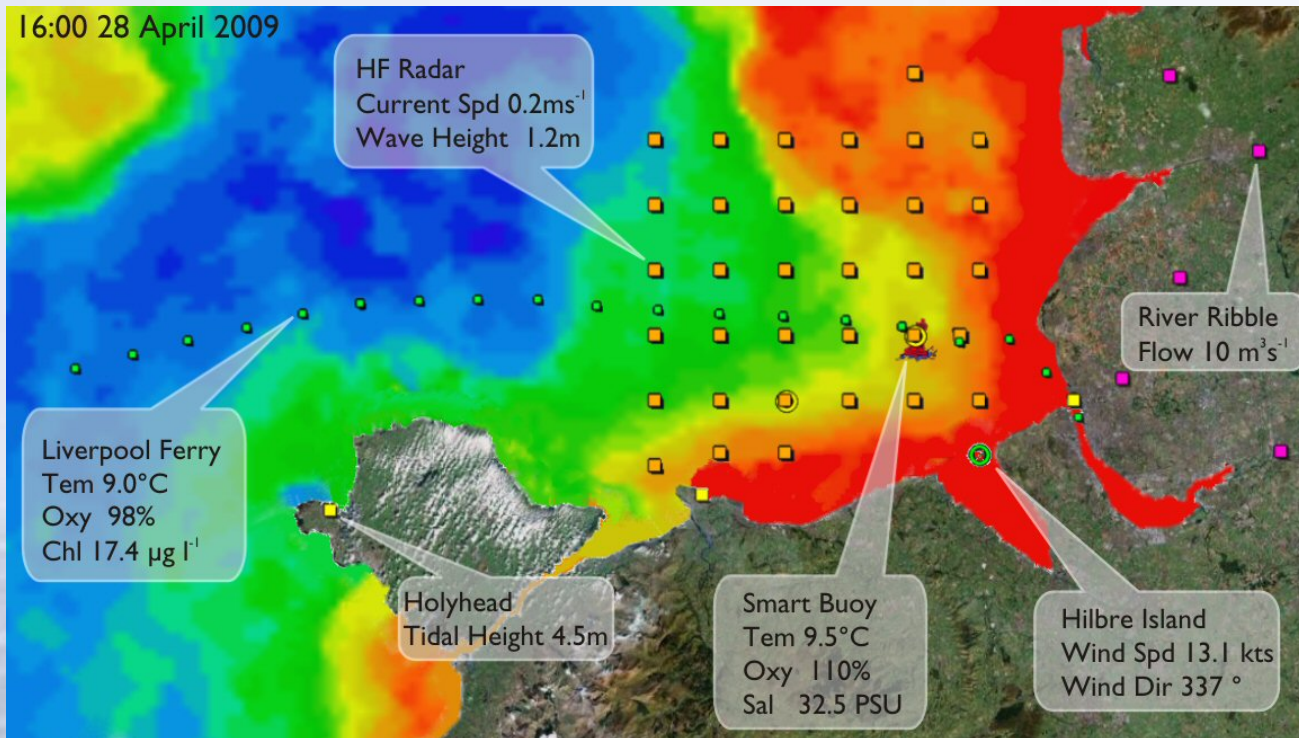


Irish Sea Ferry – some results



John Howarth
Chris Balfour

Measurements (real time)

Numerical models

Web site – <http://coastobs.pol.ac.uk>

Irish Sea Observatory

Integrated measurements

Measurements to test models

Variety of space and time scales

Some real time

Long time series

In situ time series
Sites A and B

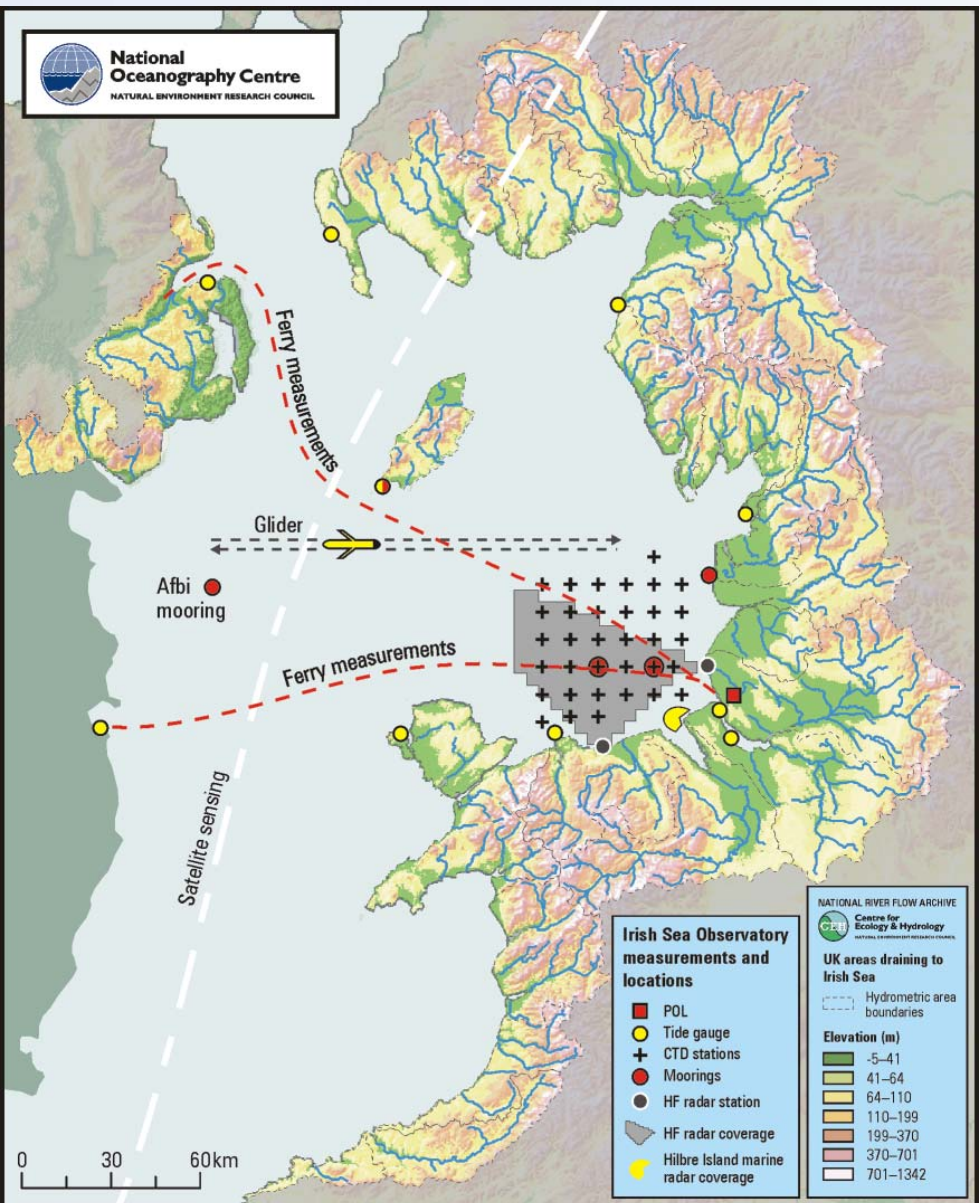
Spatial survey

HF Radar

Ferry

Satellite (weekly composite)

Glider



Liverpool Seaways, Birkenhead - Belfast



Norfolk Line / Norse Merchant / DFDS
December 2003 – January 2011

CTD – SeaBird SeaCat SBE / FSI
Turbidity – Sea Point + wiper
Fluorimeter – Chelsea Minitracka II
Oxygen – Aanderaa optode
Intake 3m below surface
Sample interval – 10 seconds
Data transmission – Orbcomm – 15 mins

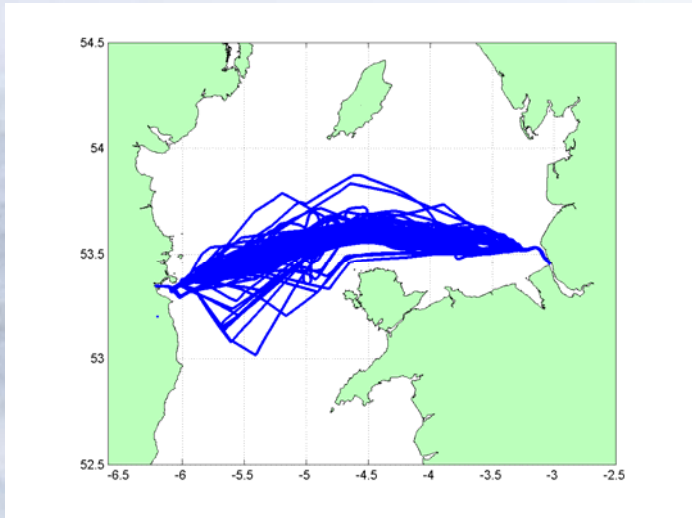
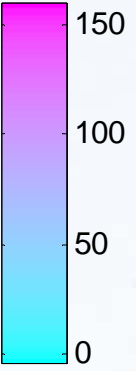
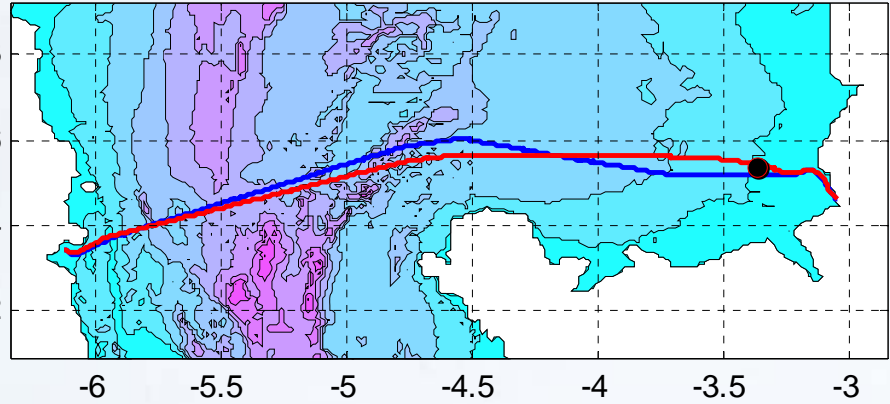
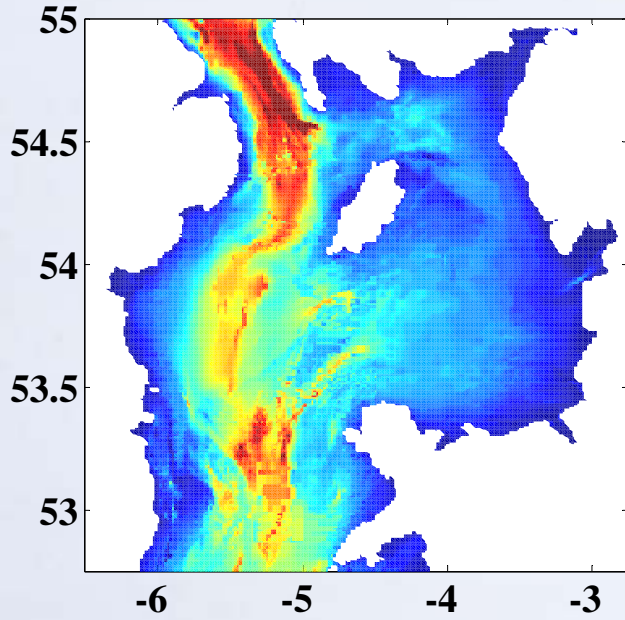


Wiper on turbidity sensor
Isolation valve

7 hour crossing, 230 km
there and back daily



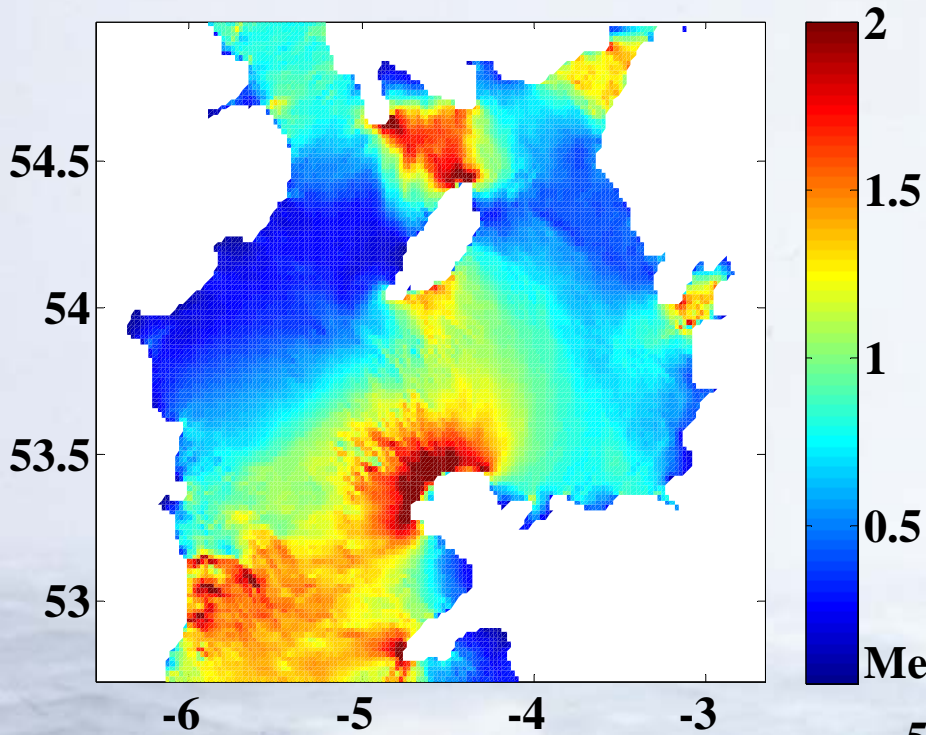
Water depths (m)



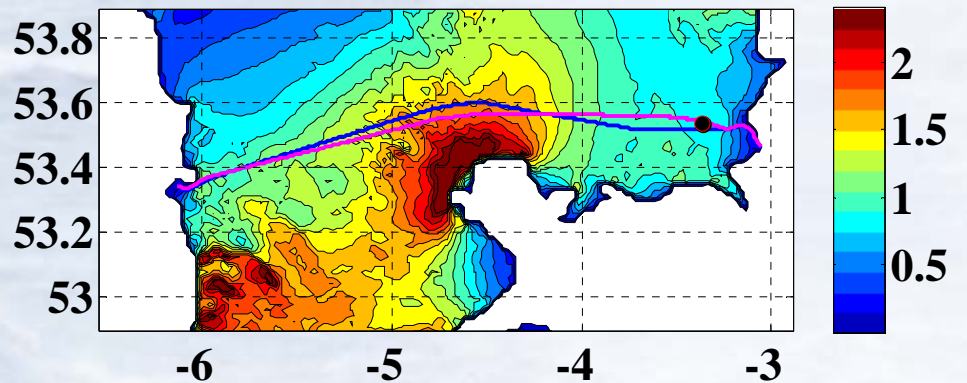
98% within 5 km of tracks

Tides

Mean spring tidal current (m s^{-1})

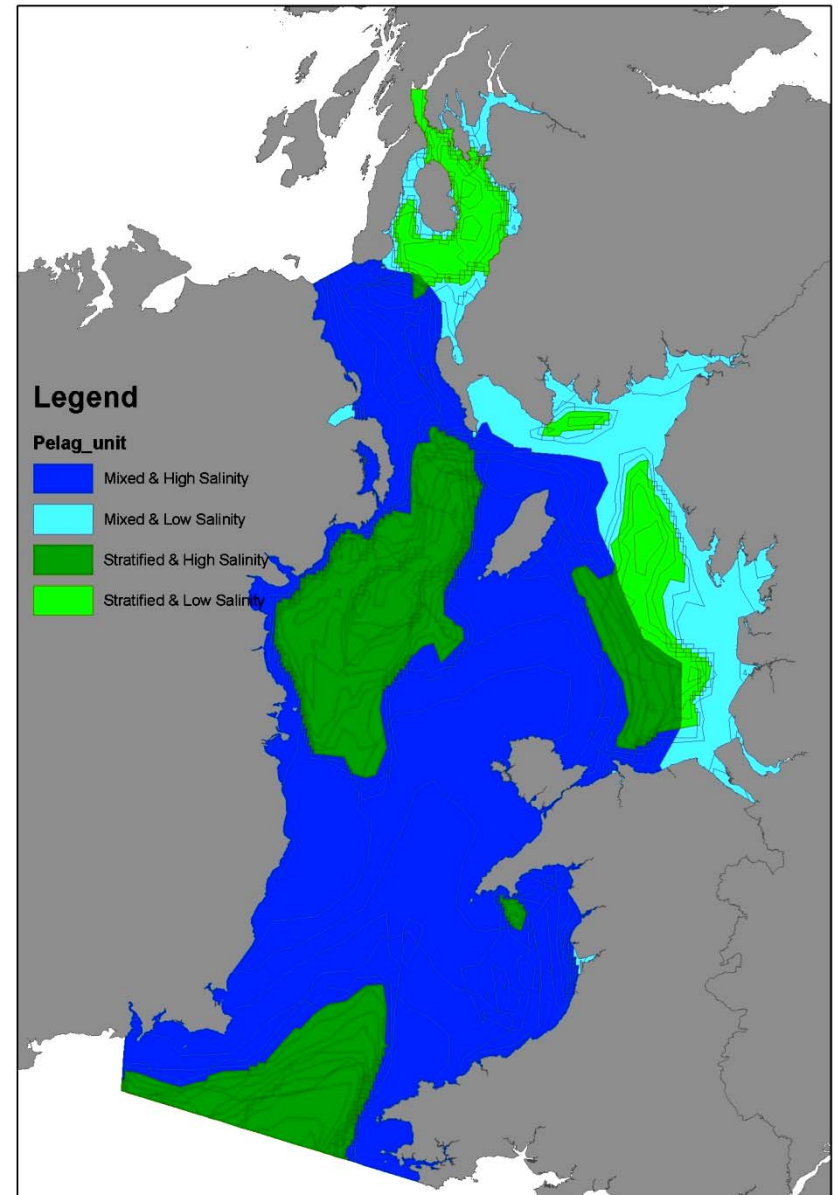
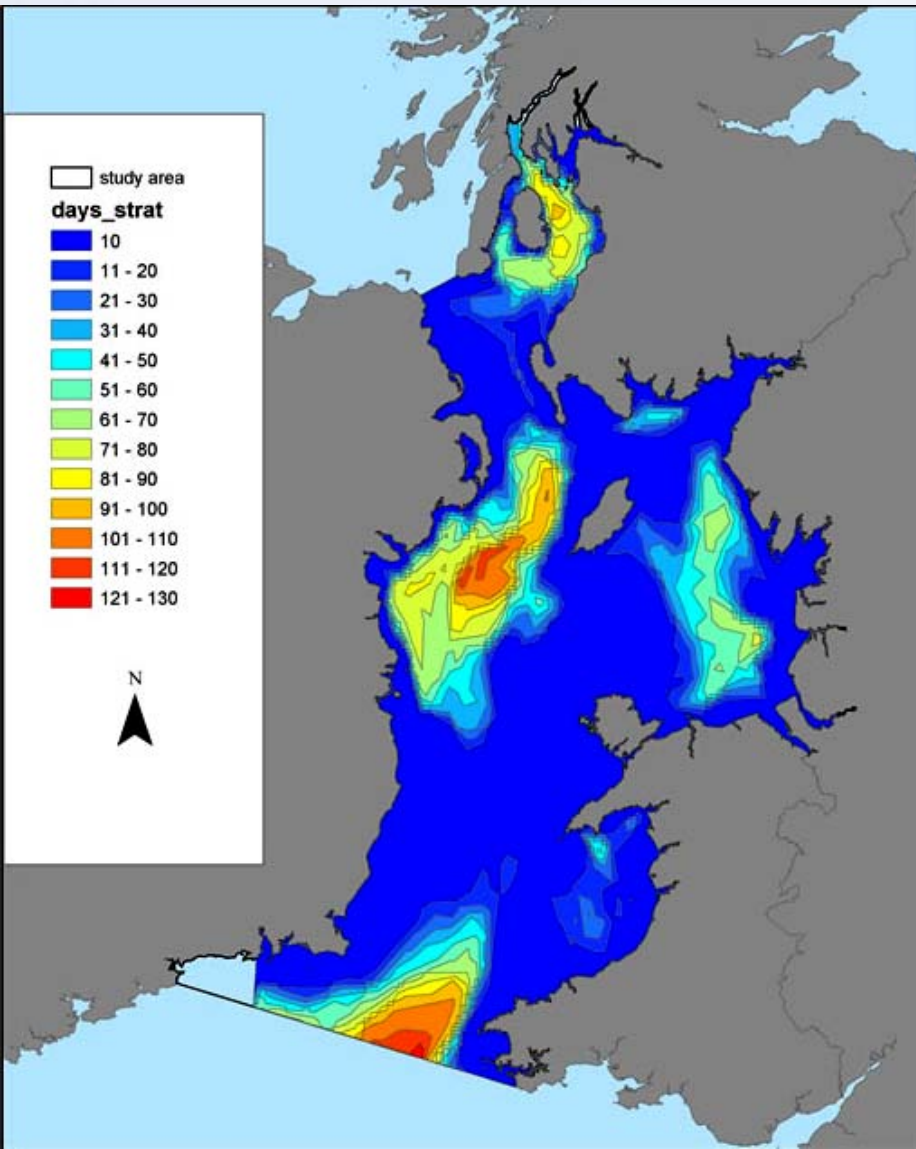


Mean spring surface maximum amplitude (m s^{-1})

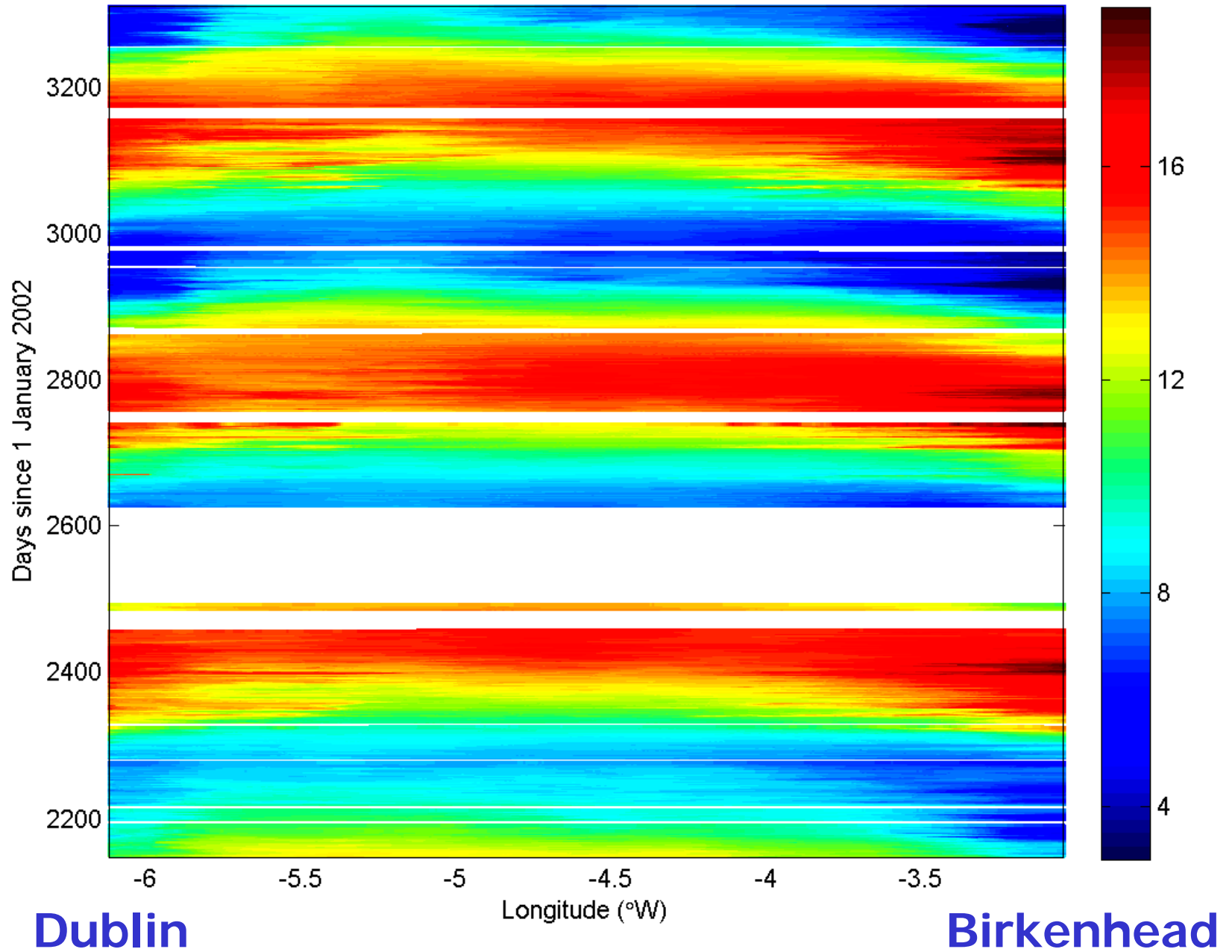


Irish Sea

Number of days temperature stratified in a year

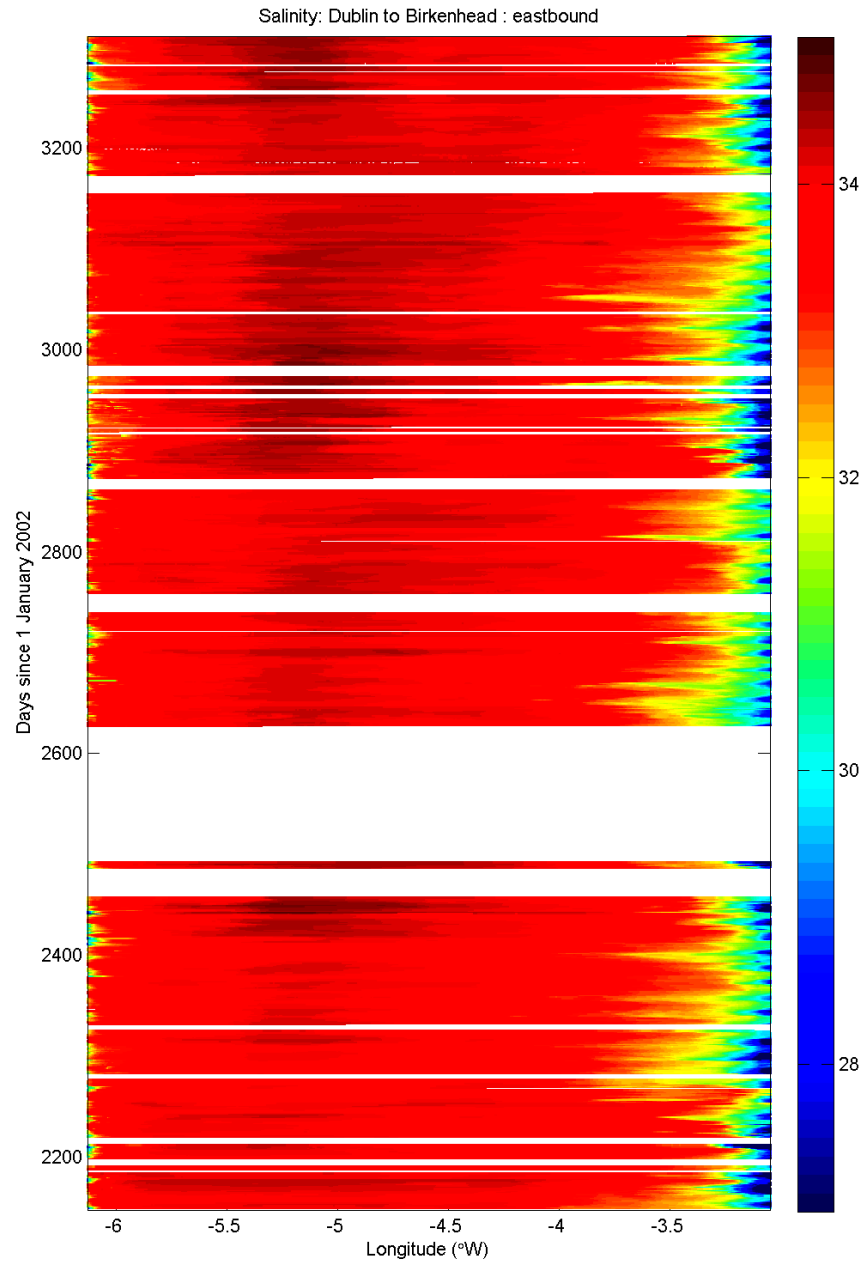


Temperature (°C)



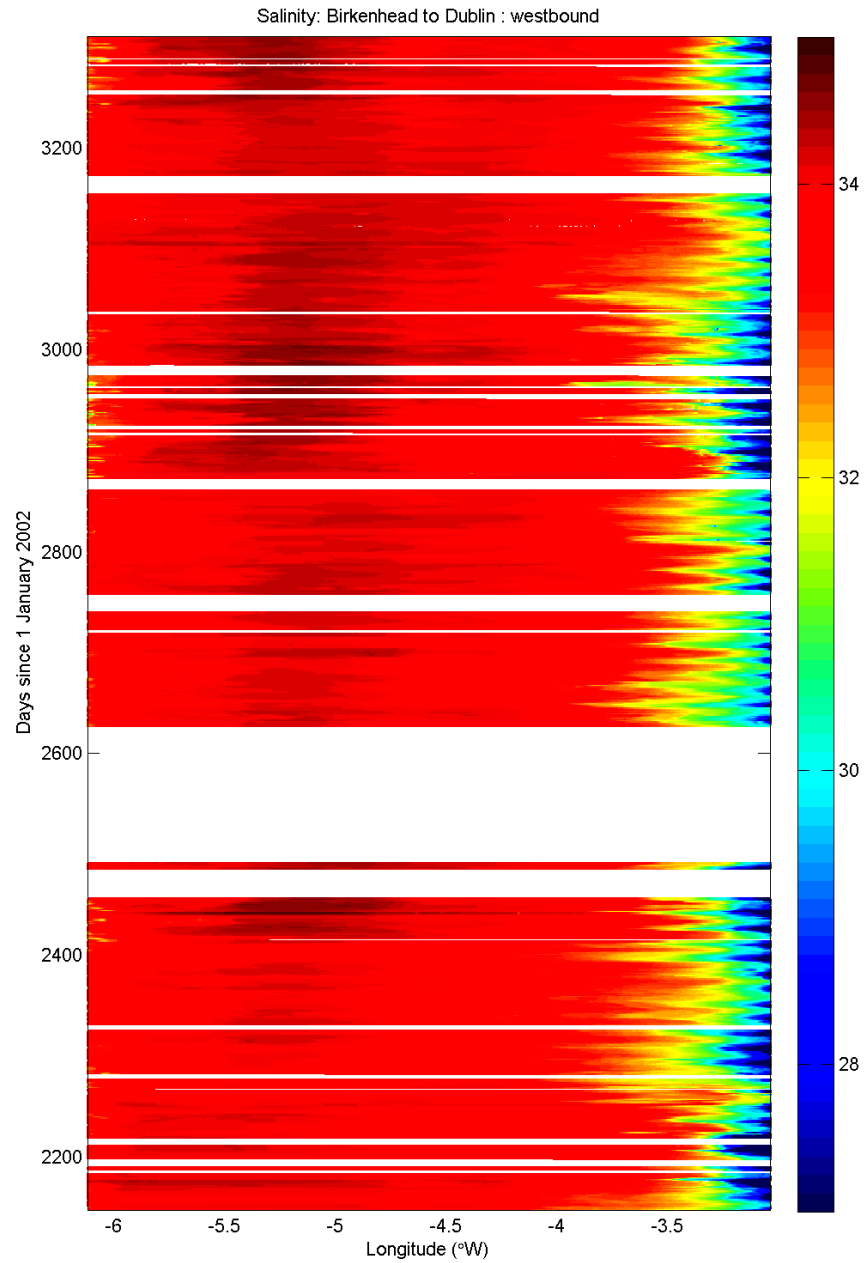
Salinity

Dublin-Birkenhead

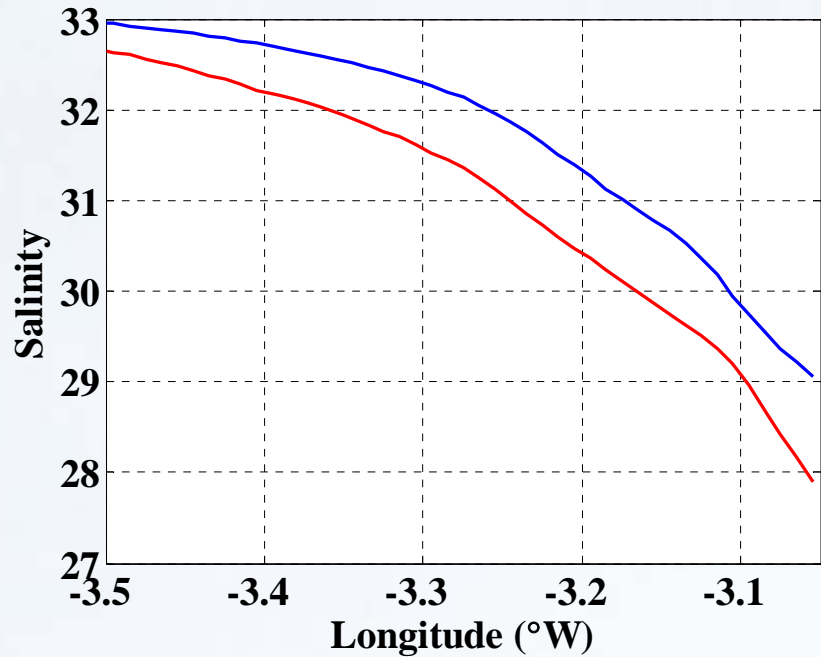
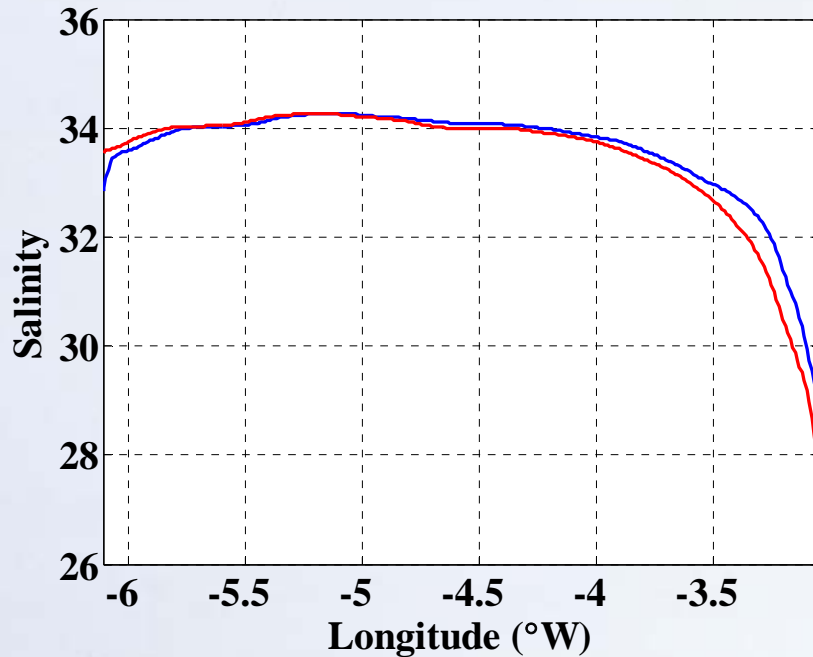


Salinity

Birkenhead-Dublin



Average salinity



Eastern end expanded

Red westbound; blue eastbound

Constant 4.75 mins; 1.6 miles (sea chest)

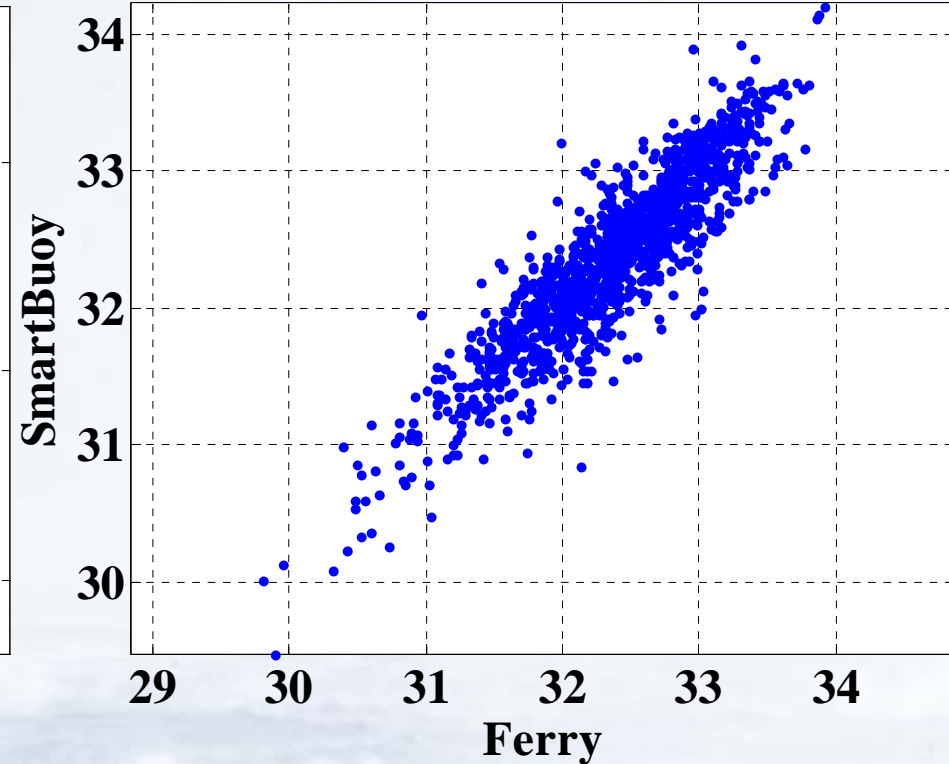
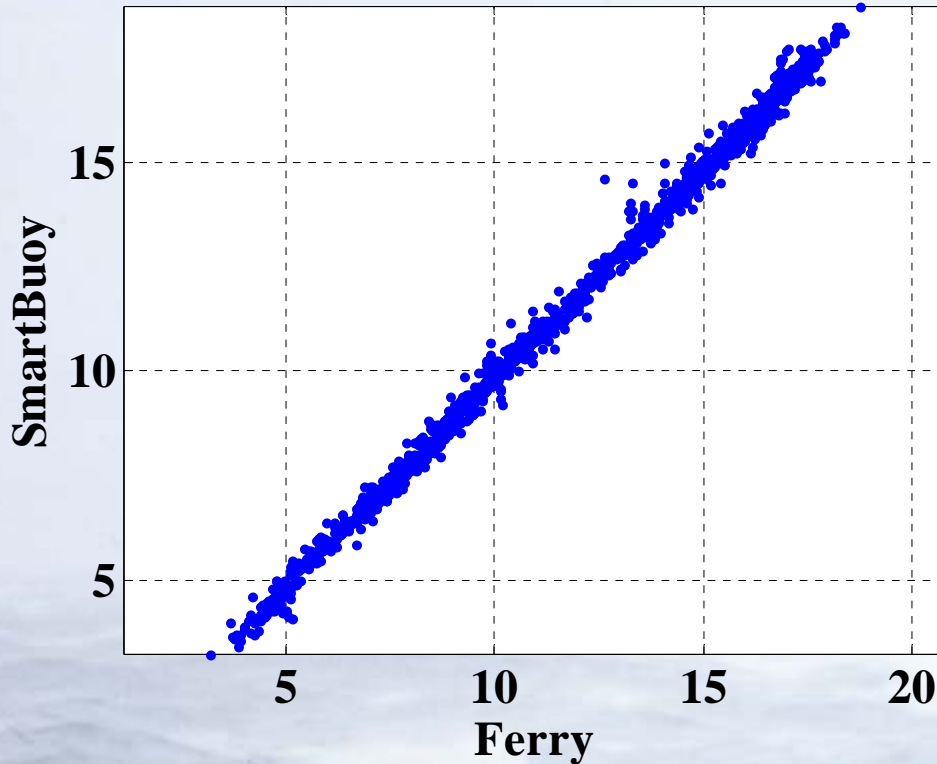
Salinity correction per crossing 0.009

(Before valve installed 0.019)

SmartBuoy Comparison

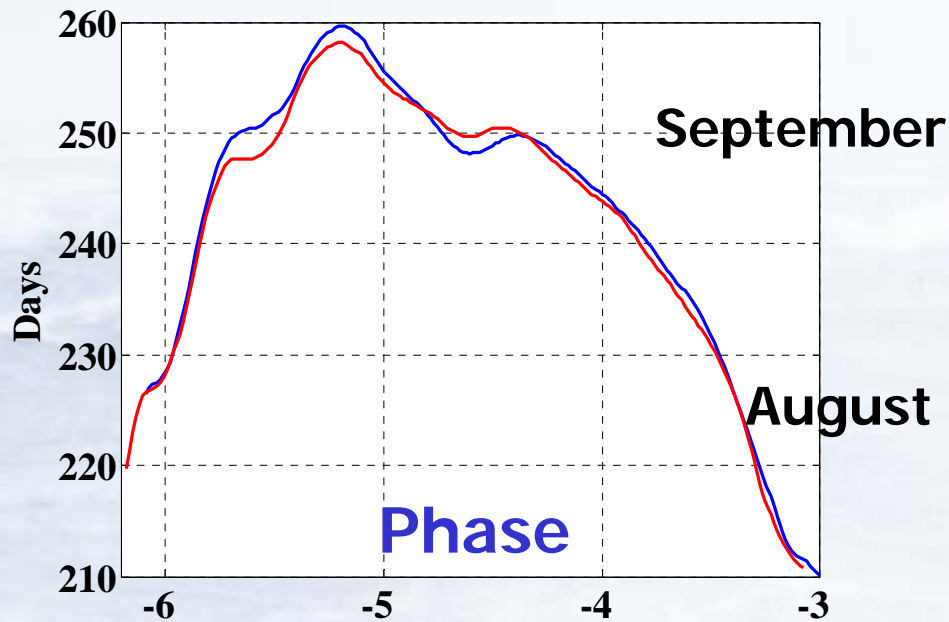
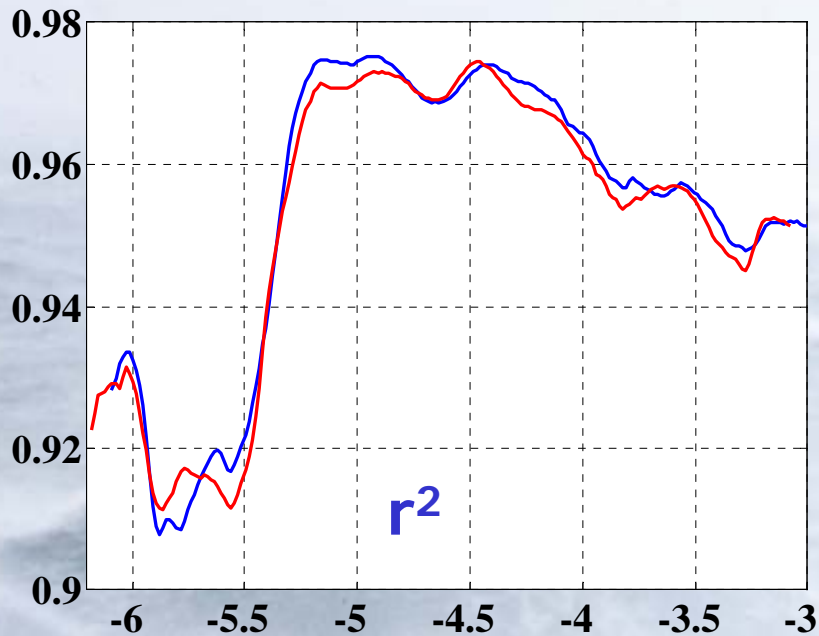
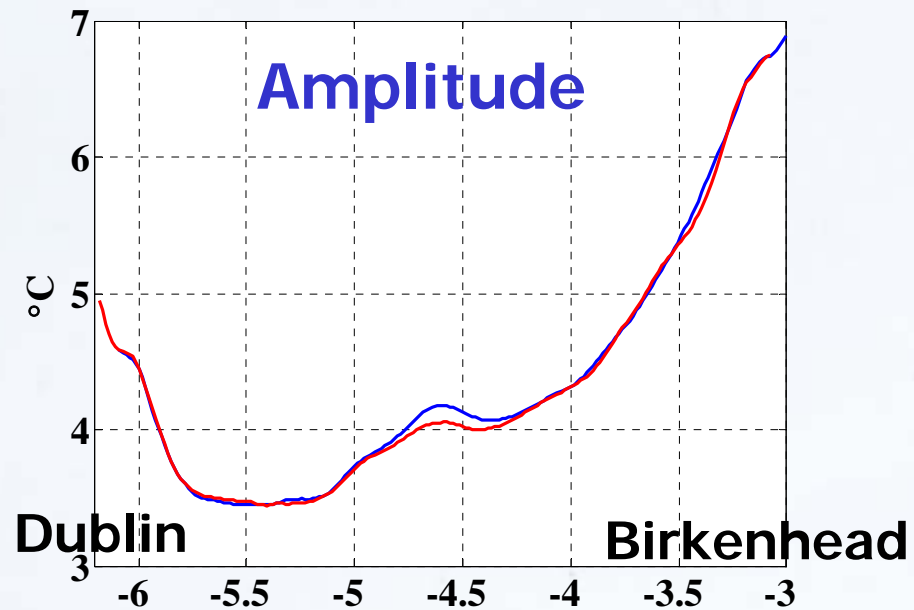
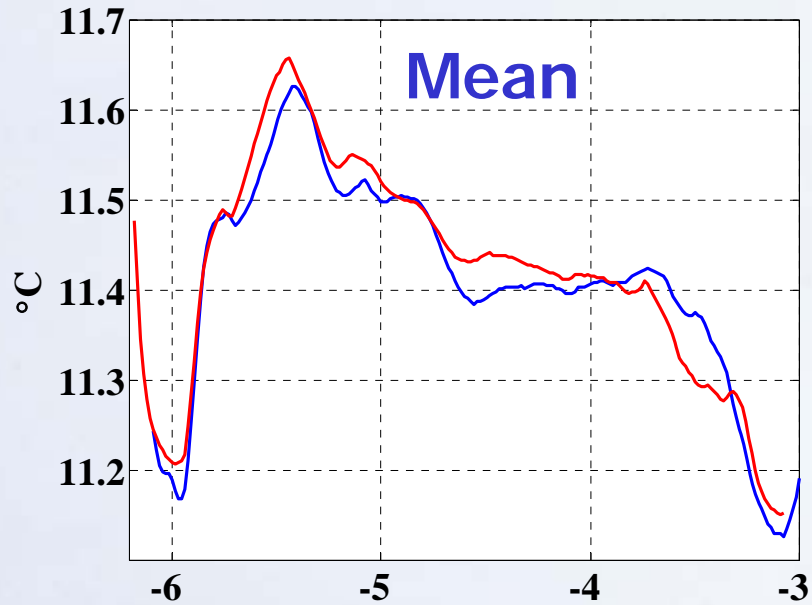
Temperature (°C)

Salinity

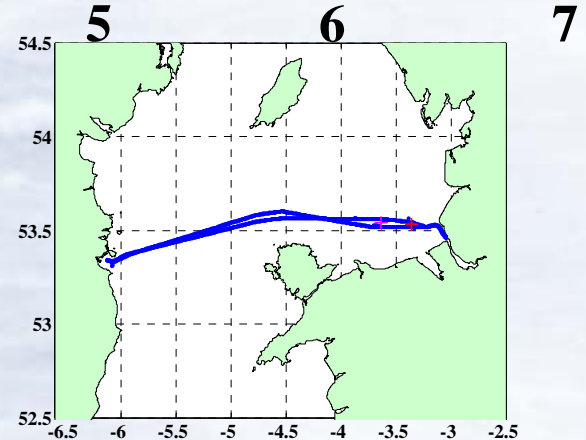
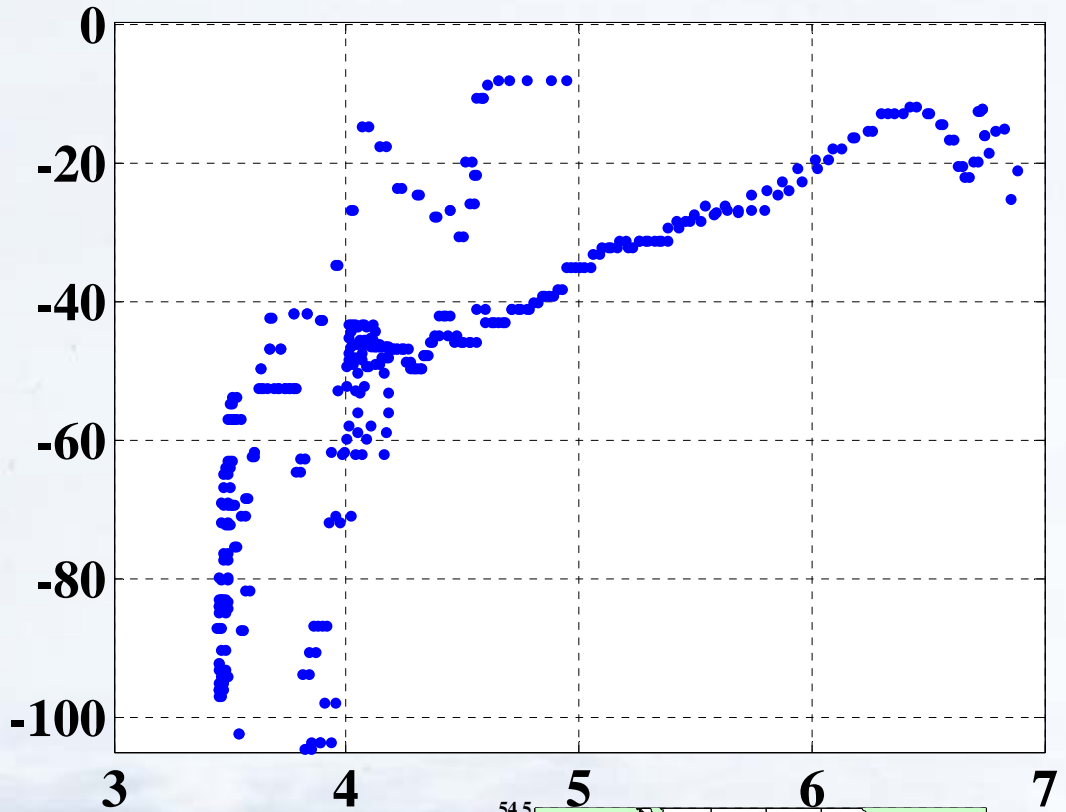
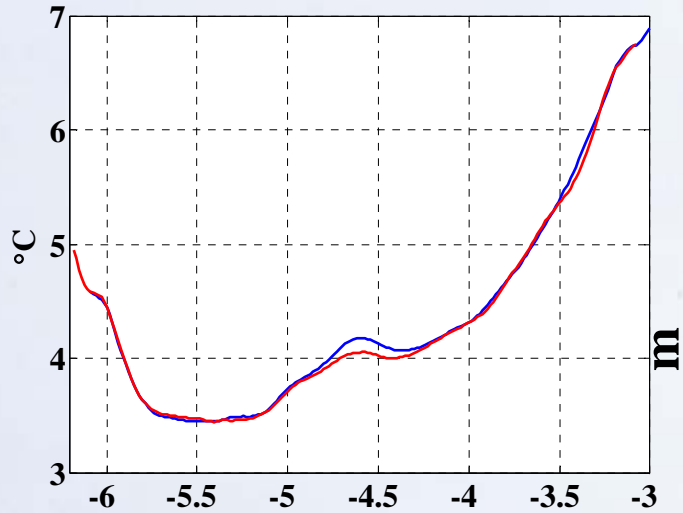


	Temperature	Salinity
Correlation coefficient	0.998	0.91
Mean difference	0.16	-0.00
Standard deviation of difference	0.23	0.27

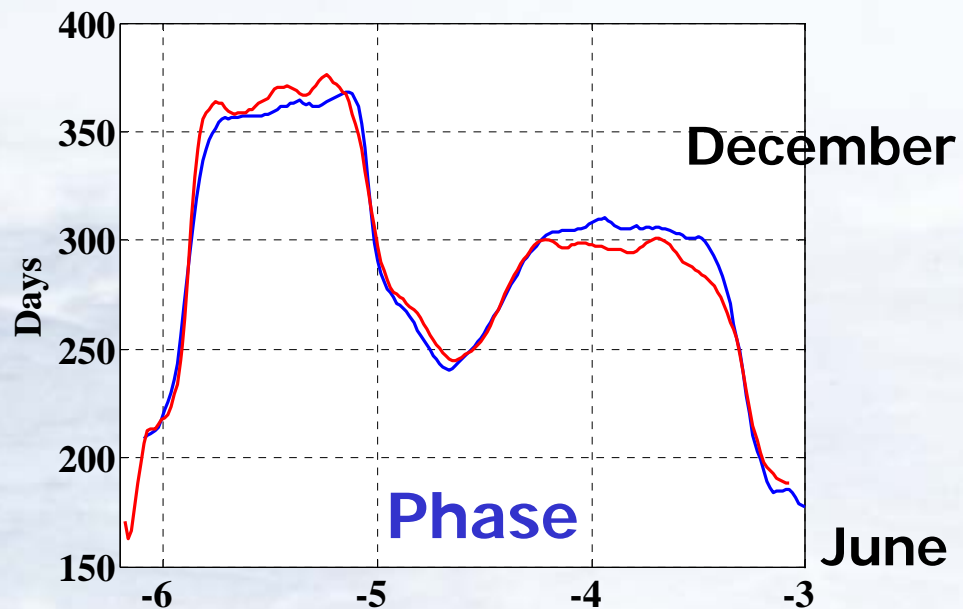
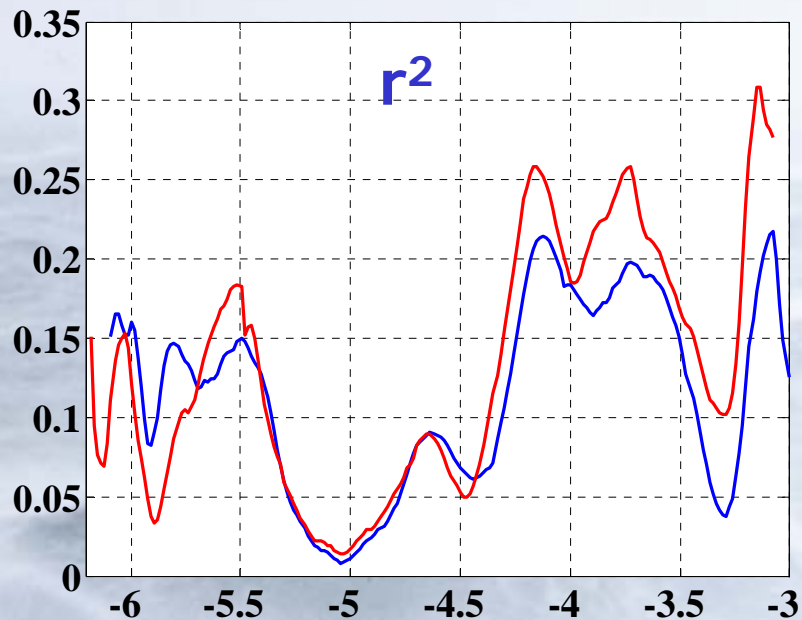
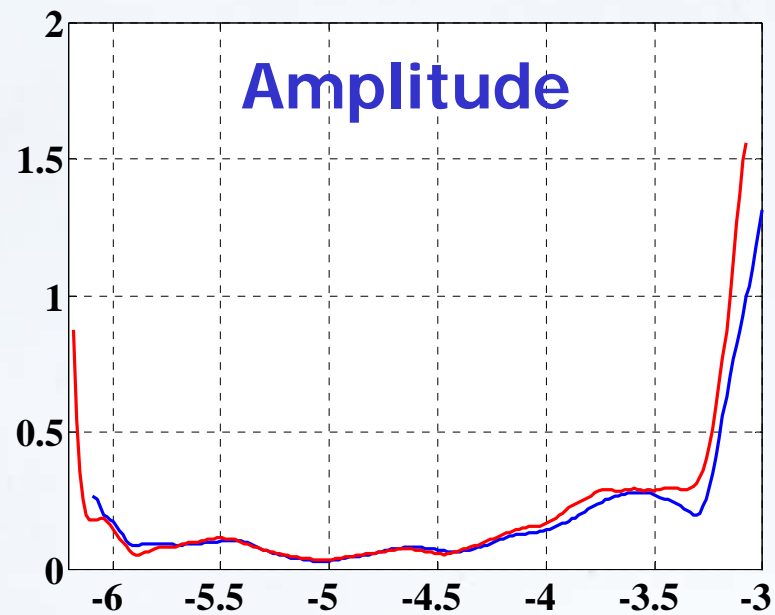
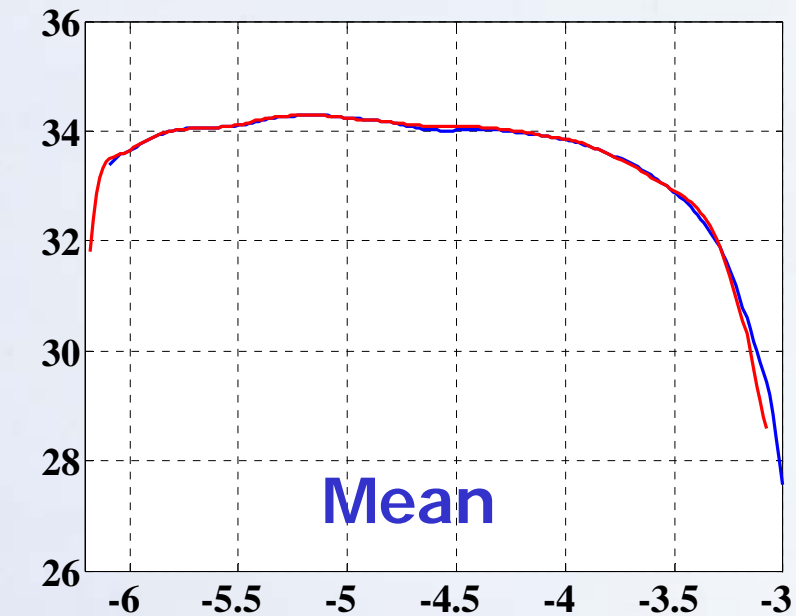
Temperature – seasonal cycle



Amplitude of temperature seasonal cycle: relation with water depth

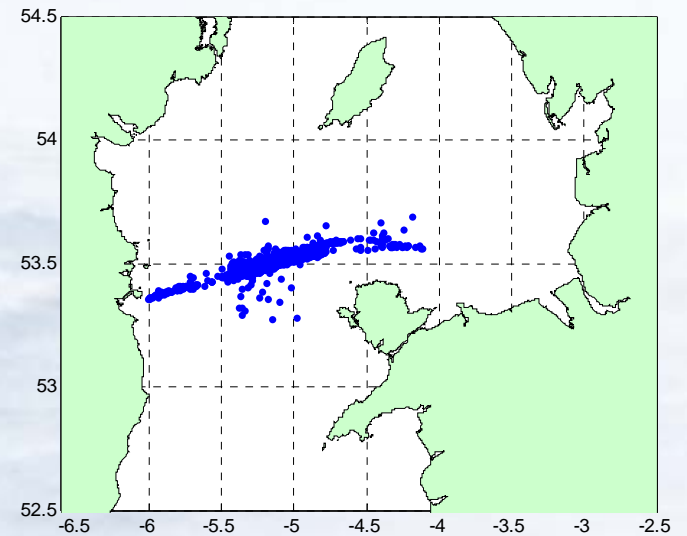
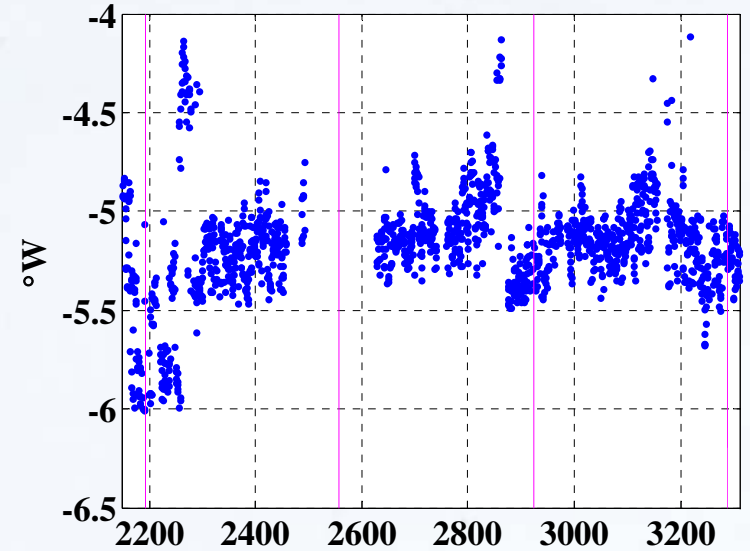
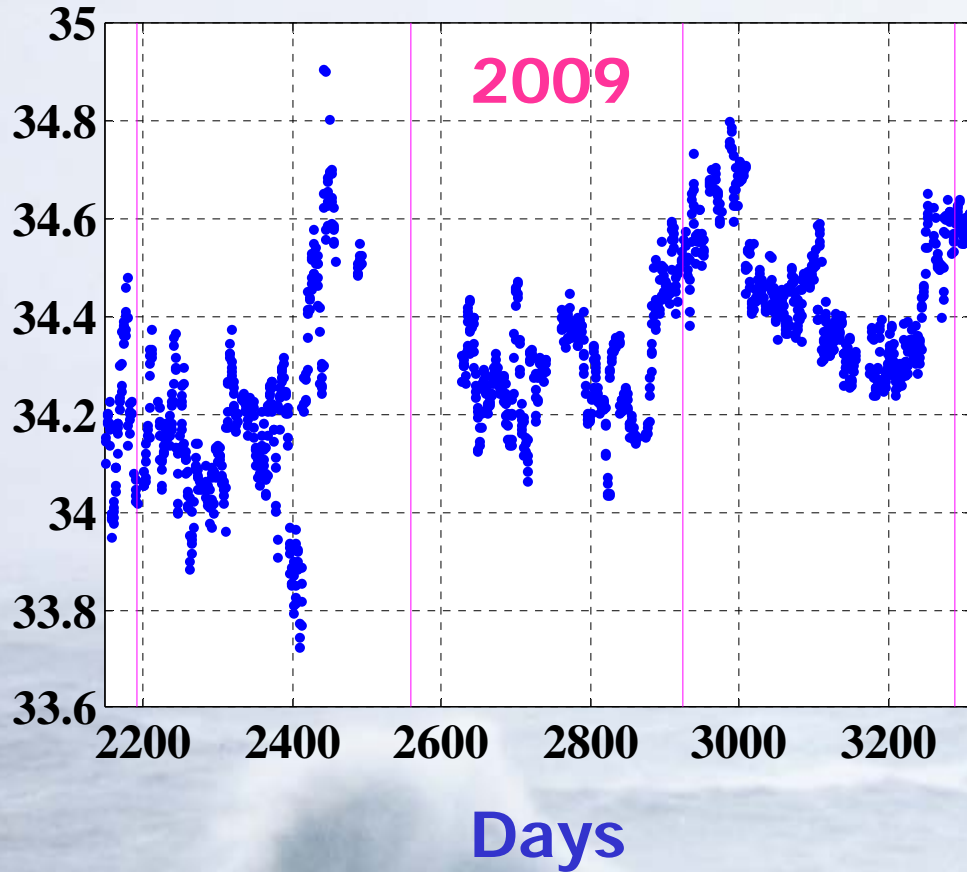


Salinity – seasonal cycle



Salinity variability

Maximum salinity per crossing



Near shore gradients

Mersey Bar

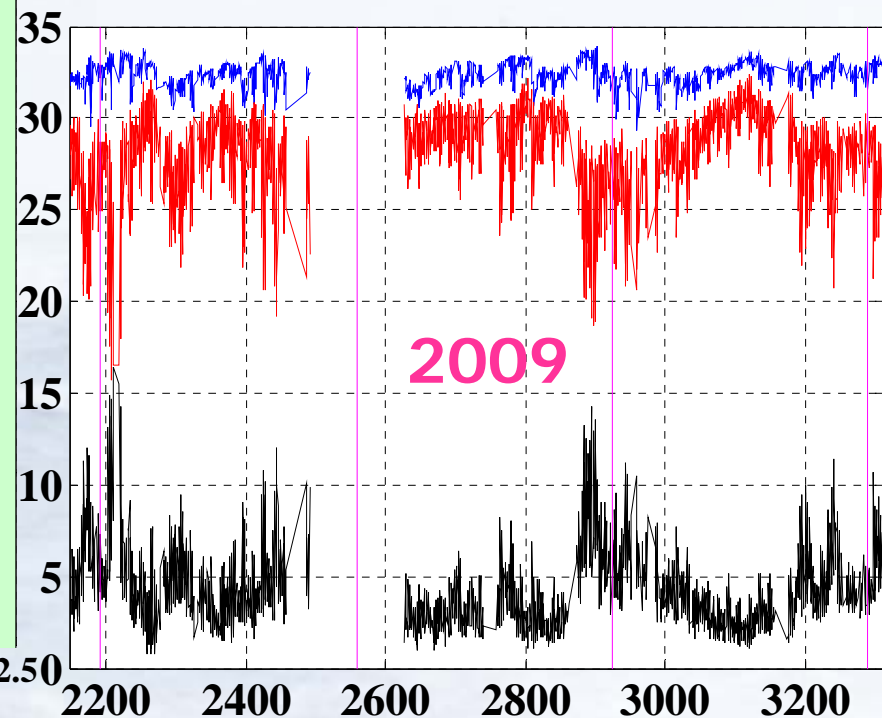
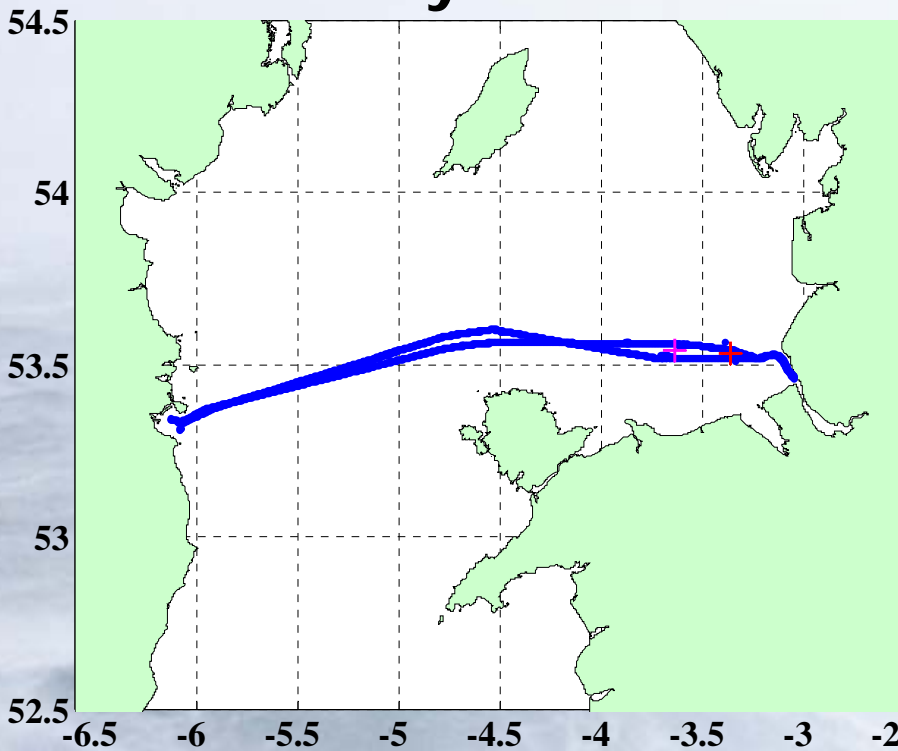
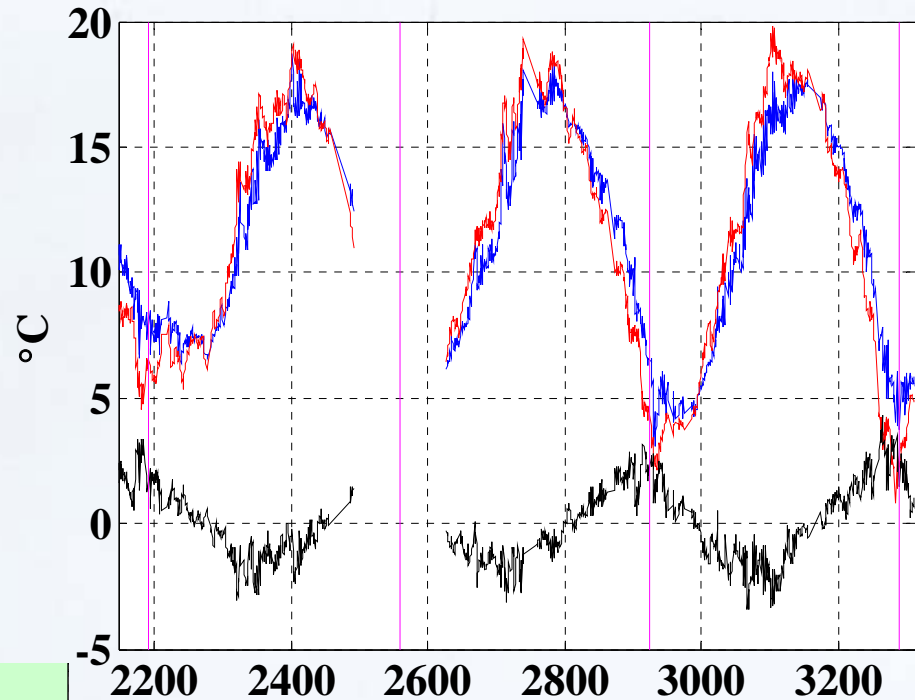
Mouth of Mersey

Difference

Correlation

Temperature 0.96

Salinity 0.42

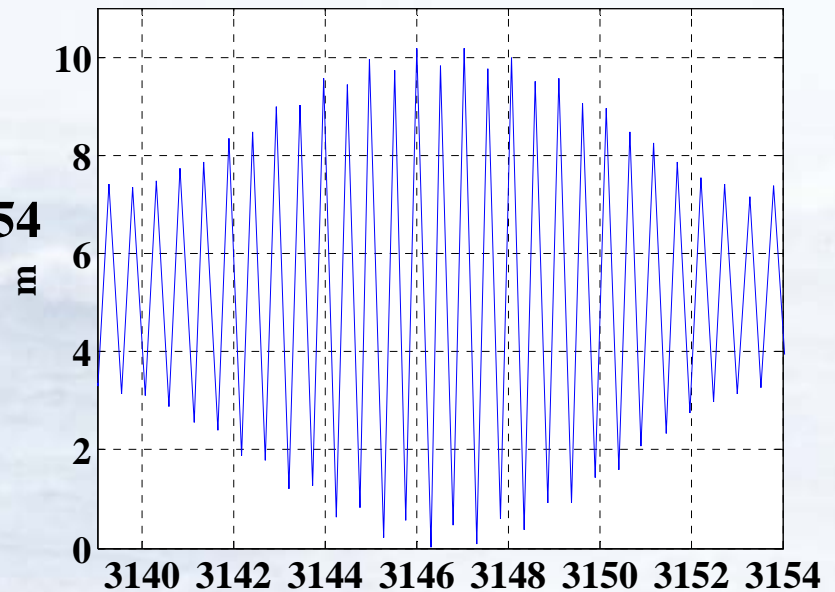


Spring – neap cycle at SmartBuoy site

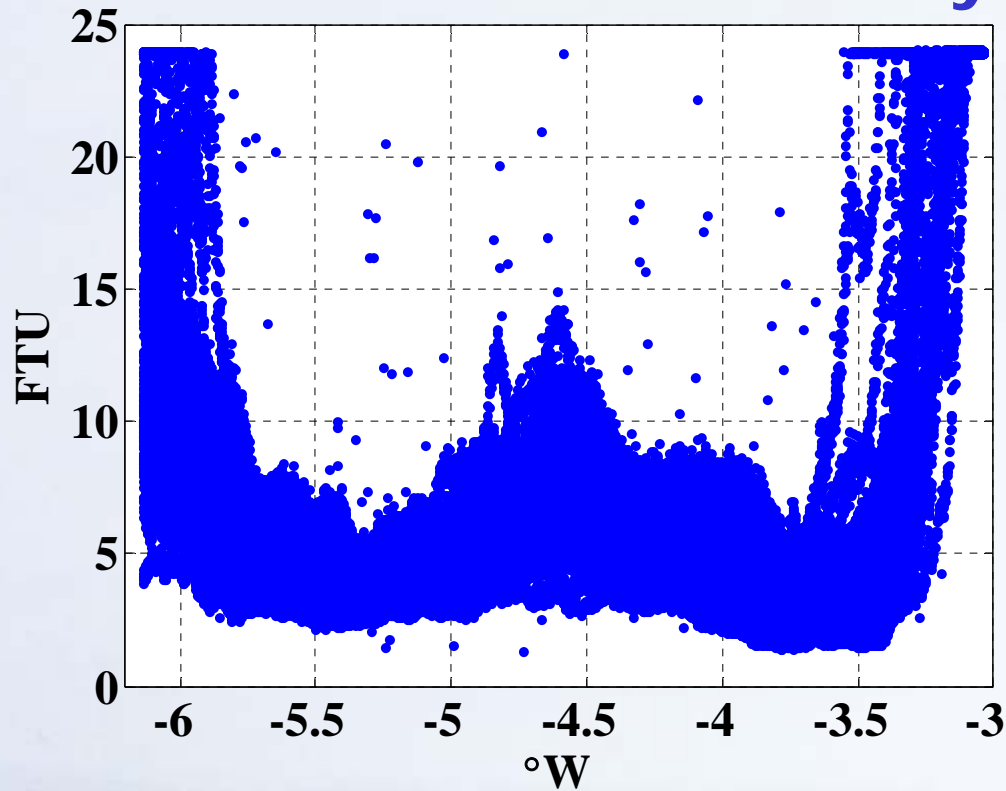
Salinity



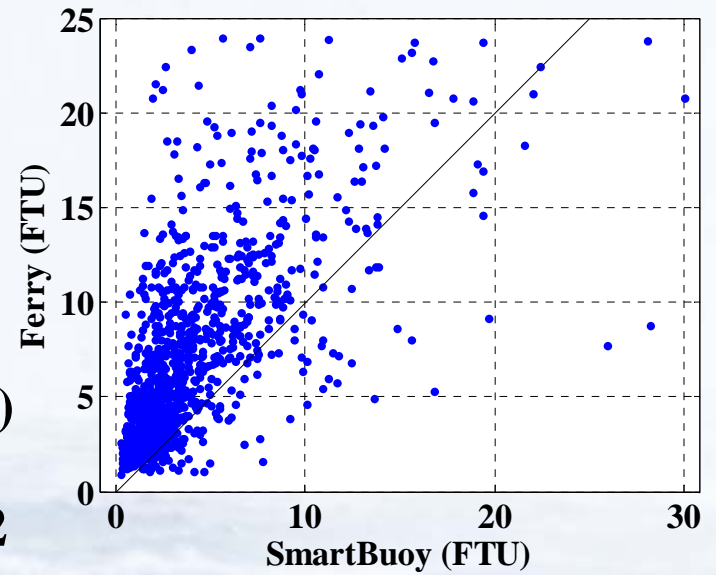
Liverpool tide gauge



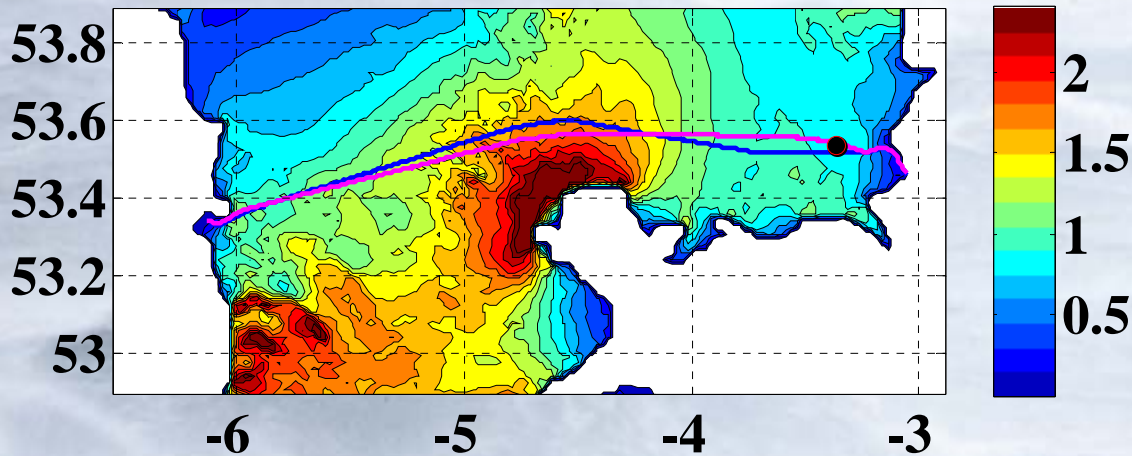
Turbidity



4-25 November 2010



Mean spring surface maximum amplitude (m s^{-1})



$r=0.67$

Summary

East-west differences – time / distance constant

Seasonal cycle

Temperature variability

Salinity variability

Nearshore gradients

Effect of Spring-Neap cycle



Liverpool Seaways, Birkenhead - Belfast



Norfolk Line / Norse Merchant / DFDS
December 2003 – January 2011

Salinity

CTD – SeaBird SeaCat SBE / FSI
Turbidity – Sea Point + wiper
Fluorimeter – Chelsea Minitracka II
Oxygen – Aanderaa optode
Intake 3m below surface
Sample interval – 10 seconds
Data transmission – Orbcomm



Wiper
Isolation valve

7 hour crossing there and back daily

