



GARDLINE ENVIRONMENTAL

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The value of inter-instrument consistency during a three year monitoring programme along the east coast of England.

Overview

- Introduction to the 'Anglian Wave and Tide Monitoring Programme'
- The nature of the environment
- Data acquisition
- Reliability in consistency
- Instrument comparisons
- Conclusions

Introduction

The Anglian Wave and Tide Monitoring Programme

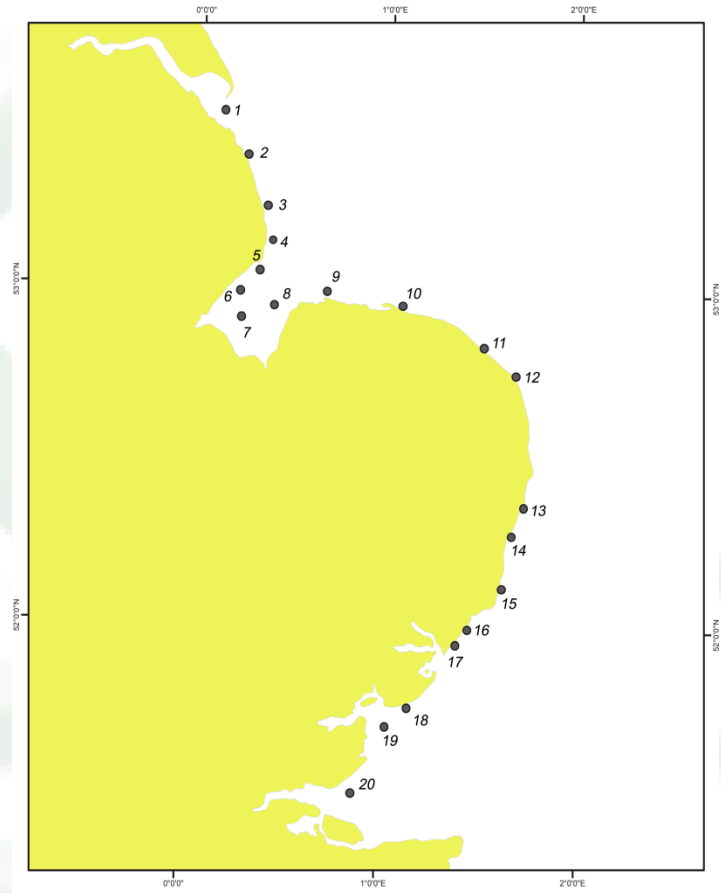
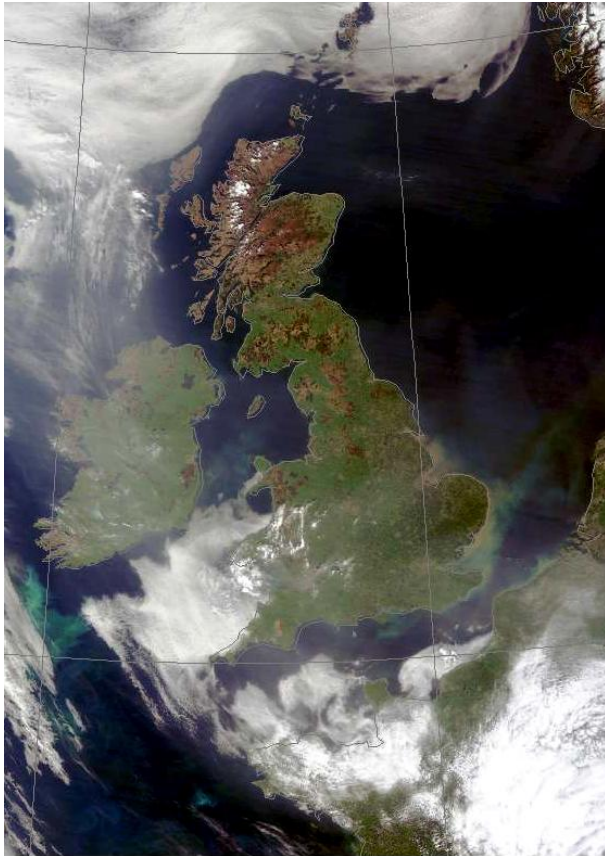
- A high spatial and temporal monitoring programme funded by the DEFRA on behalf of the EA
- Twenty sites along the east coast of England from the River Humber in the North to the River Thames in the South
- 400 AWAC Deployments throughout a three year period
- Monitoring Waves, Tides and Currents

Introduction

- It was vital to acquire robust and continuous data
- Gardline Environmental Limited invested in 40 Nortek AWACs
- Inevitably there were problems encountered throughout the project



Introduction



The Nature of the Environment

- The east coast of England is an eroding coastline
- The sediments range from fine clay, to coarse sands, pebbles and stones
- The AWACs were deployed in a mobile and energetic environment
- We experienced a number of problems
 - Third party interference
 - Substantial biofouling
 - Instrument burial

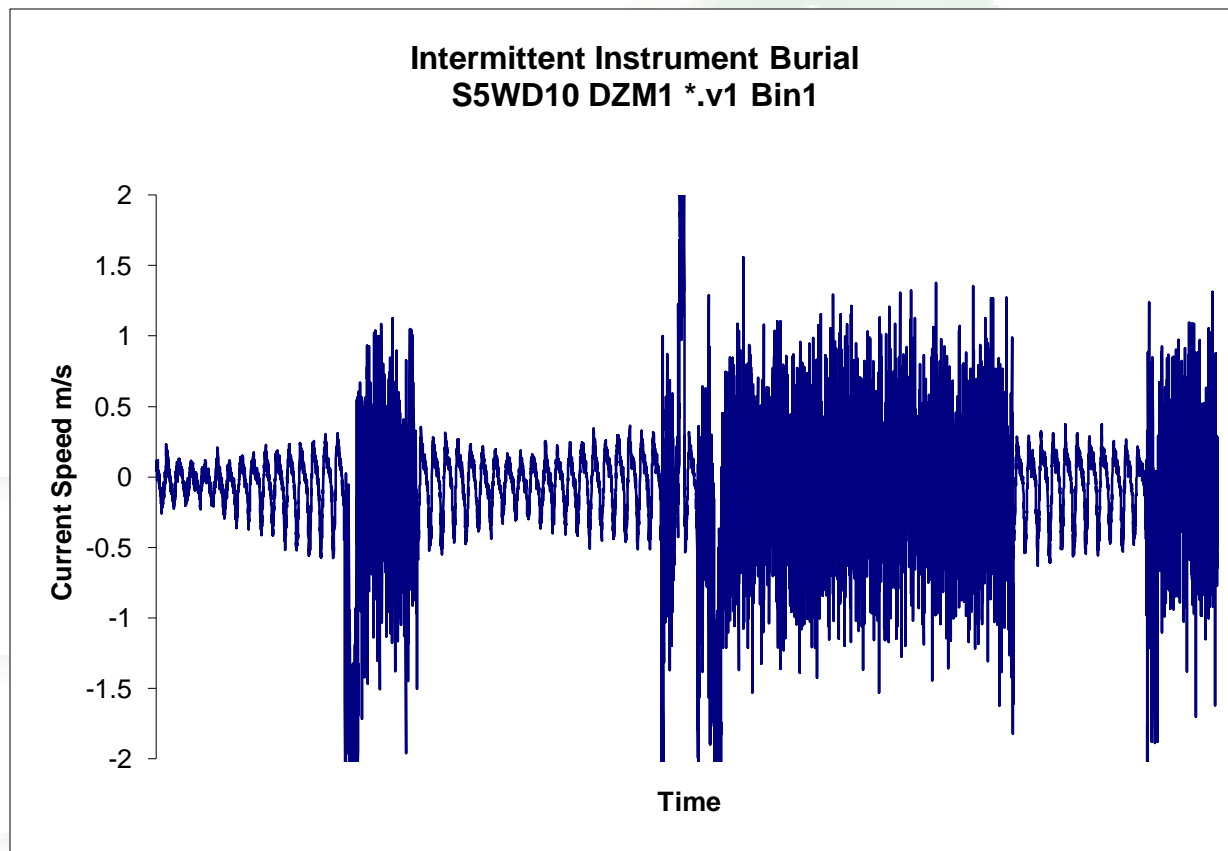
The Nature of the Environment



The Nature of the Environment

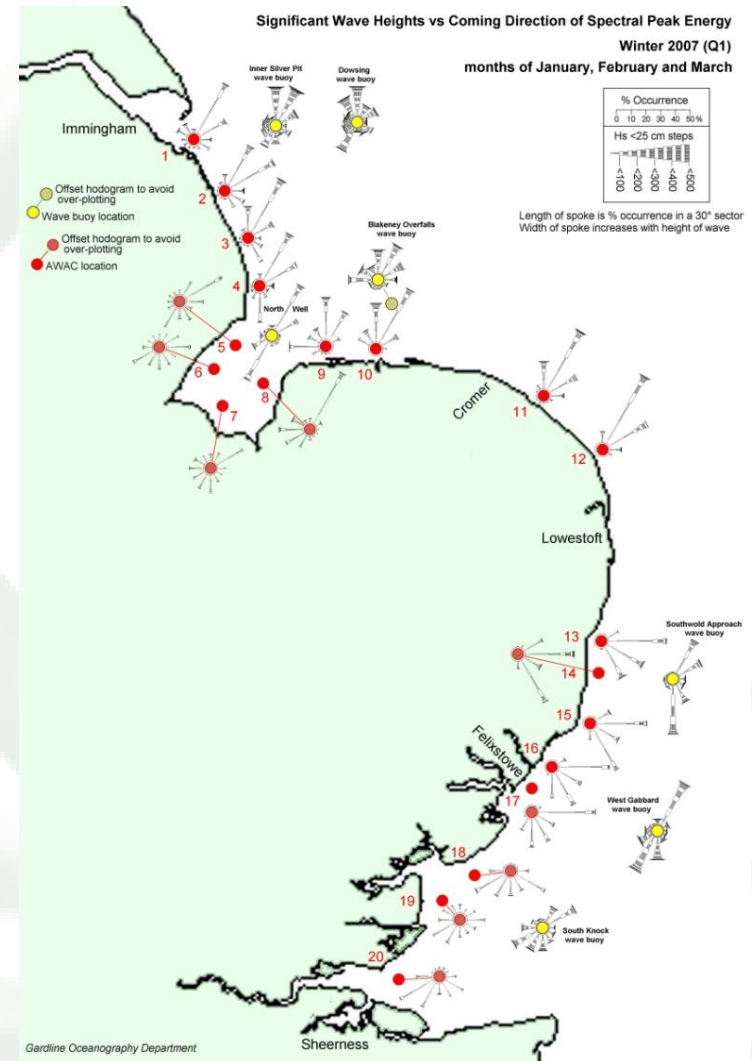


The Nature of the Environment



Data Acquisition

- The value of the project was to be able to obtain an insight into regional variations
- Having a pool of instruments that were able to sit side by side and measure consistently, meant that sites were comparable

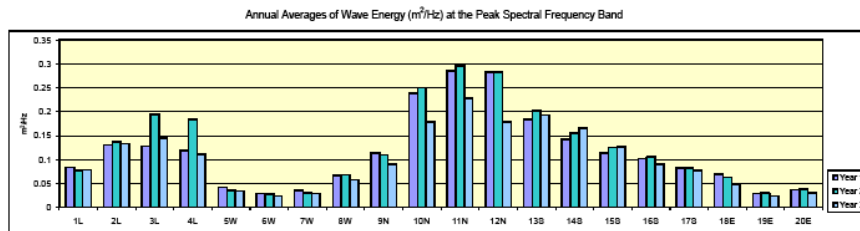
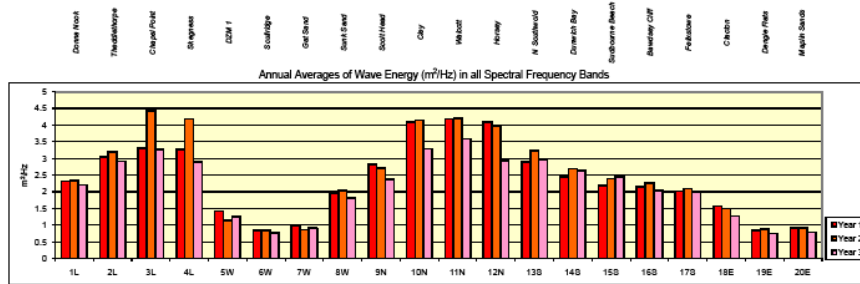


Data Acquisition

- The value of the project

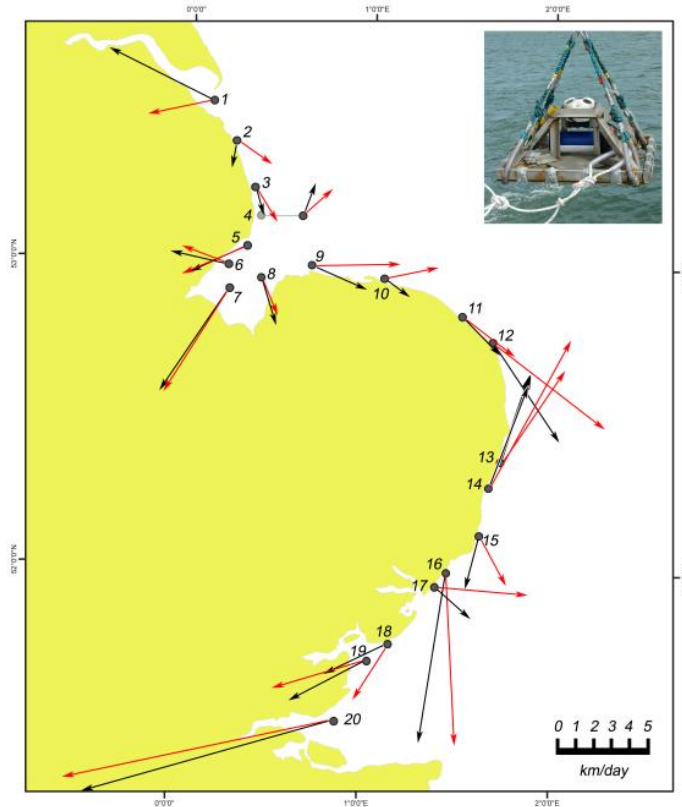
EA Anglian Wave and Tide Monitoring

Geographical Distribution of Observed Coastal Wave Energy



Garantine Oceanography

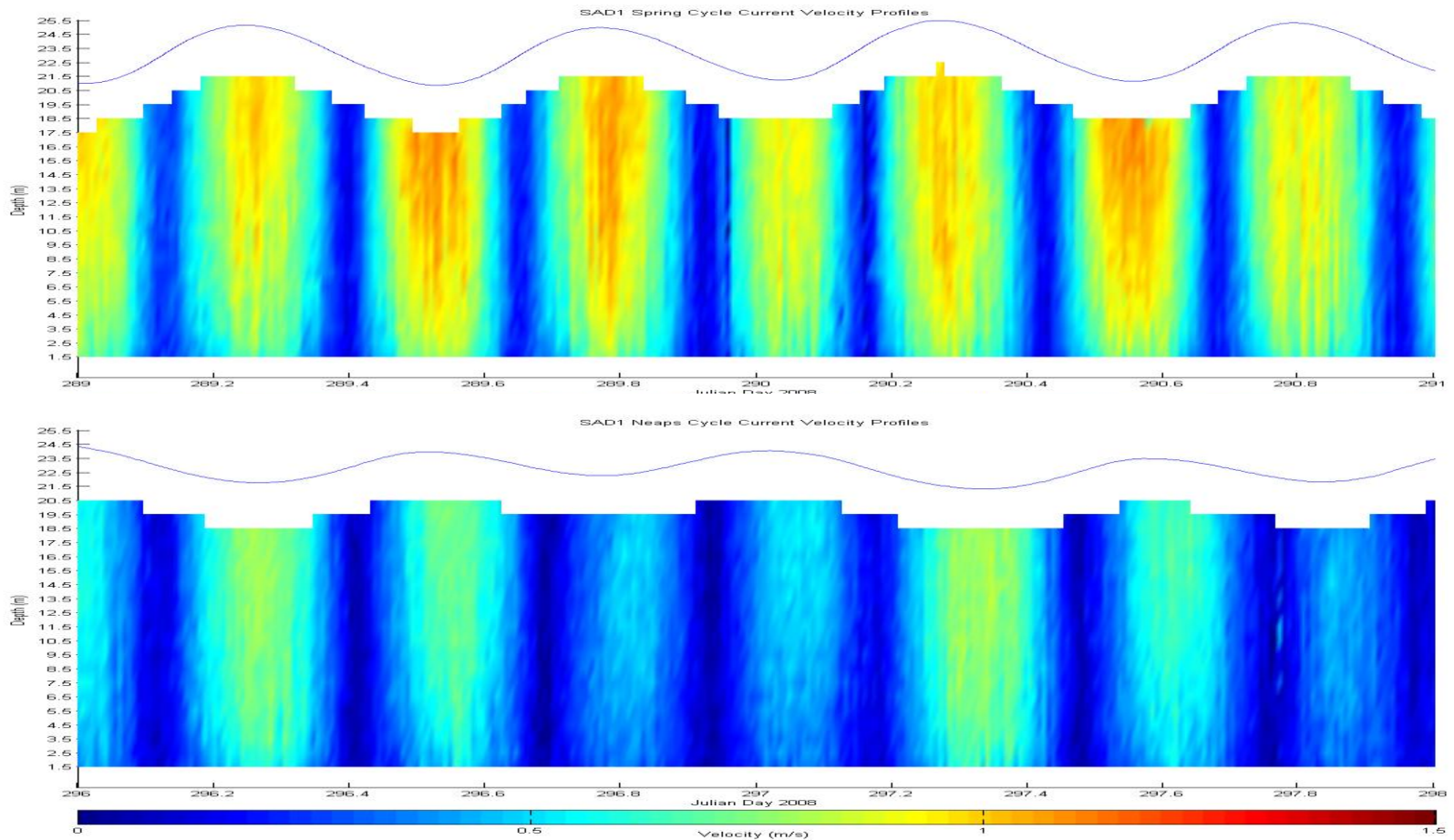
Mean Annual Wave Energy histograms



Annual % data return per site D14 to D20

| | | | | |
|-------------------|------|------------------------|------|---|
| 1. Donna Nook | 84% | 11. Walcott | 100% | Annual averaged net current vector 5.5m above seabed |
| 2. Theddlethorpe | 100% | 12. Horsey | 82% | |
| 3. Chapel Point | 94% | 13. Southwold North | 90% | Annual averaged net current vector 1.5m above seabed |
| 4. Skegness | 73% | 14. Dunwich Bay | 100% | |
| 5. DZM1 | 79% | 15. Sudbourne Bay | 99% | |
| 6. Skulridge Mark | 83% | 16. Bawdsey Cliff | 82% | |
| 7. Gat Sands | 83% | 17. Felixstowe | 100% | |
| 8. Sunk Sands | 68% | 18. Clacton | 88% | |
| 9. Scolt Head | 100% | 19. Dengie Flats | 100% | |
| 10. Cley | 59% | 20. South Maplin Sands | 100% | |

Data Acquisition



Reliability in Consistency

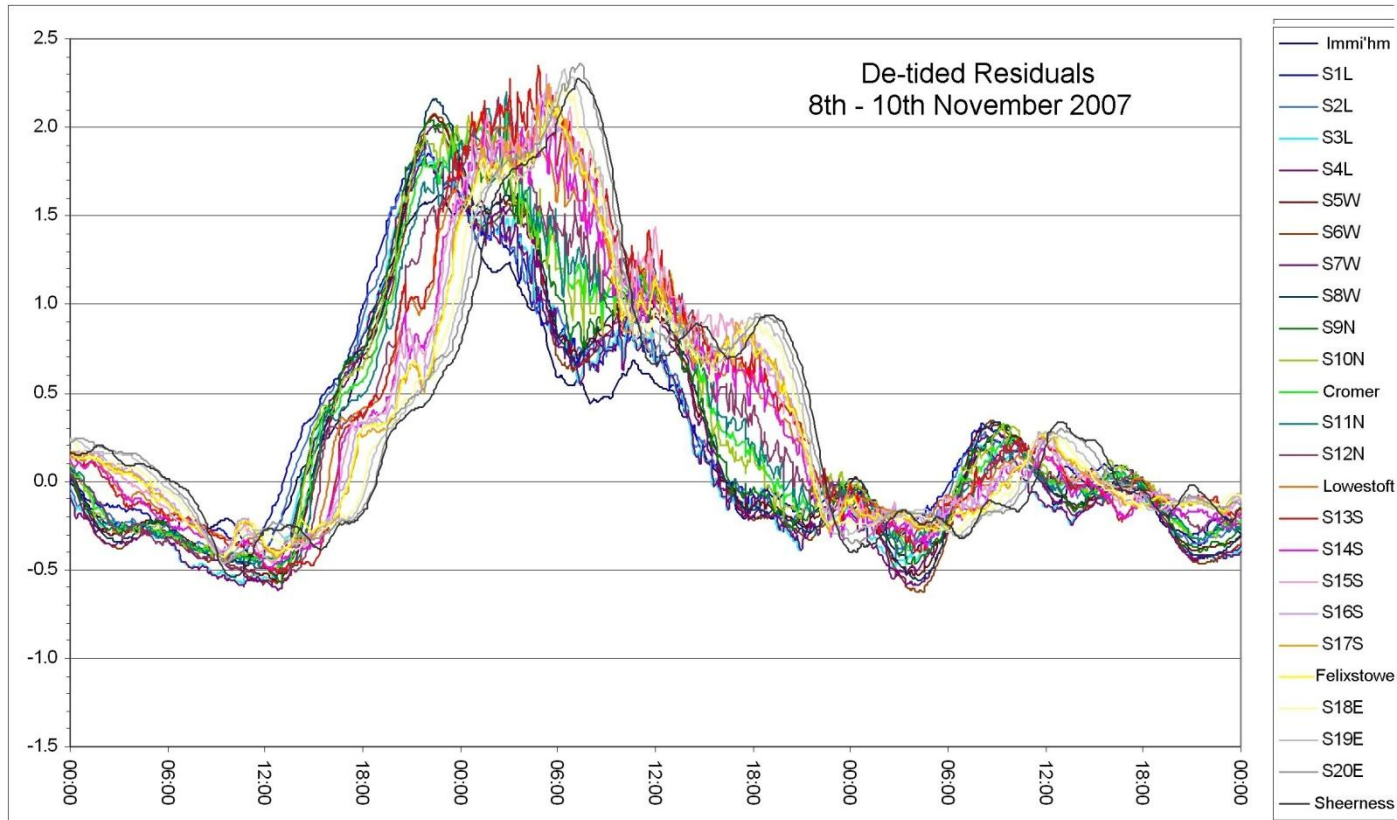
- To be able to analyse annual, seasonal or monthly data sets spurious data had to be corrected and data gaps had to be filled
- In the early stages of the project there seemed to be no consistency in directional data
- Once it was established that the compass had to be calibrated in the frame we began to see consistency at each site and we were then able to use these consistencies to identify any anomalous compass drift

Reliability in Consistency

- Throughout a deployment period MSL did not vary between sites so we could use this as a temporary datum
- We used the NTSLF to be able to reduce our sites to ODN (the UK datum)
- Tidal data were harmonically analysed against 34 constituents
- Instrument settlement was identified using the residuals from the harmonic analysis and the pitch and roll sensors from the *.sen file
- Any mistakes made in settlement corrections were identified from annual analysis where there would be a noticeable step following a second analysis against 60 constituents

Reliability in Consistency

- North sea storm surge 2007

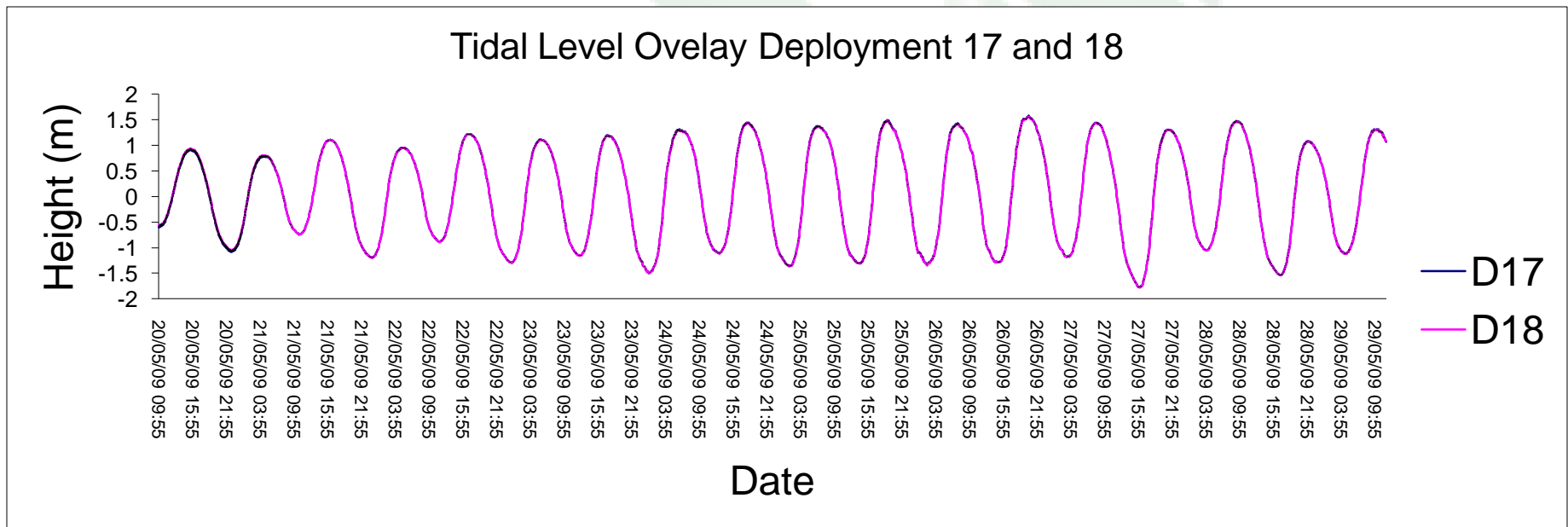


Reliability in Consistency

- If there was a failed recovery we would deploy a second AWAC to maintain a continuous data set
- This meant we had a way of identifying just how consistent the instruments were
- Throughout the final year of the project there were several occasions when there were two AWACs deployed side by side

Instrument Comparisons

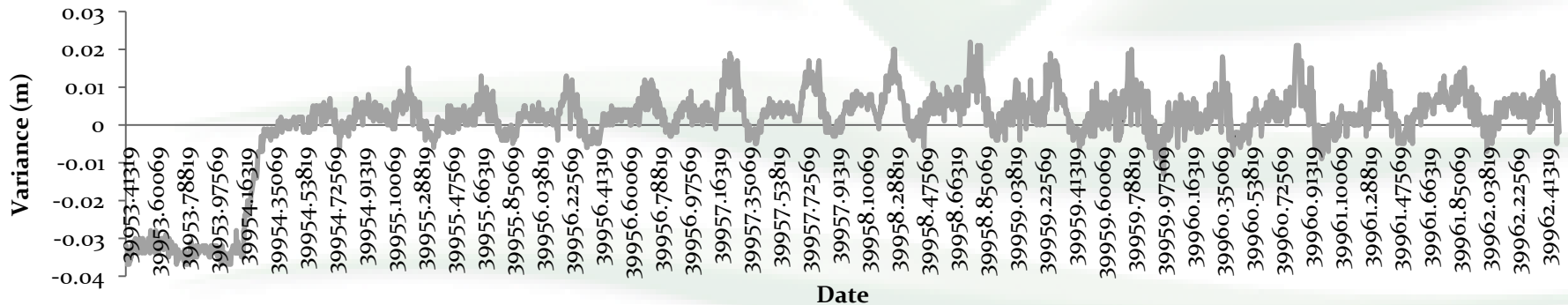
- These tidal data are from S12N Horsey on the Norfolk coast
- Deployment 18 (AWAC 5265) sat alongside Deployment 17 (AWAC 5304) which had lost its surface marker buoy and was unrecoverable. D17 was recovered by divers two weeks later



Instrument Comparisons

- The first day shows an offset due to instrument settlement
- The following 10 days show remarkable similarity with an R^2 value of 0.99986 and variation in the two sets to a maximum of 2.2cm = 0.03% of the water depth

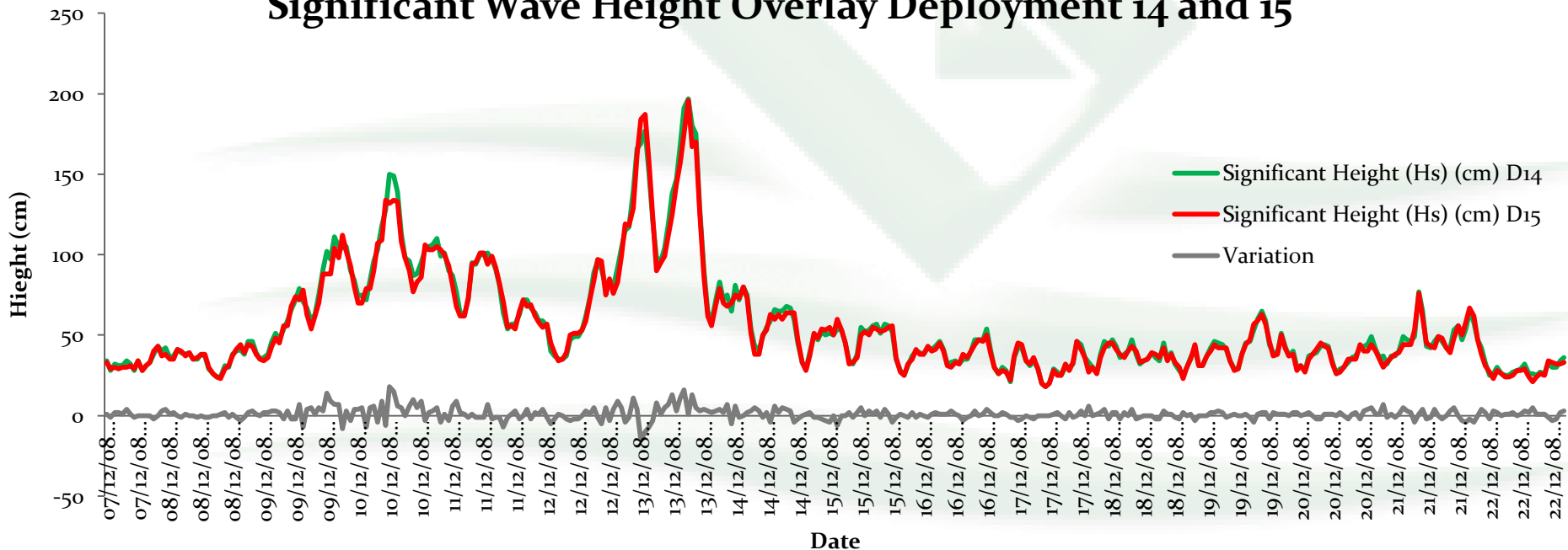
Overlap variance



Instrument Comparisons

- S1L Donna Nook in the approaches to the River Humber also lost its surface marker
- Deployment 14 (AWAC 5111) overlapped with Deployment 15 (AWAC 5304)

Significant Wave Height Overlay Deployment 14 and 15



Instrument Comparisons

- The variation between the two instruments is also very small
- The two data sets have an R^2 value of 0.9881 with a maximum difference in the two sets of 18cm
- The various other parameters recorded by the AWACs also showed a very close correlation

Conclusions

- The consistency between the AWACs meant we could have confidence in our annual, monthly and event files, which are made up of multiple deployments from different instruments
- Very few problems were encountered throughout the project as a result of internal AWAC failures
- They also out performed our expectations in their physical durability
- Having a large instrument pool meant we were able to identify problems and with the support of Nortek rectify them in our workshop and maintain a continuous data set, with calibrated and reliable instruments

Thank you

