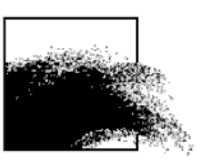


The typhoon season of 1971 in the coastal area of the Red River delta in North Vietnam

K. Baetens
P. Luyten



Studied area



- Vast area
 - China, Laos, Vietnam
- Gulf of Tonkin
 - Ha long bay
 - Coastal zone





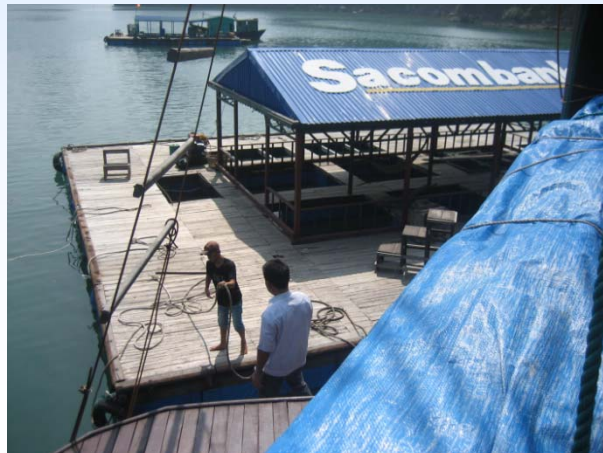
Importance of the region

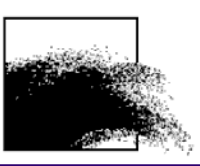


- Economic importance



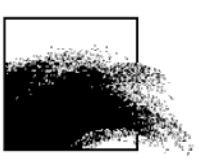
- Agriculture importance





- Typhoons
 - Lowland region
 - Vulnerable to flooding





■ Typhoons

- Dyke system of 4000 km
- Climate change induced shift
 - Change in typhoon tracks, south wards
 - Higher typhoon frequency

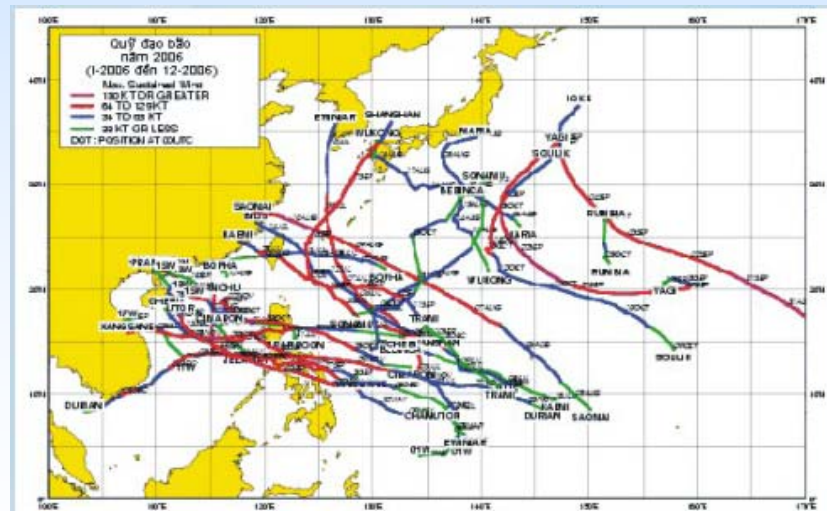
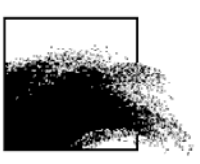
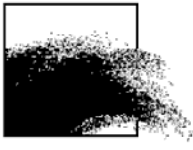


Figure 5. Typhoon tracks in the North Western Pacific Ocean & East Sea

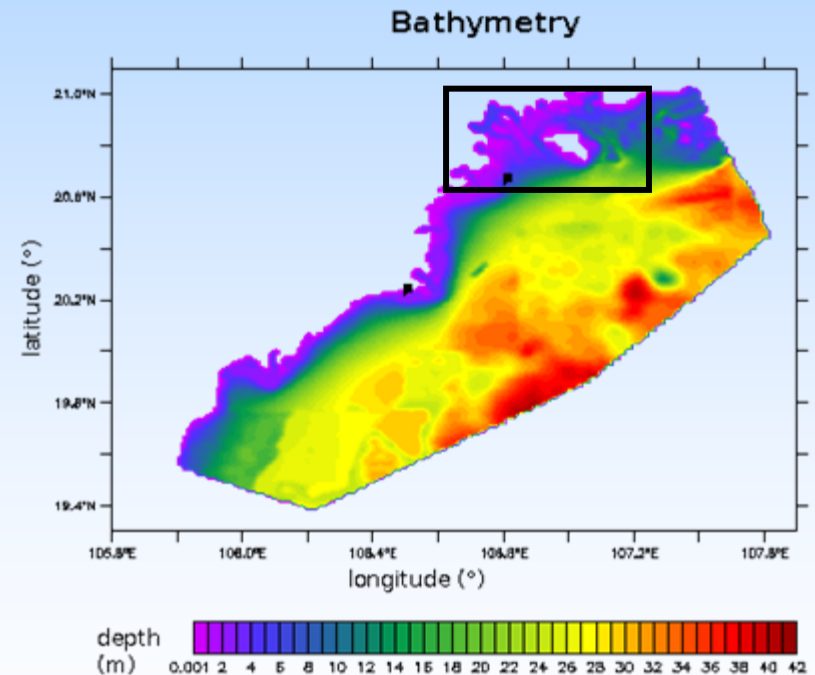
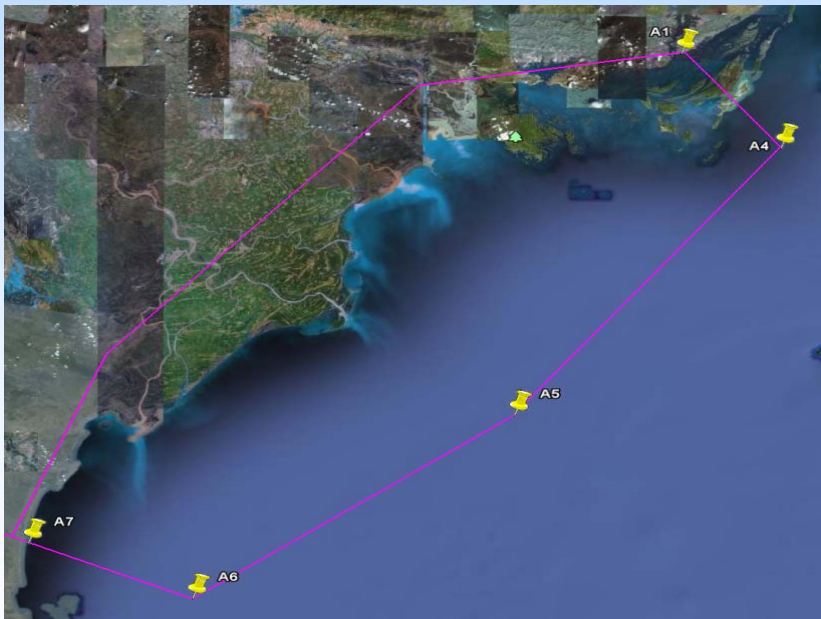


- Typhoon season of 1971
 - Year with 100.000 victims in Hanoi
 - Little information on situation at the coastal zone
- This presentation tries to give an impression of the situation at the coast



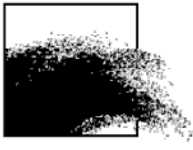


- max depth=40.7
- Many islands in Halong bay area
- Main grid resolution 0.01° (+/- 1 km)

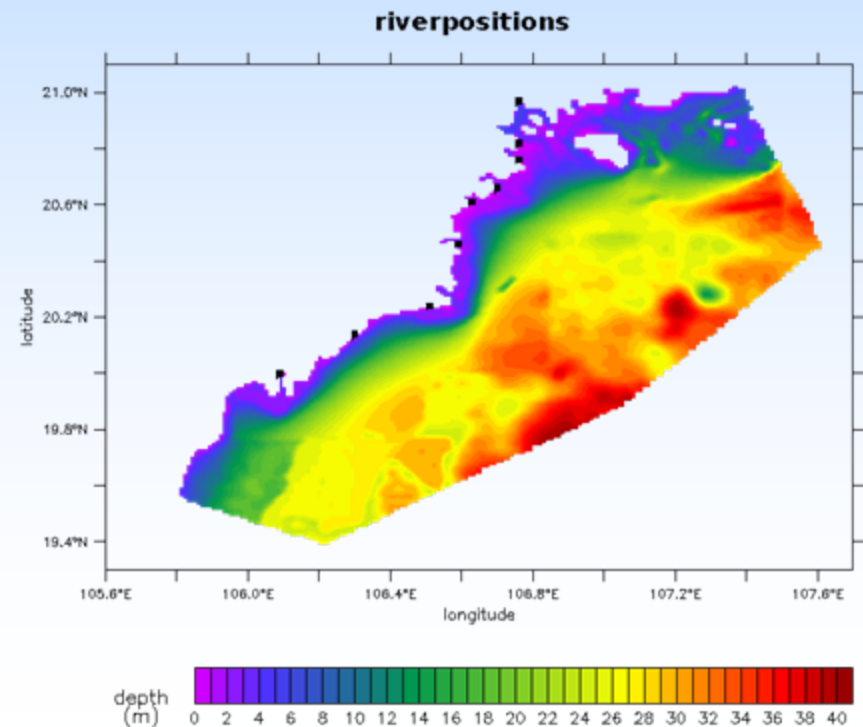




Model set up

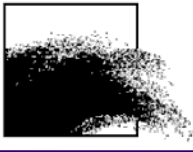


- COHERENS V2.2
- Ragged boundary
 - Spin-up
 - Model code improvements
- 4 dominant tides: O1, M2, K1, S2
- 9 rivers



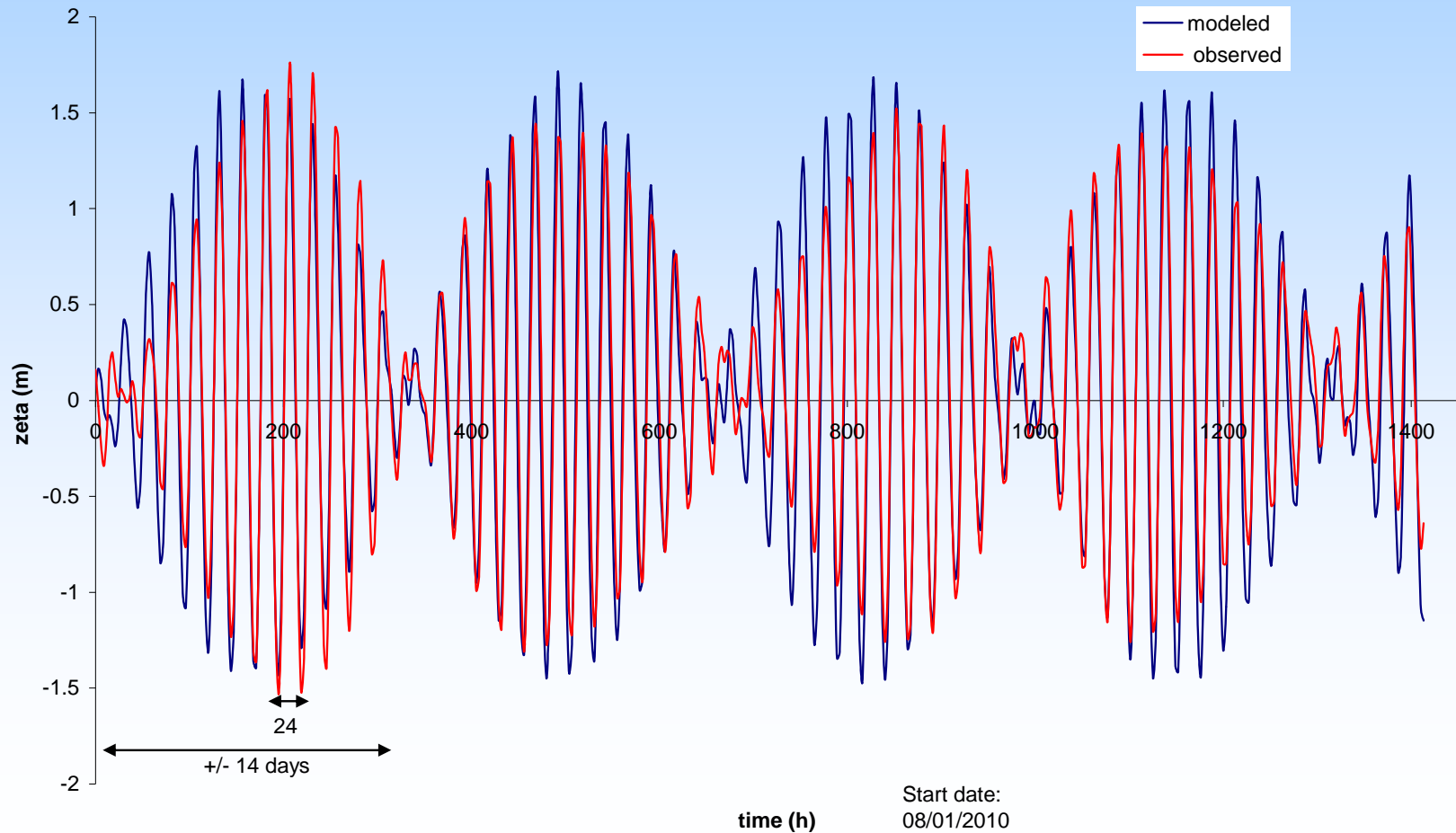


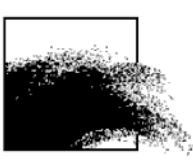
Rainy & dry season



$R^2 = 0.90$

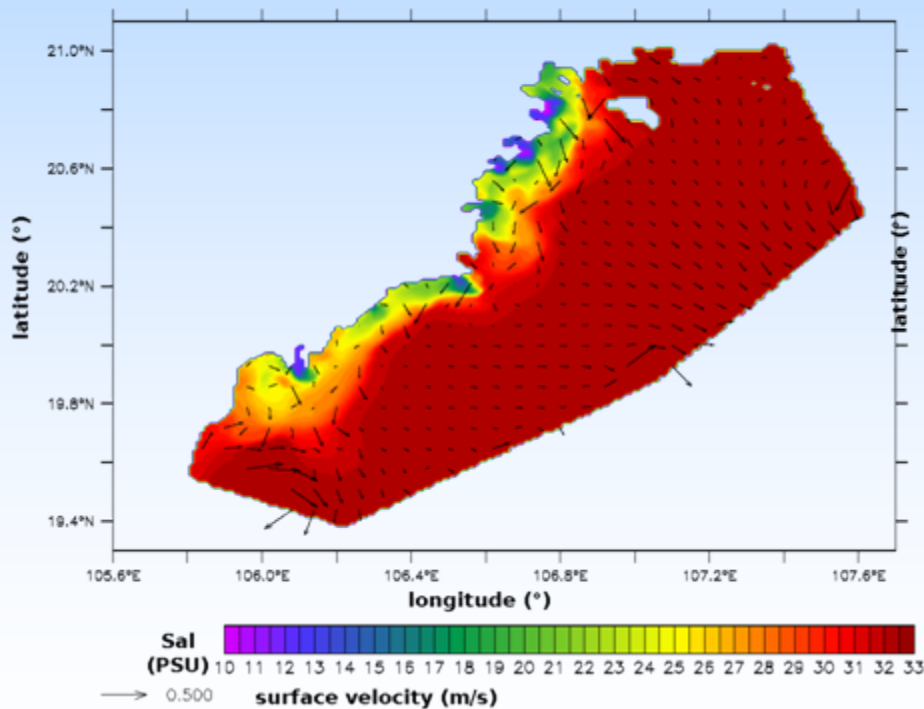
Rainy season



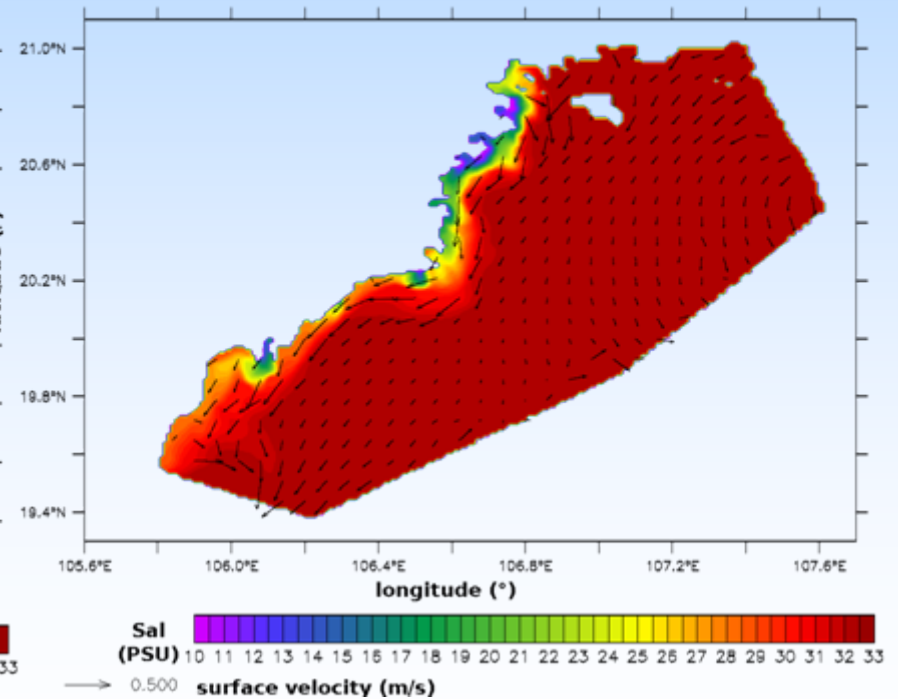


NE wind 4 m/s

Dry season, no wind

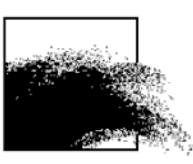


Dry season, wind



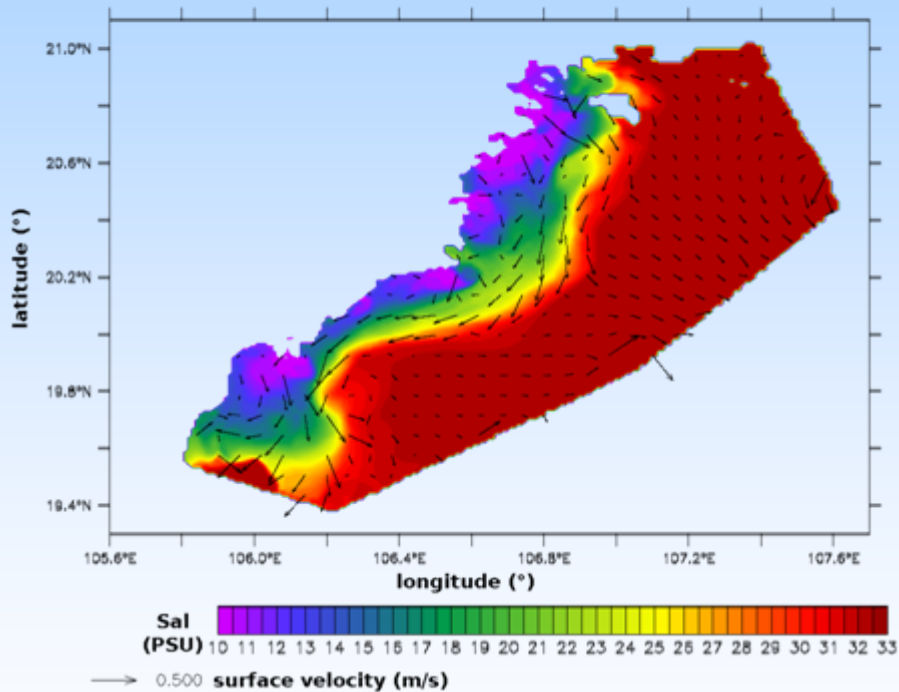


Theoretical rainy season

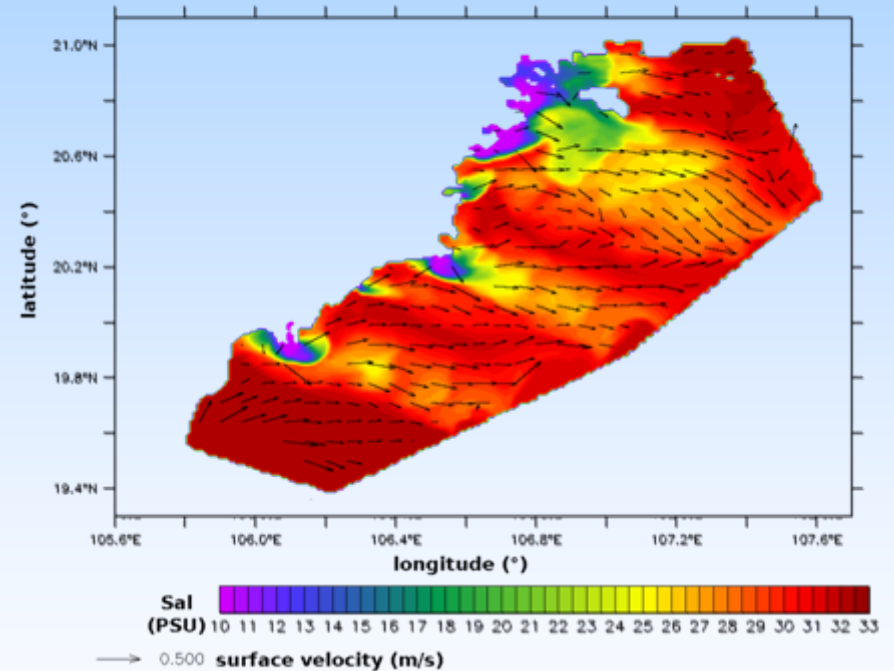


SW wind, 3.5 m/s

Rainy season, no wind

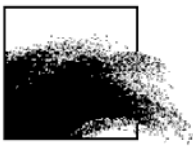


Rainy season, wind



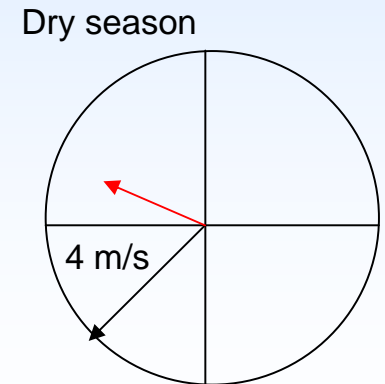
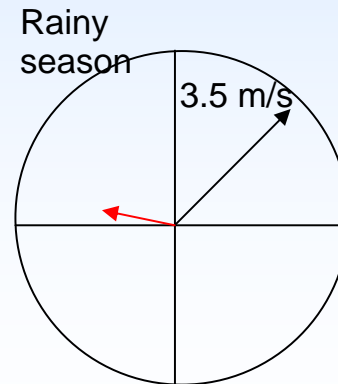


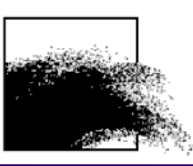
Case study



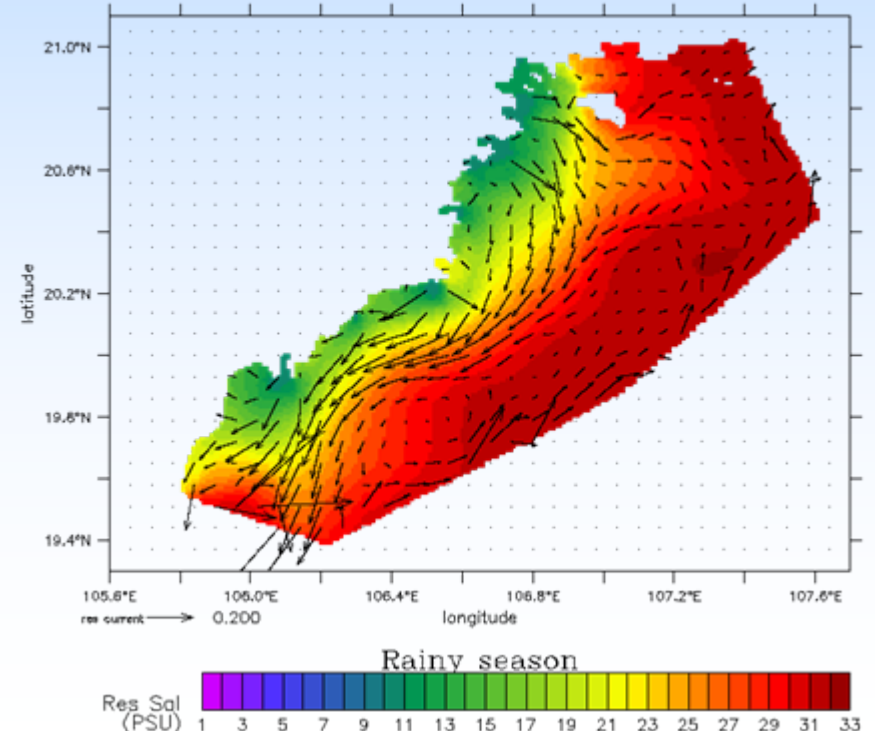
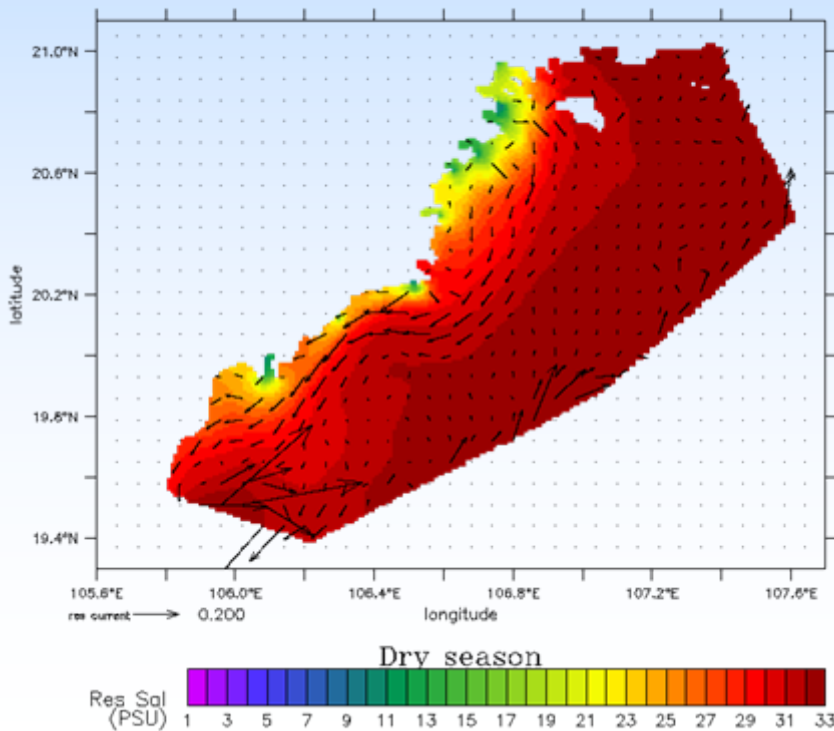
- 2 months in 2010 during dry and rainy season
- Theory vs reality

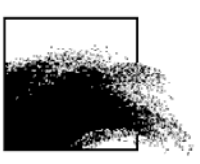
	Velocity (m/s)	Direction (°)
Dry season (march-april 2010)	1.99 (4)	157.27 (225)
Rainy season (august-september 2010)	1.75 (3.5)	175.32 (45)



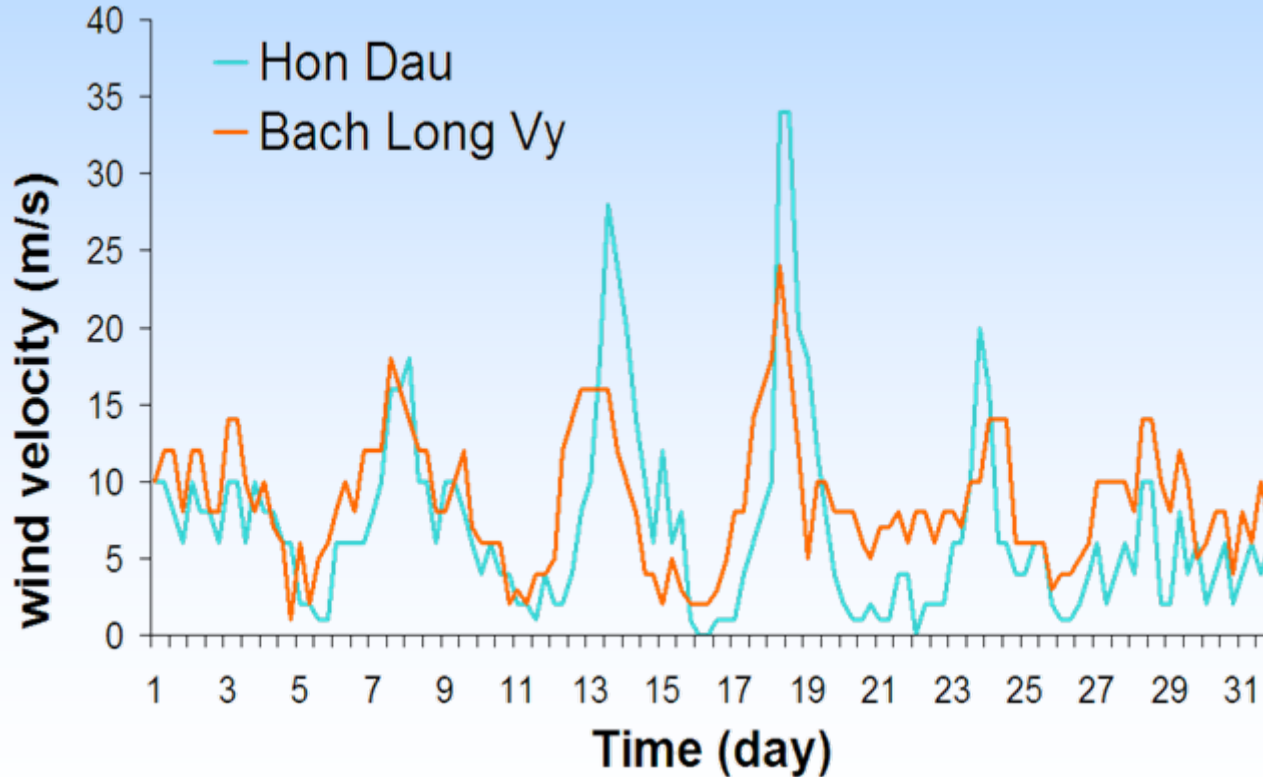


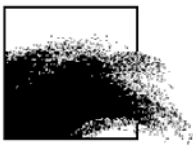
- Residual currents during 'normal' dry and rainy season



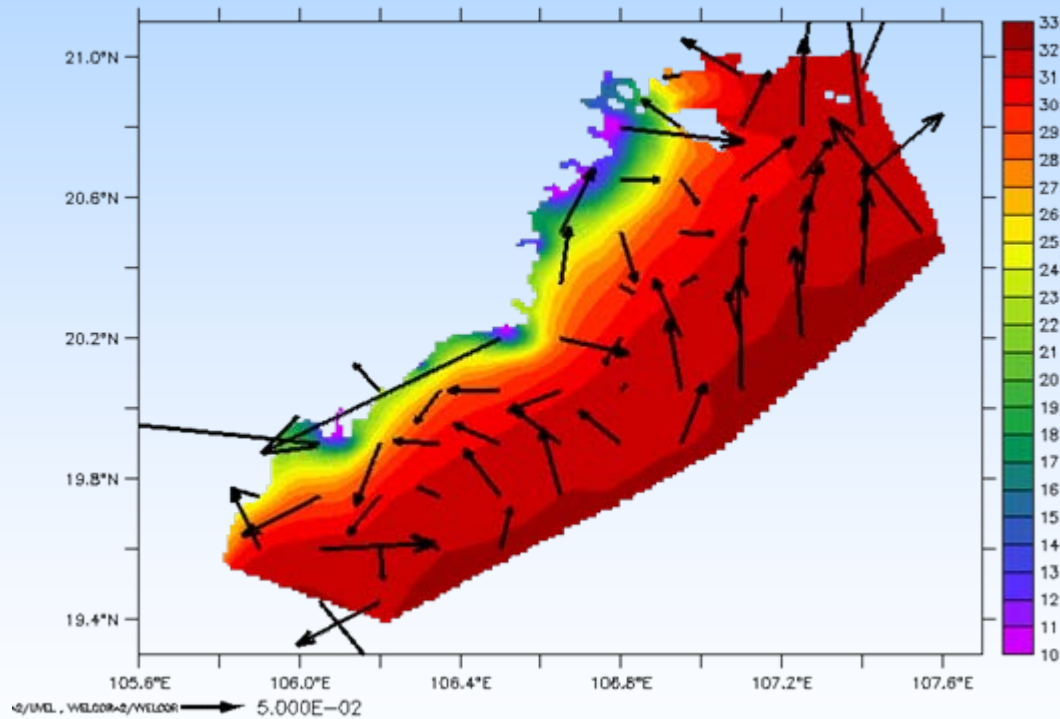


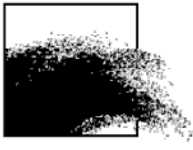
- July 1971
- Surface wind
 - Hon Dau station



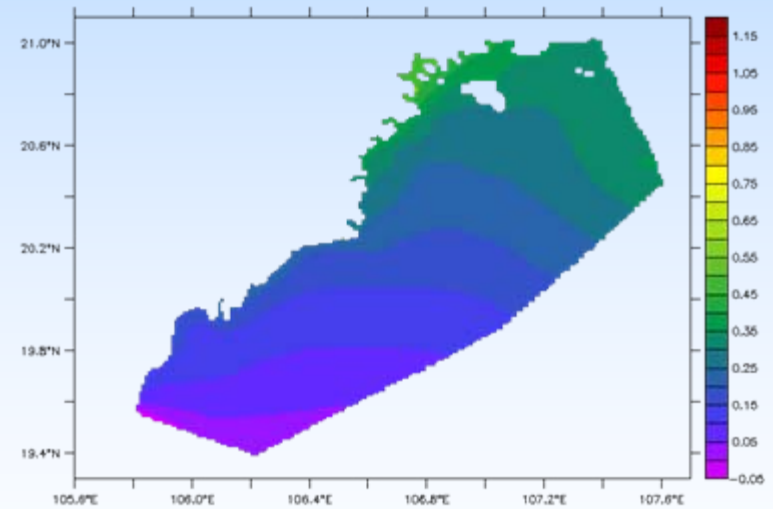
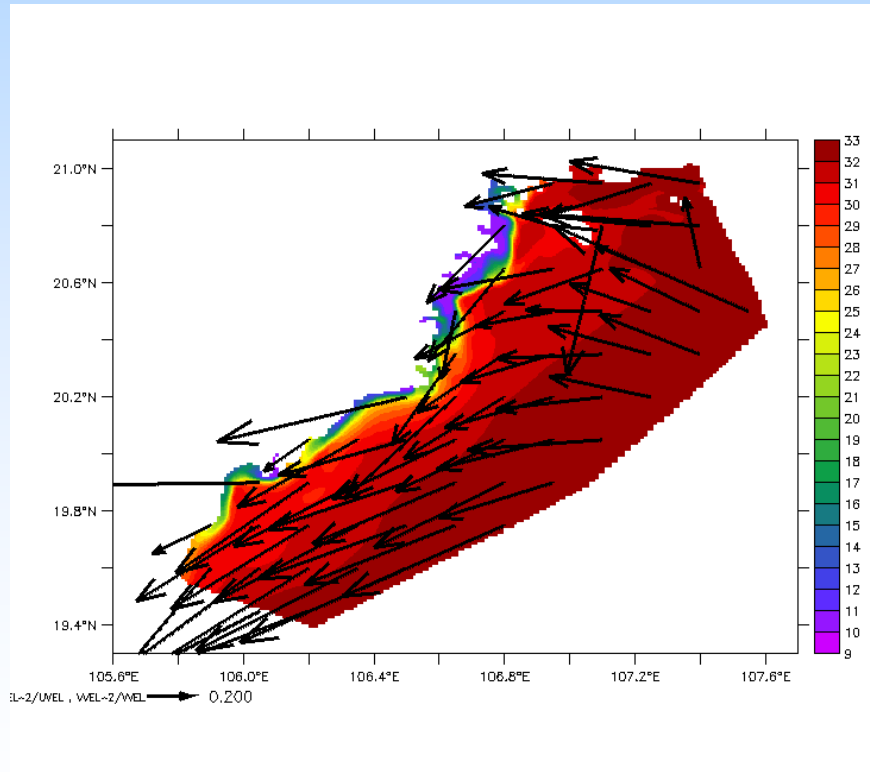
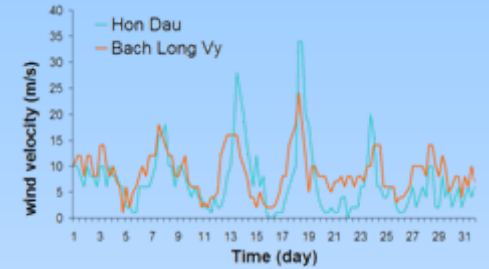


- Residual current mainly landward directed



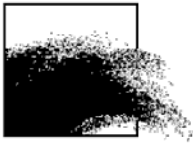


14 July

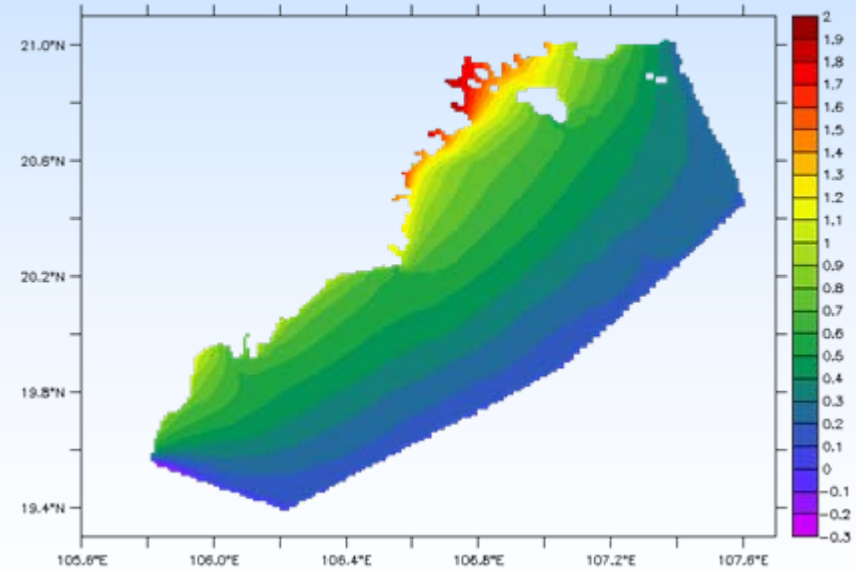
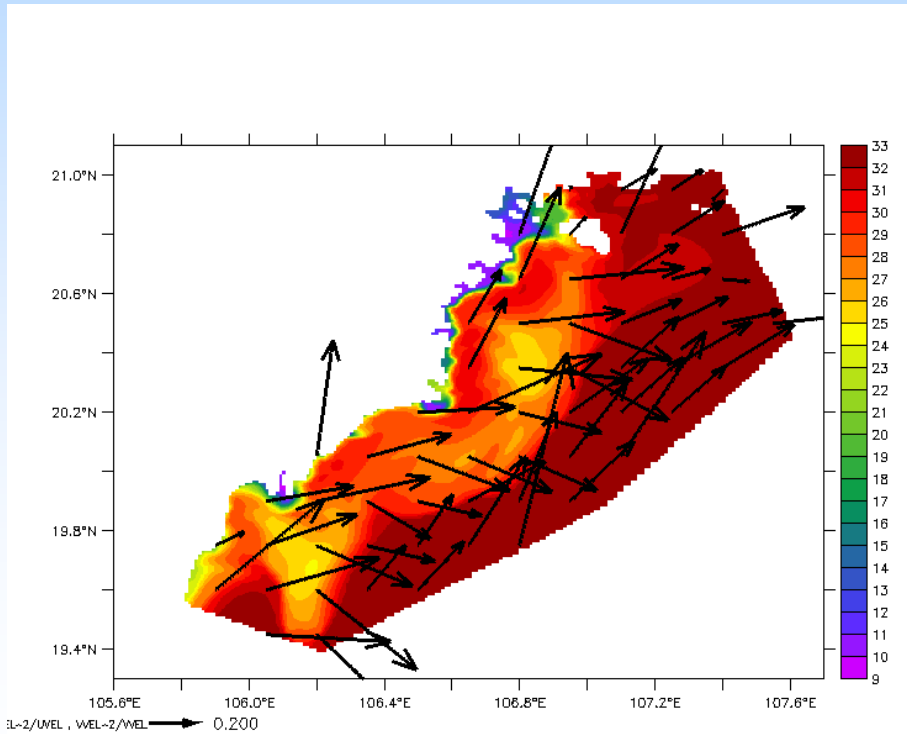
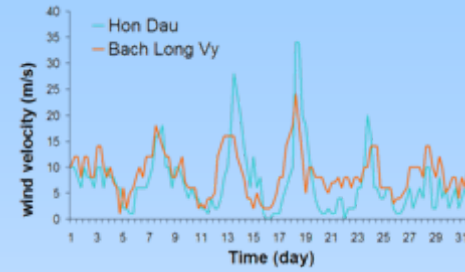




Typhoon

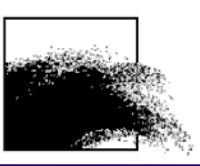


18 July





Conclusions



- Data
- First introduction on the flood of 1971
- Inundation scheme