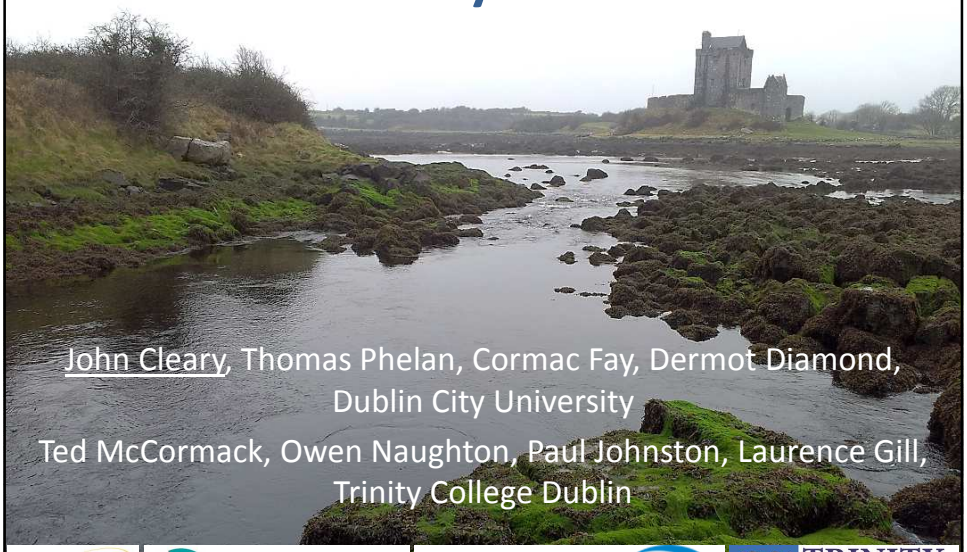
Kinvarra Bay Data Fusion



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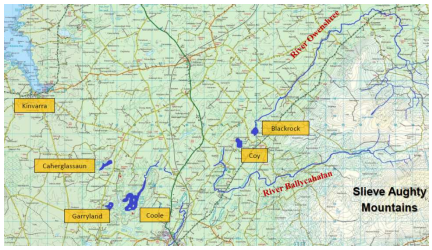
Trinity College Dublin

DCU | NCSR National Centre for Sensor Research | SMARTBAY IRELAND | TRINITY COLLEGE DUBLIN

Objectives

- Develop mobile, wireless-enabled sensing system
- Mapping of conductivity, temperature, depth with high temporal and spatial resolution
- Conduct boat-based transects of Kinvarra bay in order to determine quantity of submarine freshwater inputs from north Galway karst system

Background



- Karst system with series of turloughs
- 2 major freshwater inputs to Kinvarra Bay

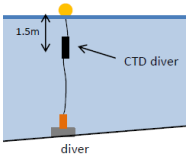
Problem

Low Tide

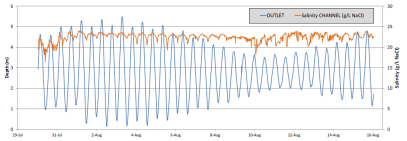
High Tide

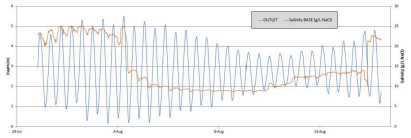
- Intertidal freshwater inputs
- Flows cannot be easily gauged

Previous sampling (TCD)



- Fixed point sampling using CTD Diver probes





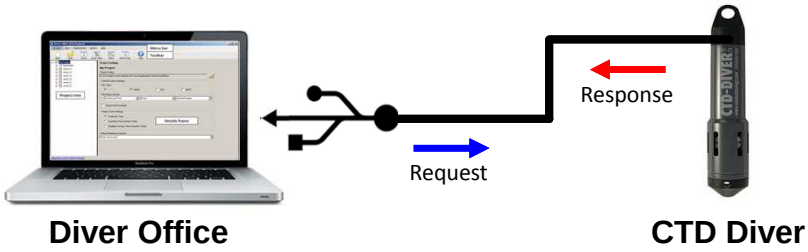
- Data from two previous deployments

CDT Diver integration

- Communications Protocol
- Management Application
- System Testing
- Hardware purchased
  - CTD Diver
  - Diver Gate & cable
  - Raspberry Pi system
  - €2,400 approx.

Communications protocol

- Protocol determined using Diver Office software



Management Application

- Interface program
  - Written in Java
- CTD-PC
  - Extracts data from CTD Diver
    - Time stamp, conductivity, temperature, & depth
  - Sampling frequency controllable
    - e.g. 1 Hz or greater
- PC-GFT
  - Uploads data to GFT
  - Reporting period controllable

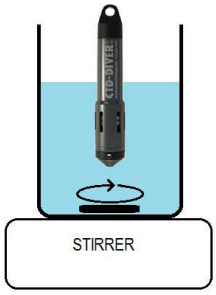
System testing

(1)

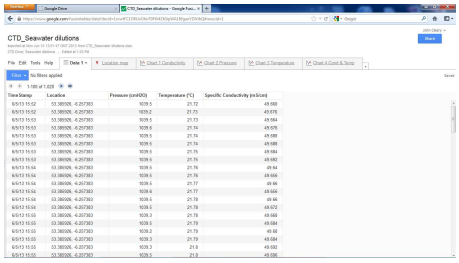
- CTD Diver validated by comparison with Hach Lange HQ40d conductivity probe
- Conductivity standard, tap water, seawater (Clontarf)

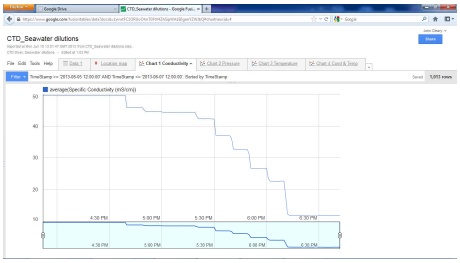
(2)

- Dynamic test using seawater dilutions
- Known volumes of tap water added at intervals
- Upload to Google Fusion Tables

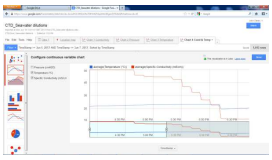


GFT interface





- Data uploaded to Google Fusion Tables
- Various views for data display / analysis
  - Data tables
  - Charts
  - Select individual parameters or overlay data streams



Kinvarra deployment

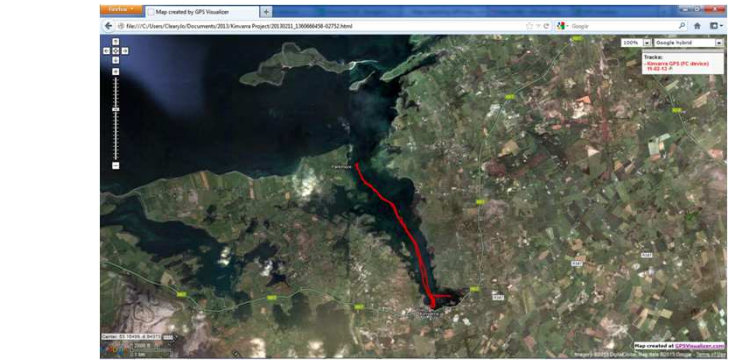
- 11 February 2013
- DCU, TCD and NUIM teams
- SmartBay provided hired rib & technical support
- GPS unit and 2 x CTD Diver used to perform longitudinal transects of Kinvarra bay
- Separate CDT Diver also deployed at fixed point
- Divers mounted at side of rib:
  - "Shallow – B" sub-surface (0-50 cm)
  - "Deep – A" approx 100 cm (outward); 200 cm (return)

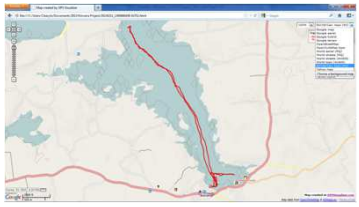
Photos



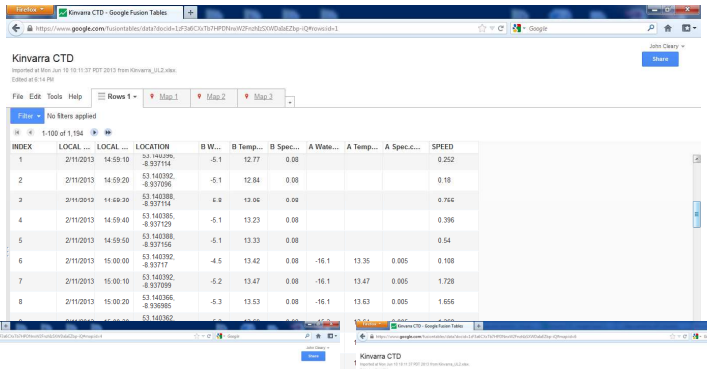


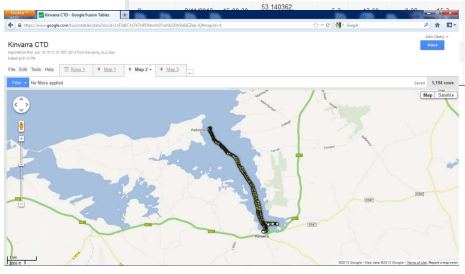
gpsvisualizer.com

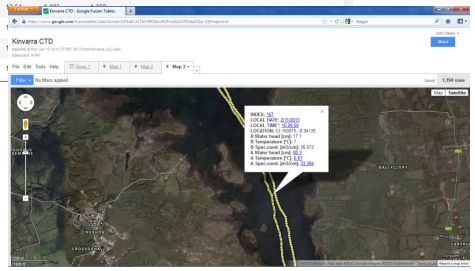




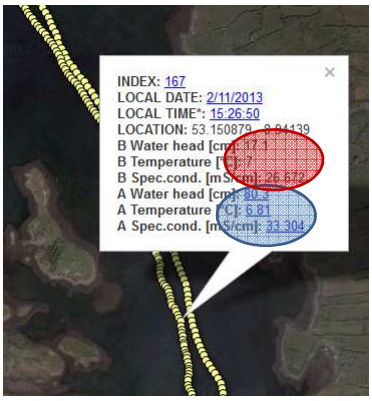
Data on Google Fusion Tables

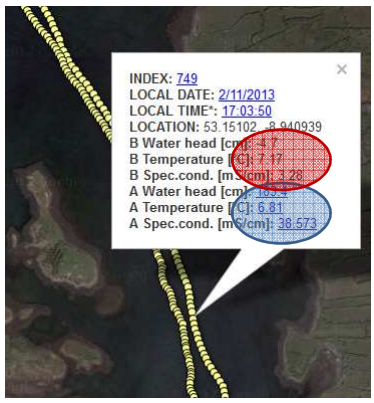






Point comparisons

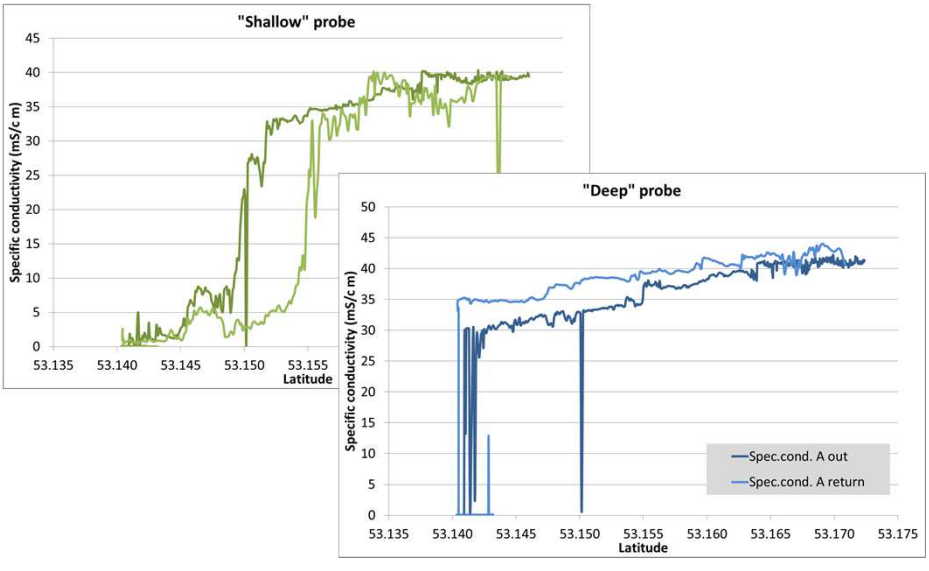


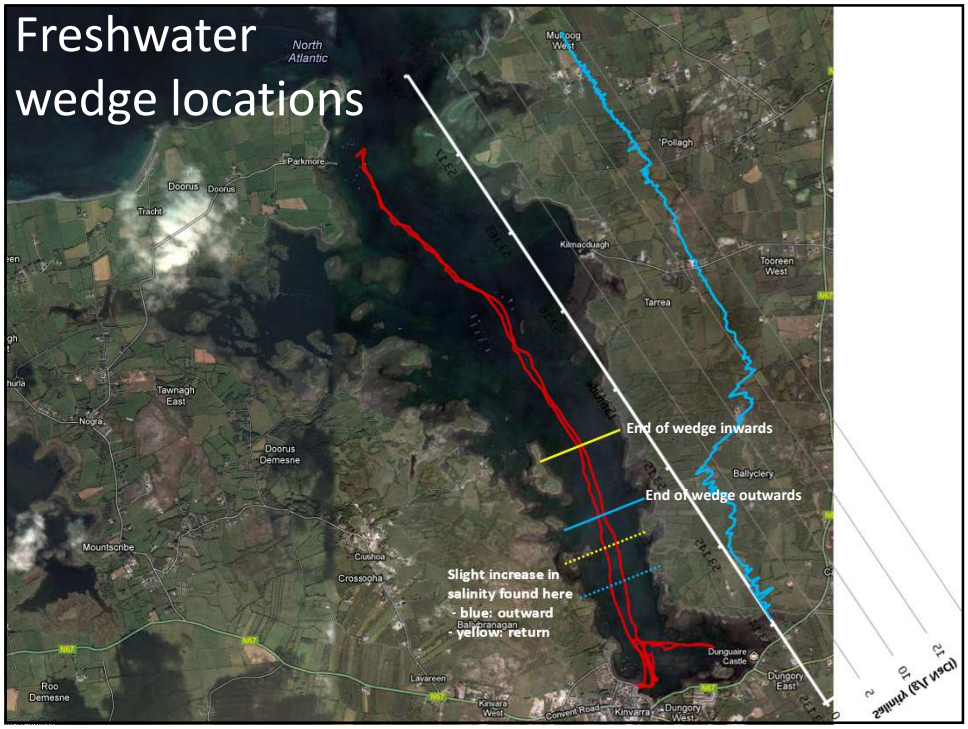


Outward transect Return

Significant decrease in conductivity of “shallow” probe indicates shift in position of freshwater wedge

Transects





Future Work

- Kinvarra wireless availability:
  - Calls and Texts ✓
  - GPRS / 3G ?
- Device
  - Encapsulation/packaging
  - Deployment scenario
  - Mounting

Conclusions

- CTD probe enabled with communications capability using Raspberry Pi system
- Transect data collected at Kinvarra Bay and hosted on Google Fusion Tables
- System available for future deployments

Acknowledgements

- SmartBay
  - Paul Gaughan, Damien Glynn
- DCU project team
  - Thomas Phelan, Cormac Fay, Dermot Diamond
- TCD project team
  - Ted McCormack, Owen Naughton, Paul Johnston, Laurence Gill