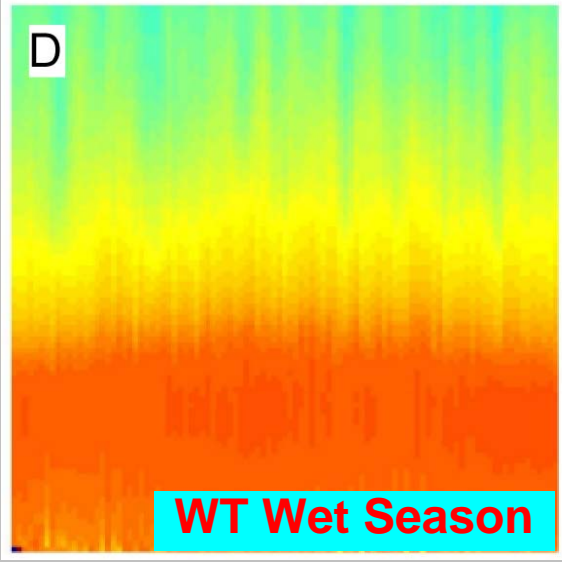
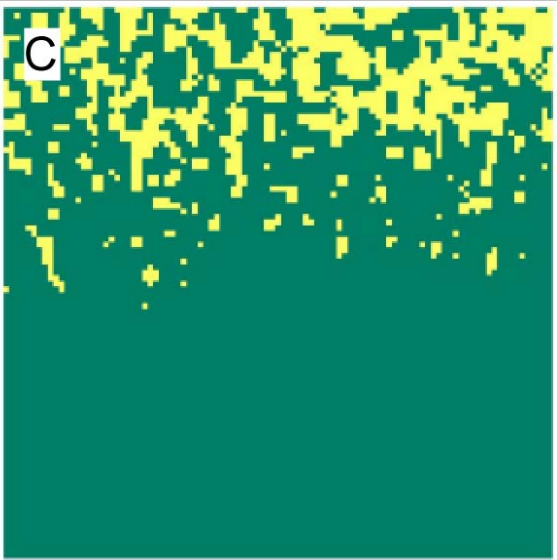
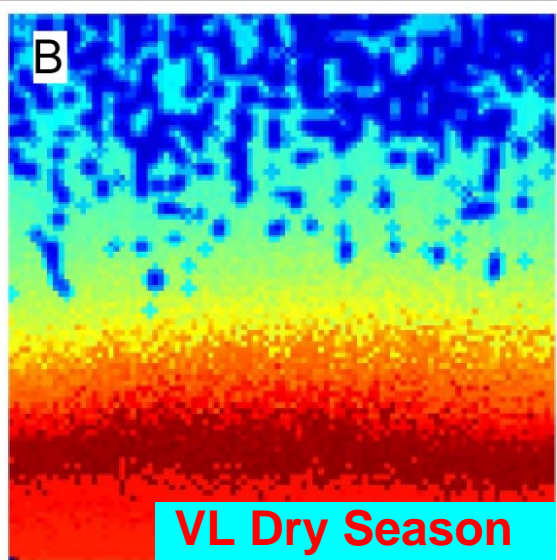
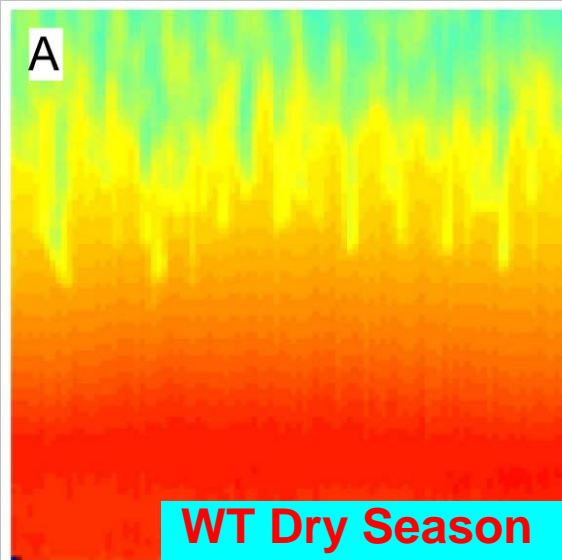


(c) Ham = 95 %



Hammock Initial distribution vs. final frequency

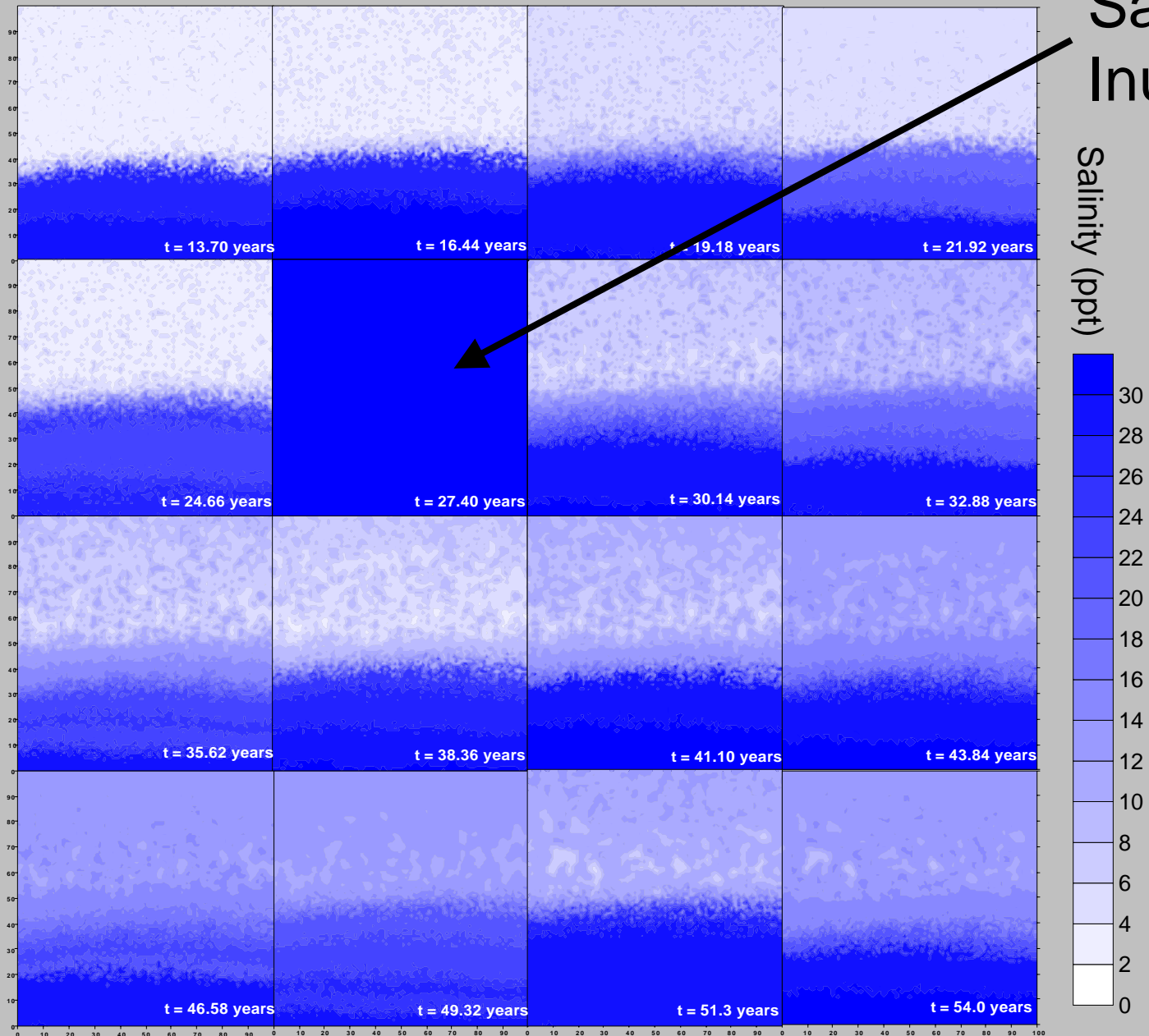




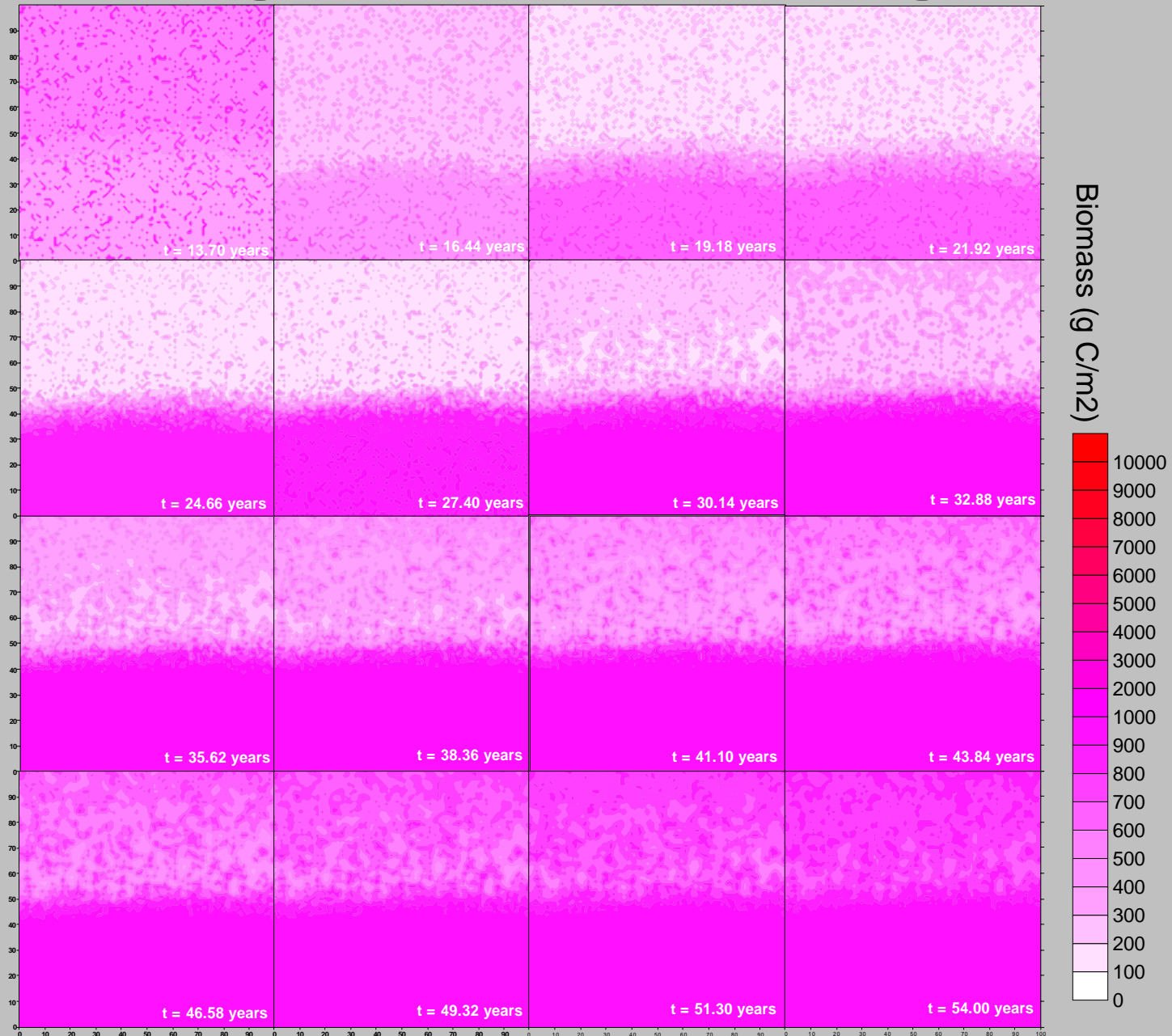
Ham = yellow
Man = green
WT = water table
VL = vadose layer

Salinity (ppt)

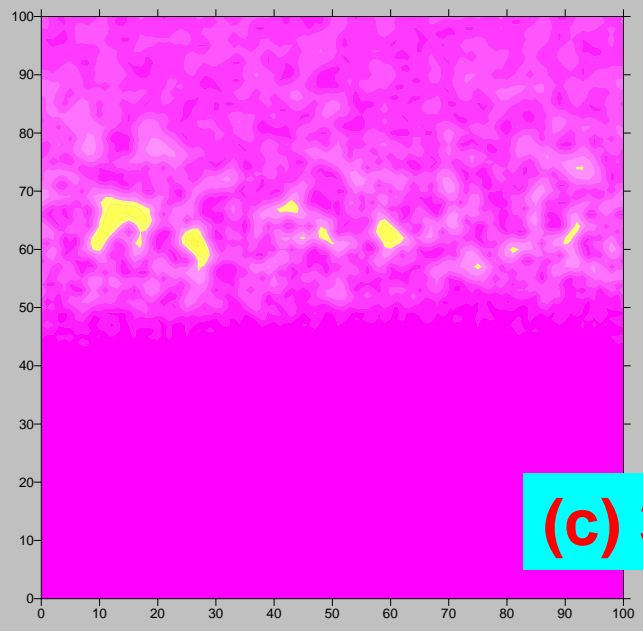
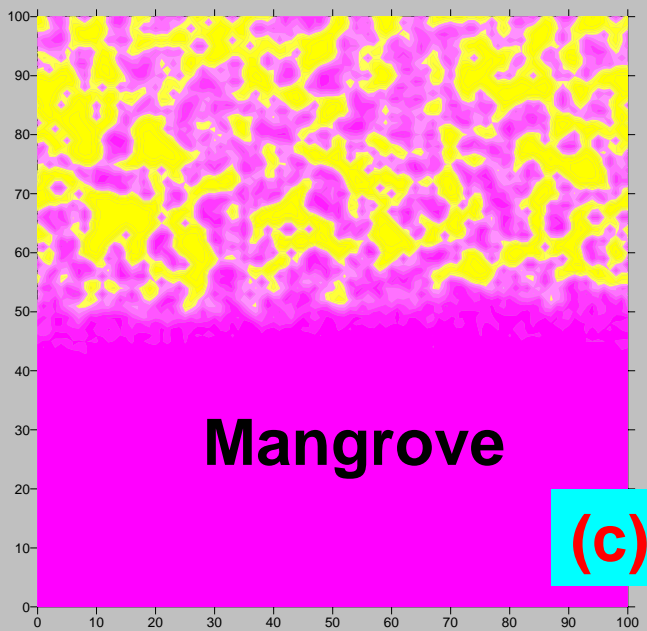
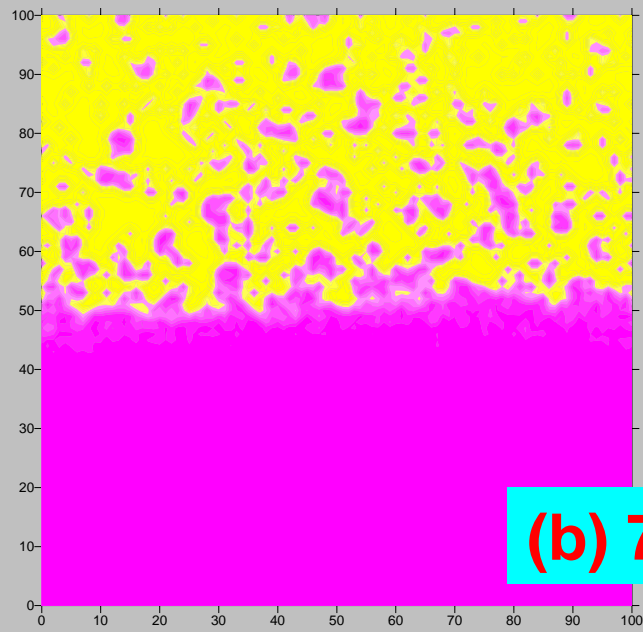
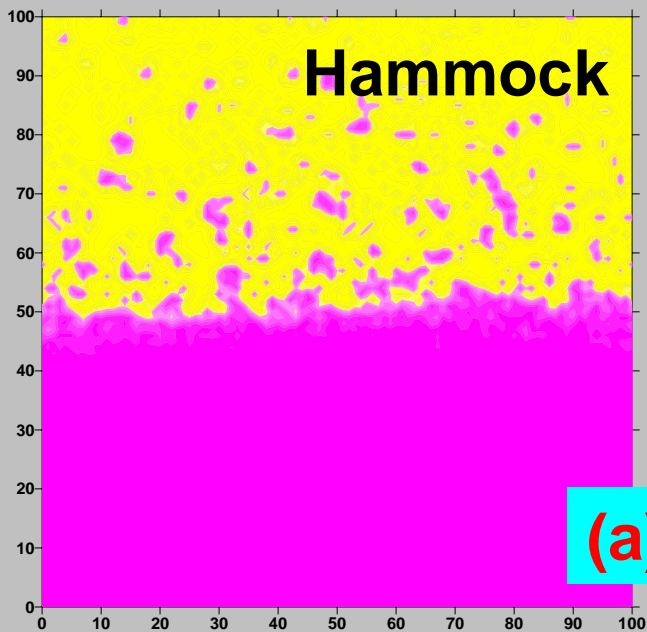
Saltwater
Inundation



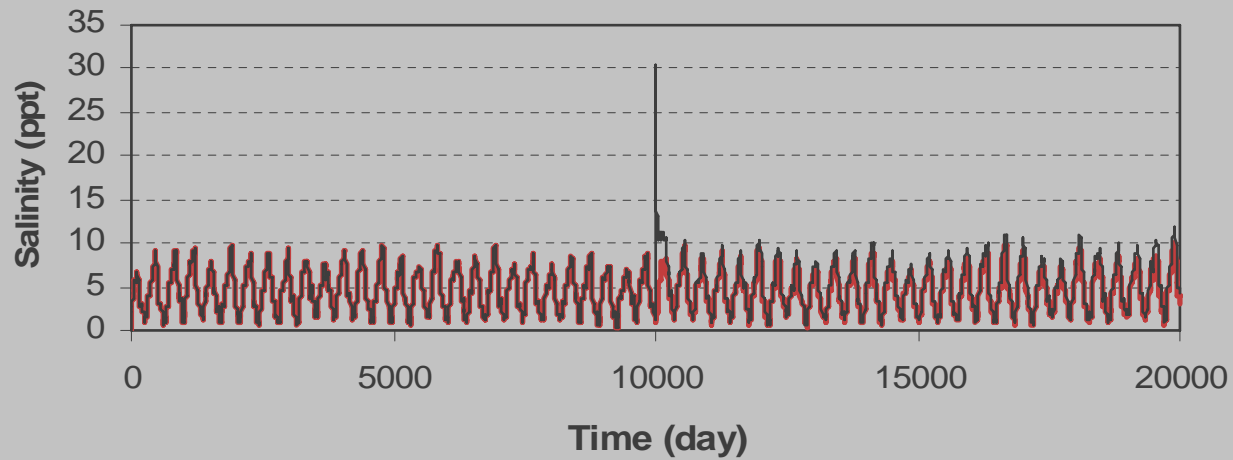
Mangrove biomass (g C/m²)



Storm Surge Effect (After 50-yr)



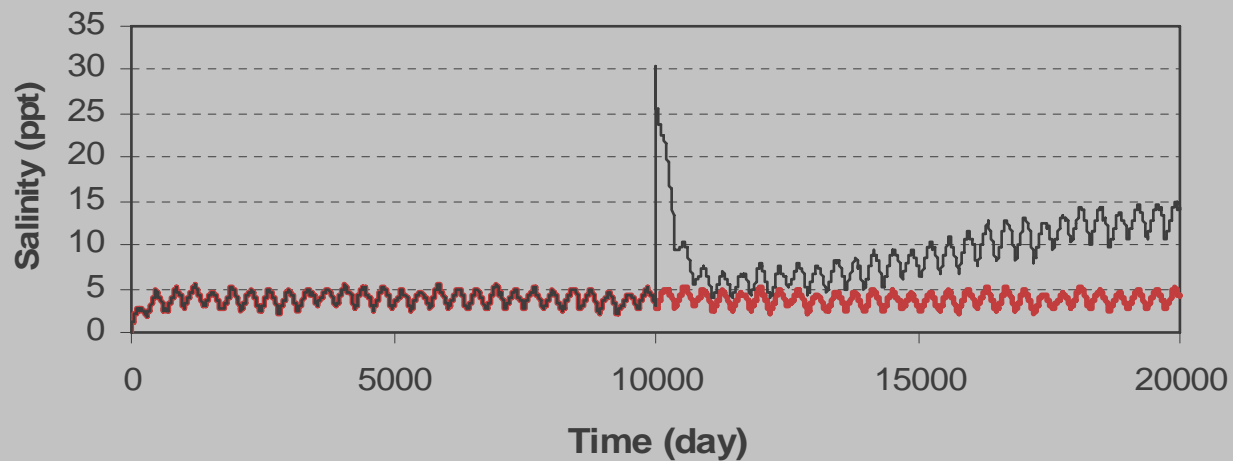
Vadose zone height = 0.2 m



(a)

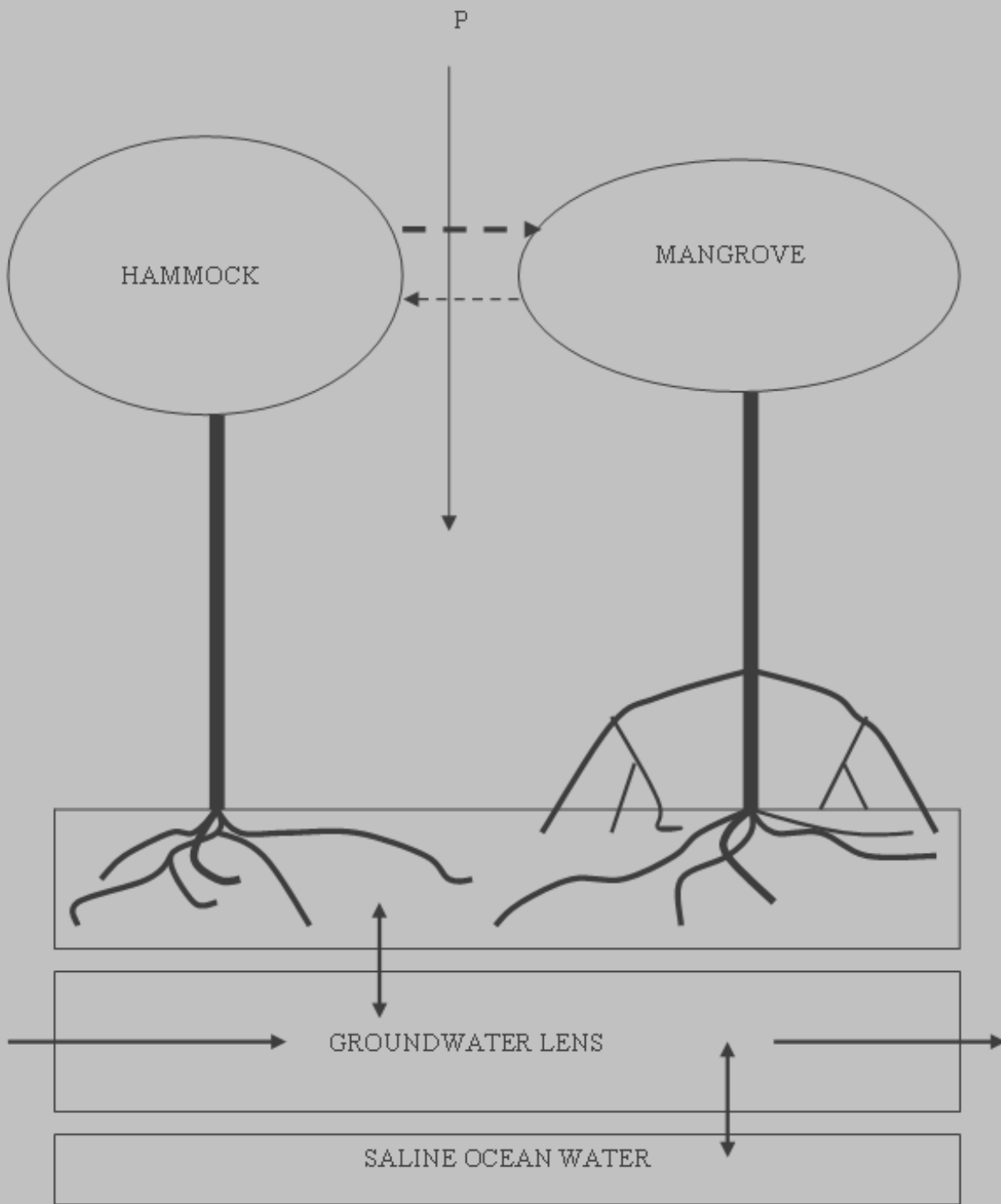
— Without SS — With SS

Vadose zone height = 1.0 m

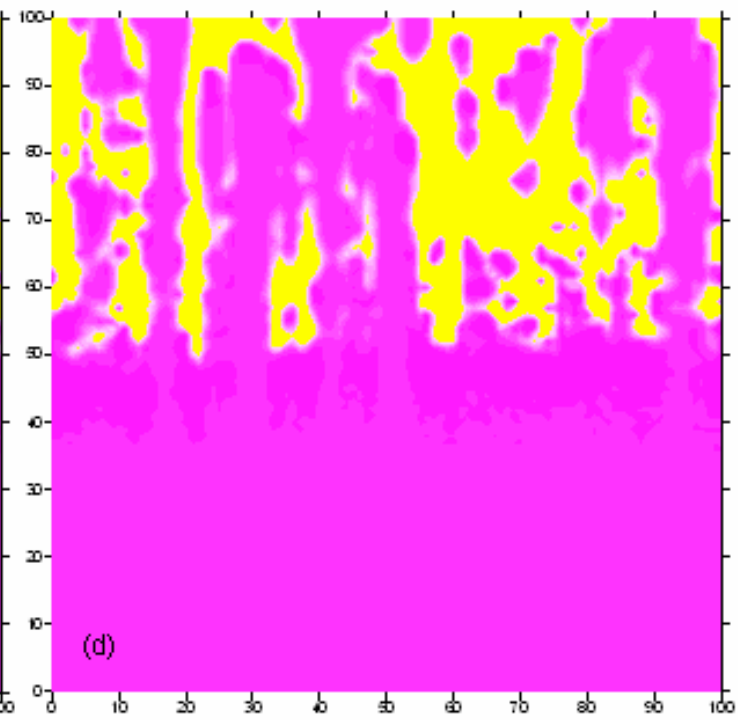
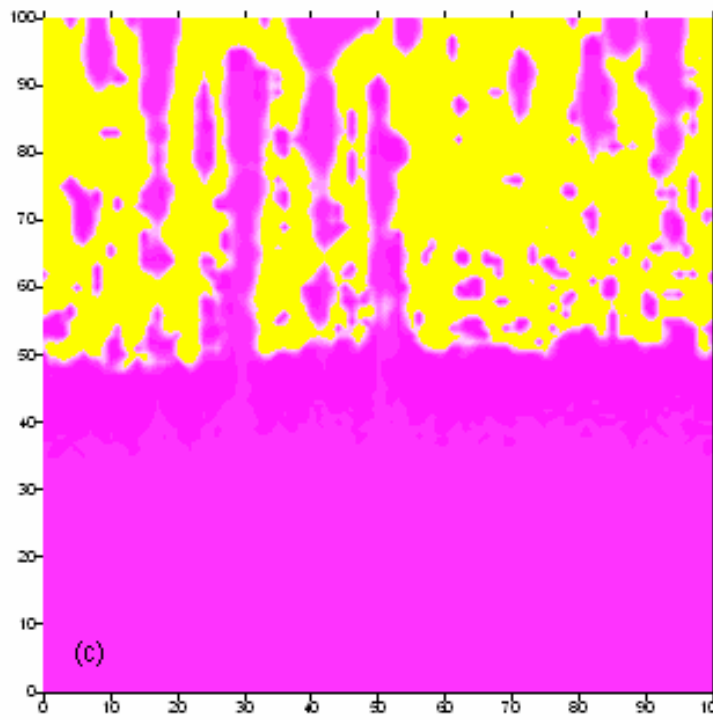
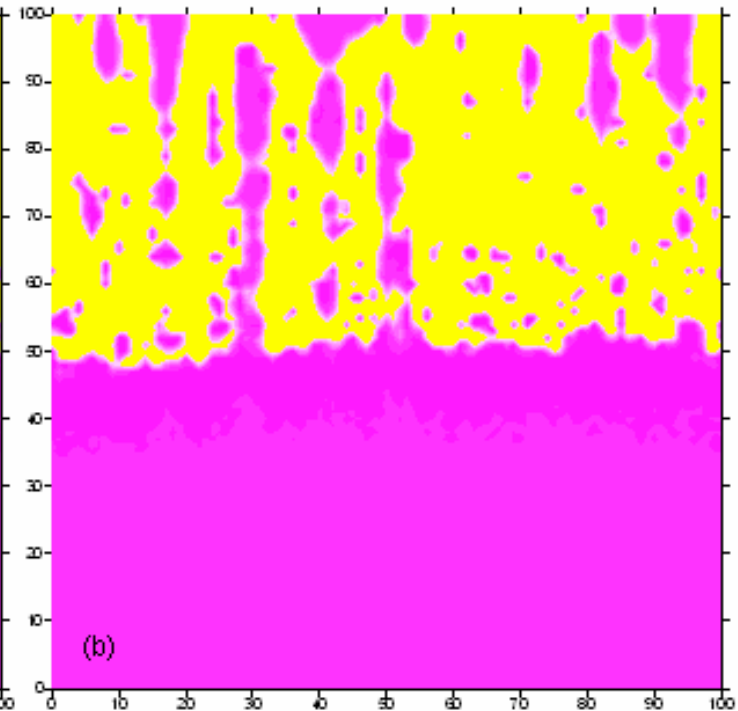
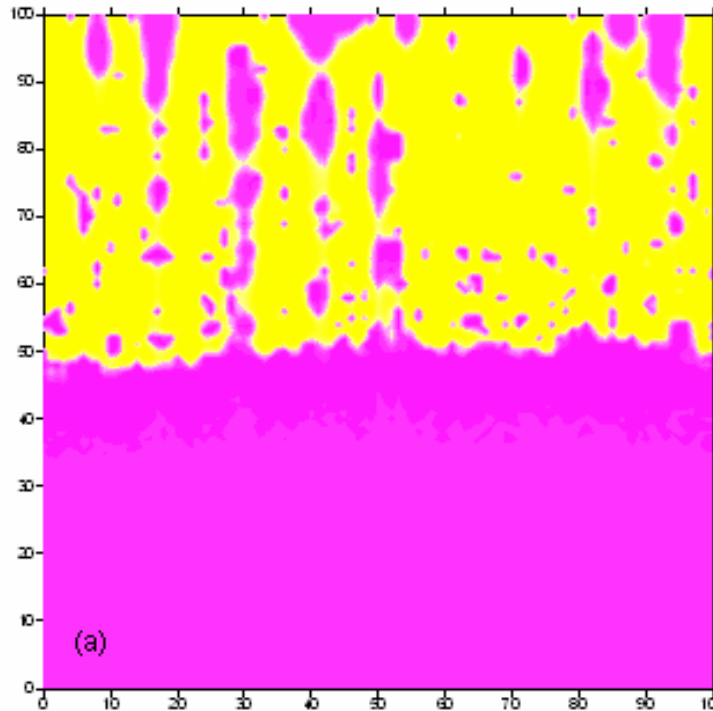


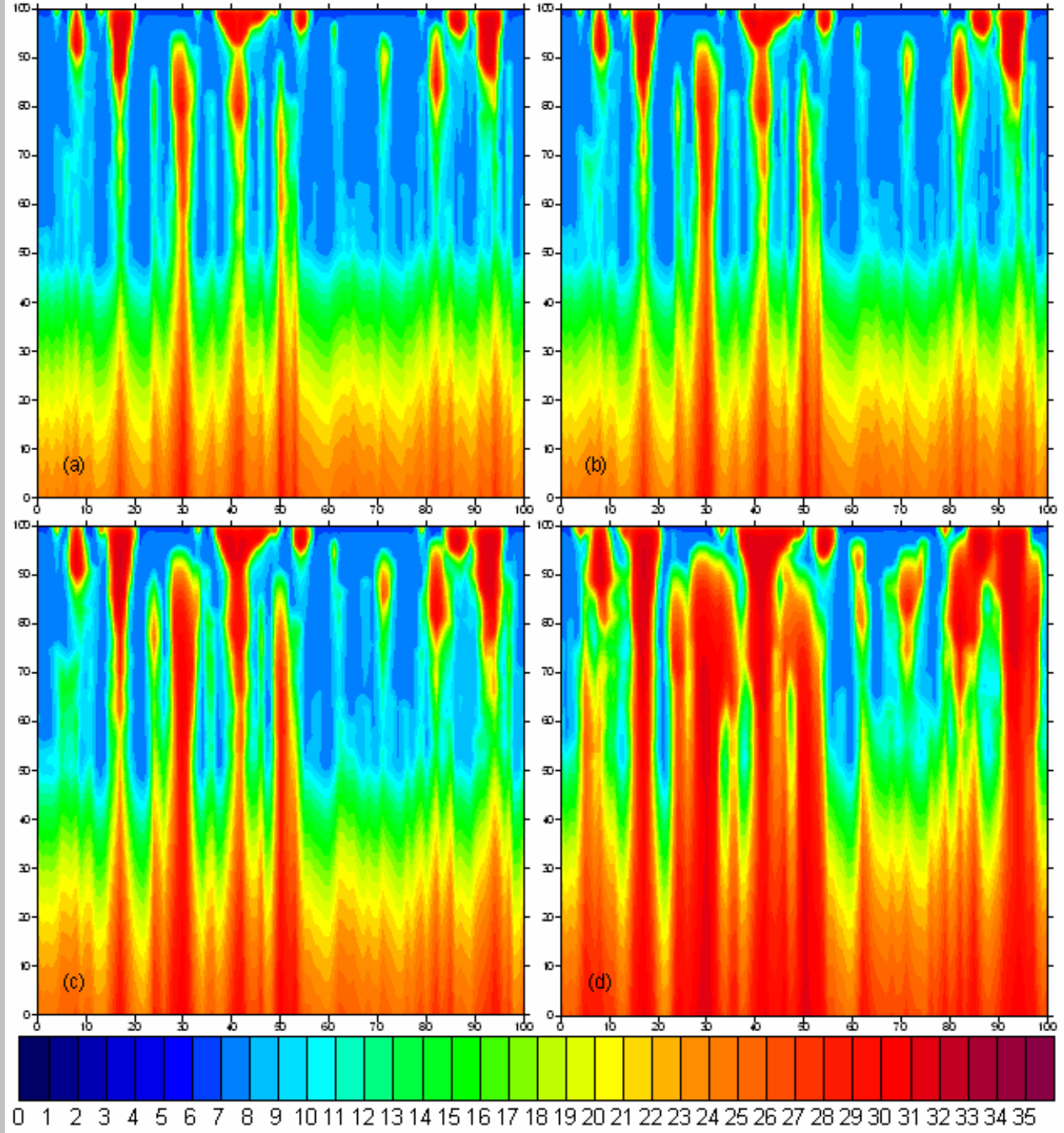
(b)

— Without SS — With SS

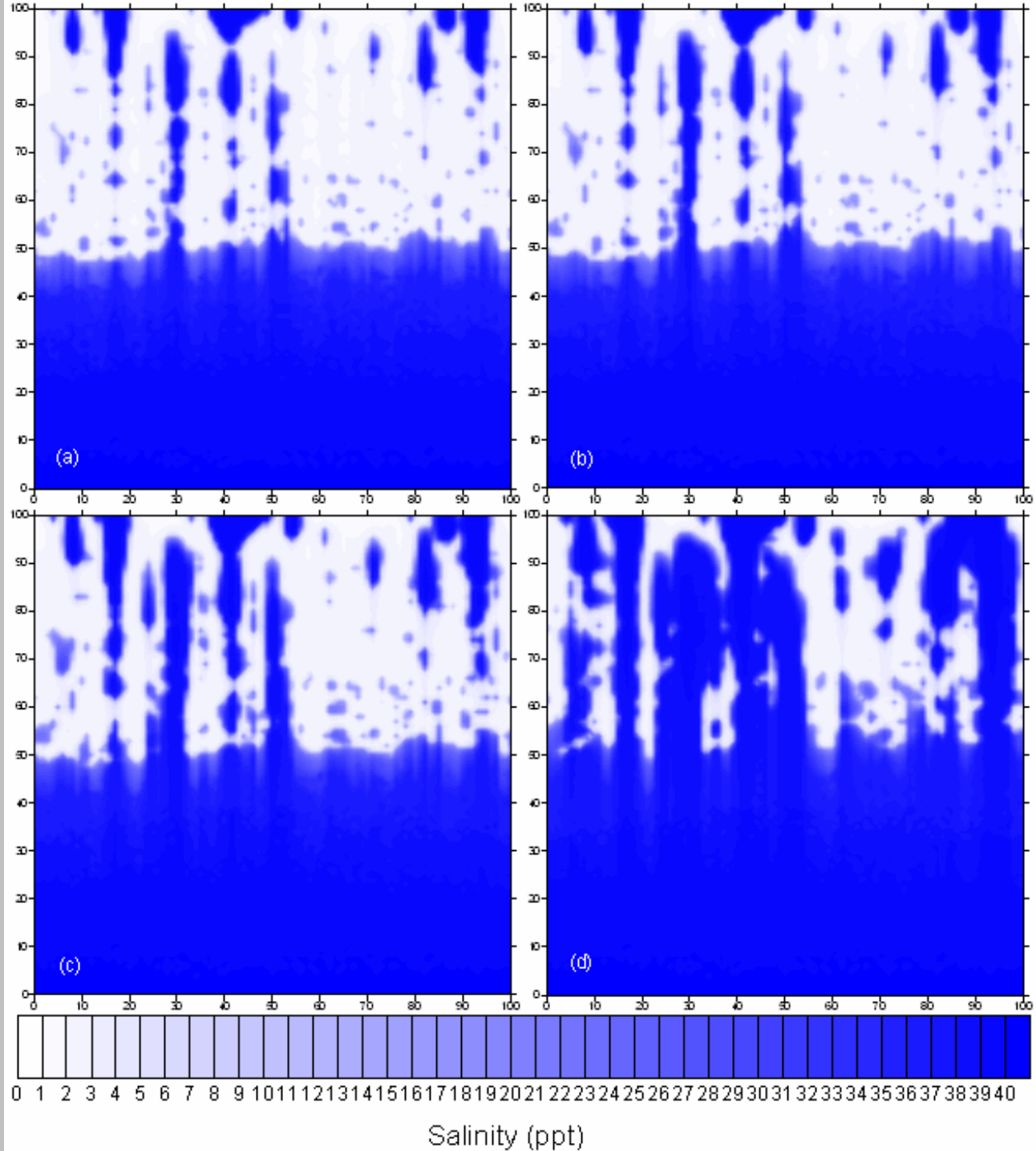


Complex Hydrology

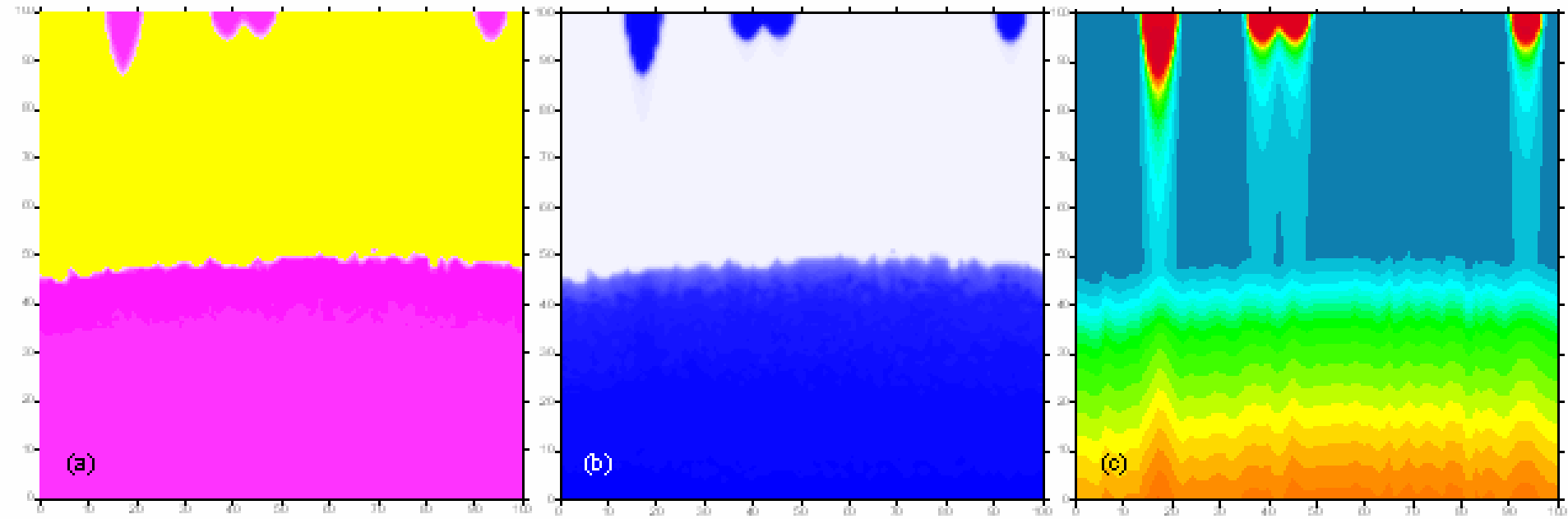


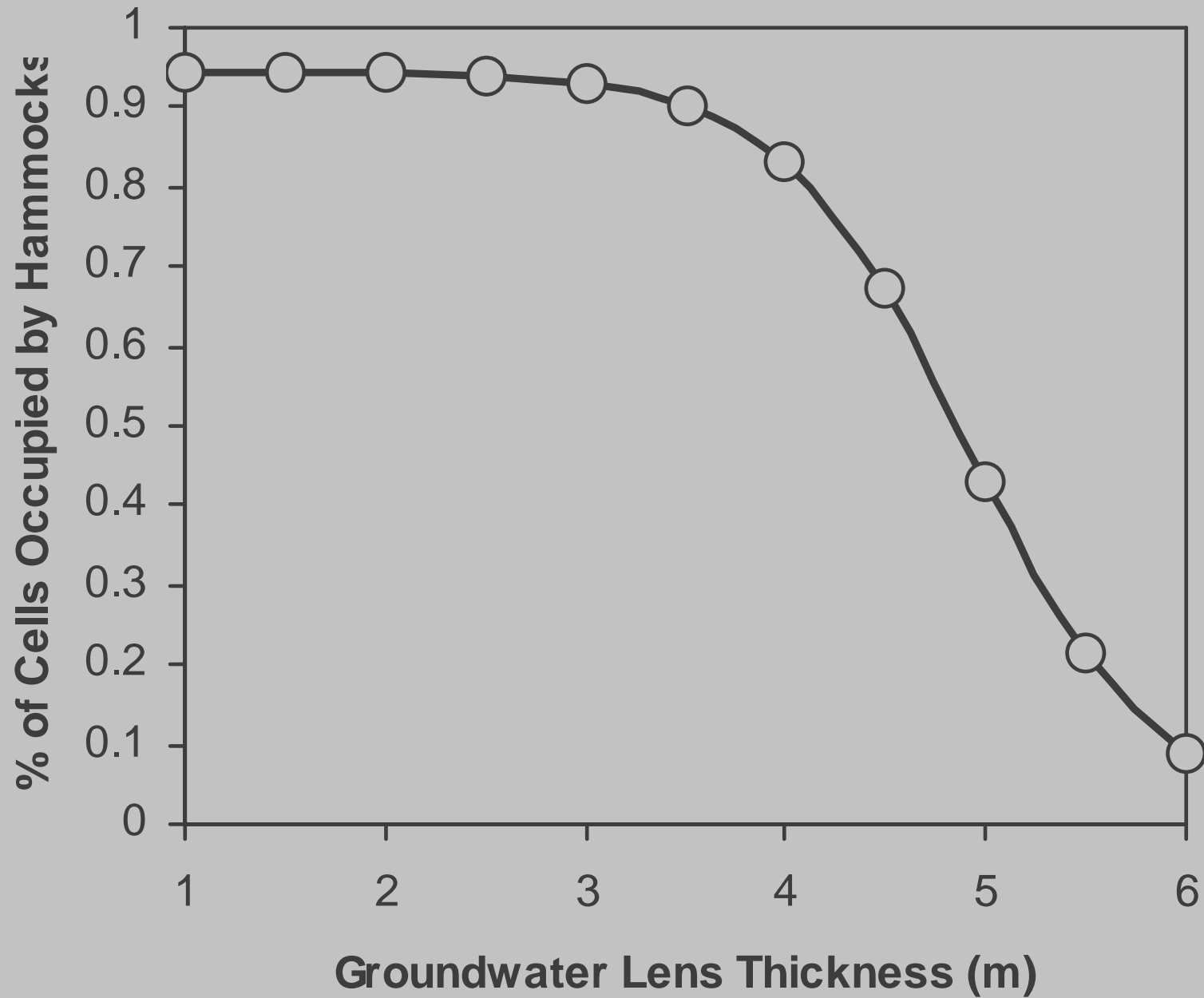


Salinity (ppt)



Groundwater Lens = 1 m





Potential Applications

- Objective: Develop model to assist in the recovery of mangrove forests in Malaysia;
- Simulate dynamics of ecosystems comprising vegetation types of varying salinity tolerance;
- Eg: Potential shift in an ecosystem of various Malaysian mangroves forests;
- Caused by a single large-scale salinity inundation induced by a major tsunami;
- Examine feedback dynamics;
- Facilitate quick recovery of mangroves that were destroyed or perturbed by tsunami.



Thank you