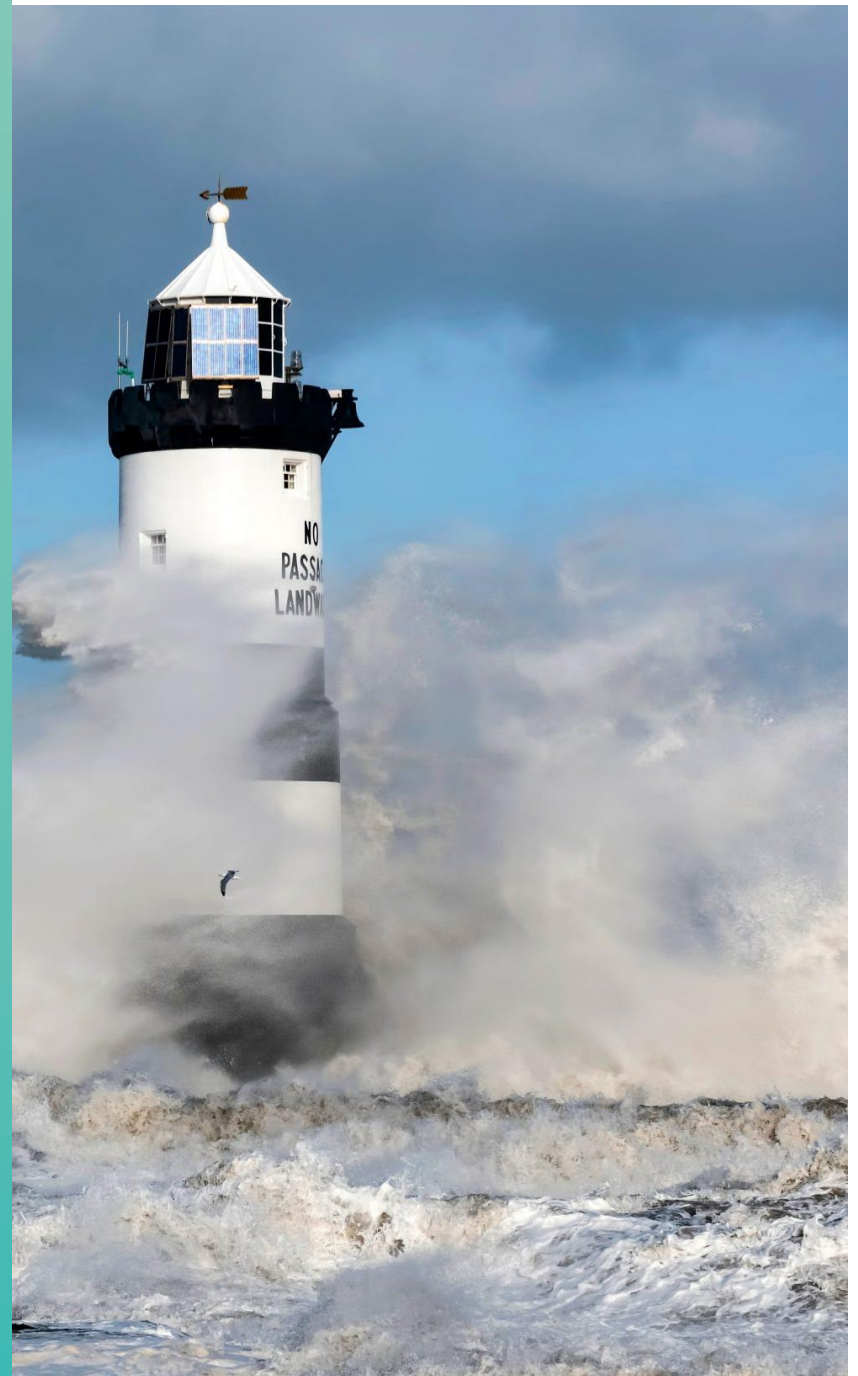


# The use of Internet of Things sensors and ERDDAP in a nowcast hazard alerting coastal flood system

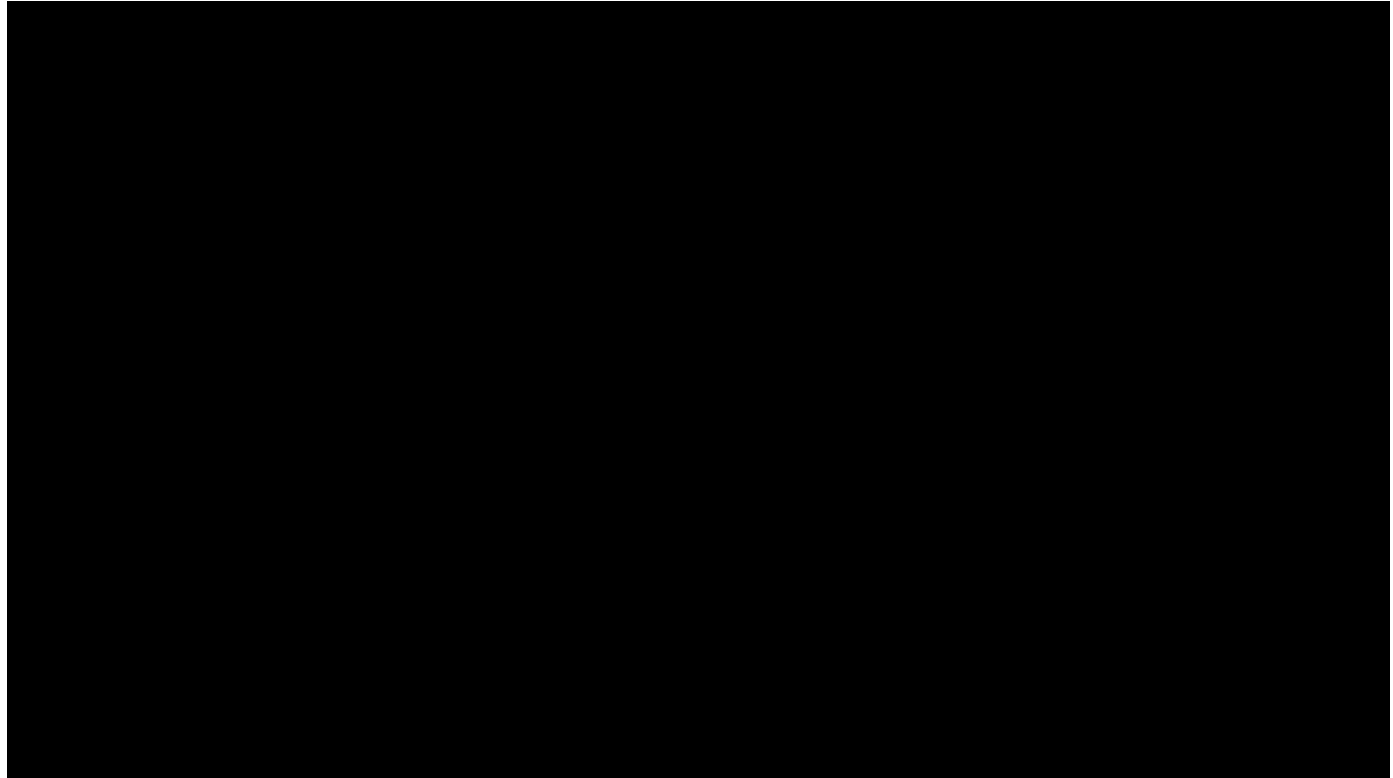
**Lou Darroch**, Tom Gardner, Emma Slater, Mags Yelland, John Walk, Andy Matthews, Chris Cardwell, Owain Jones, Alvaro Lorenzo Lopez and Jenny Brown



# Wave overtopping



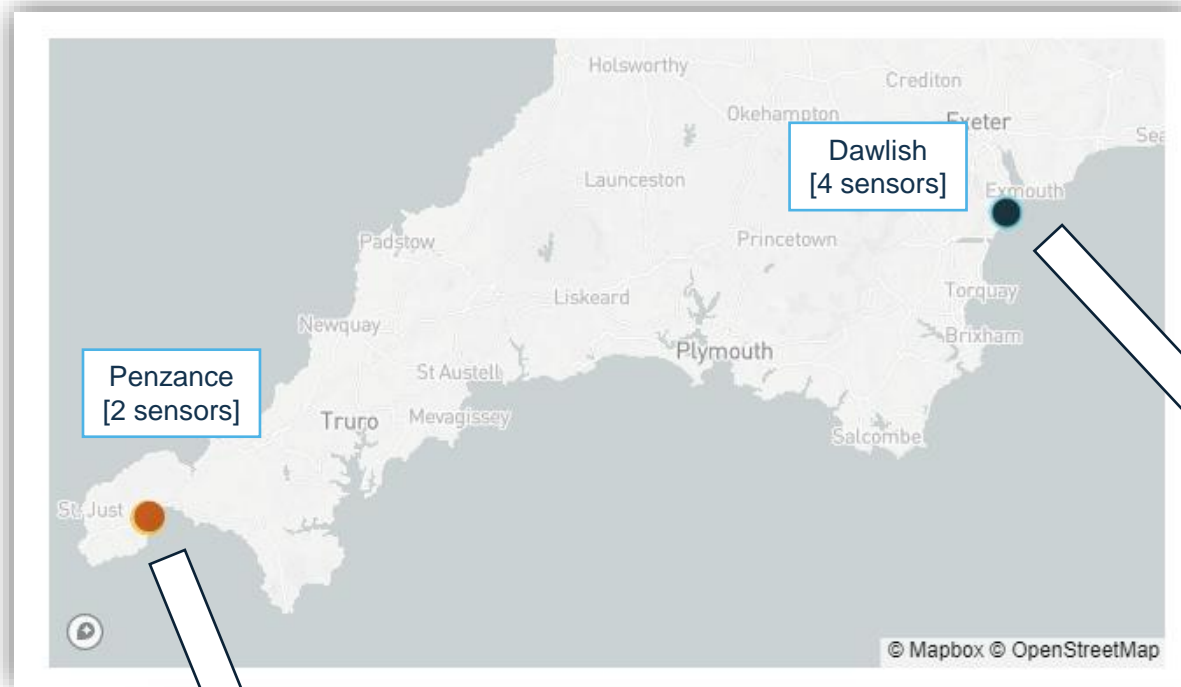
- NERC Digital Environment
- Capacitance wire system
- Early detection
- Validation of models and forecasts



Natural  
Environment  
Research Council



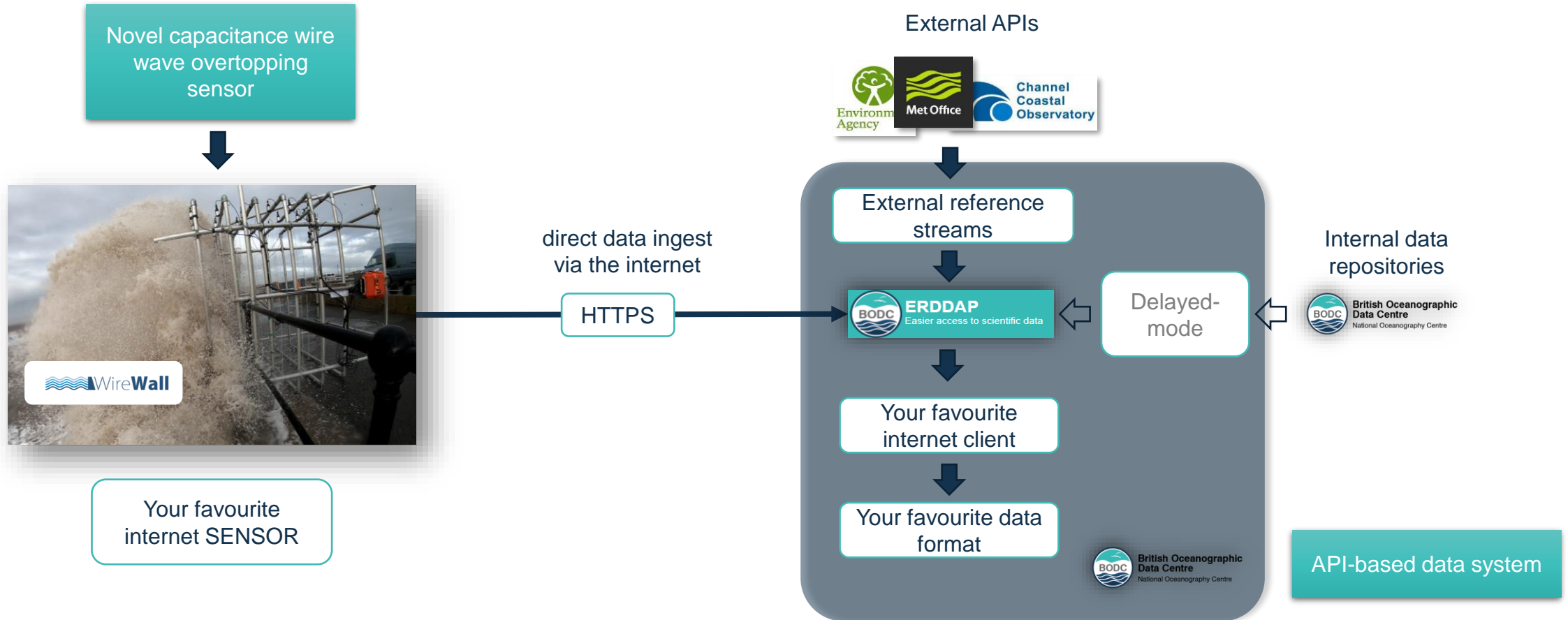
# Demonstration



Demonstrations at two high energy sites

# Internet of Things

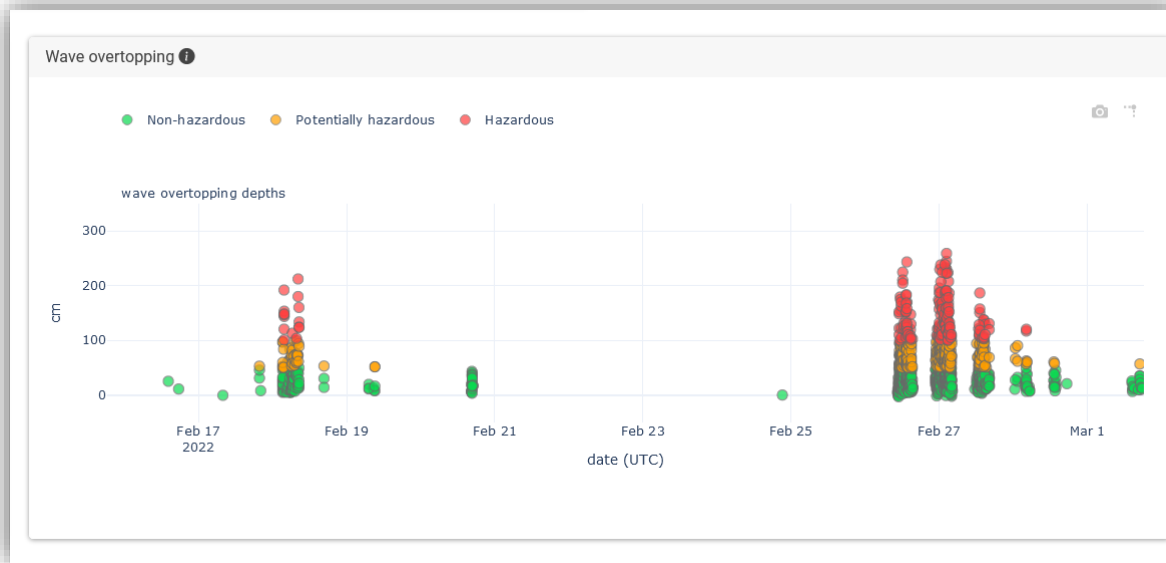
*“Dumb objects becoming connected”*



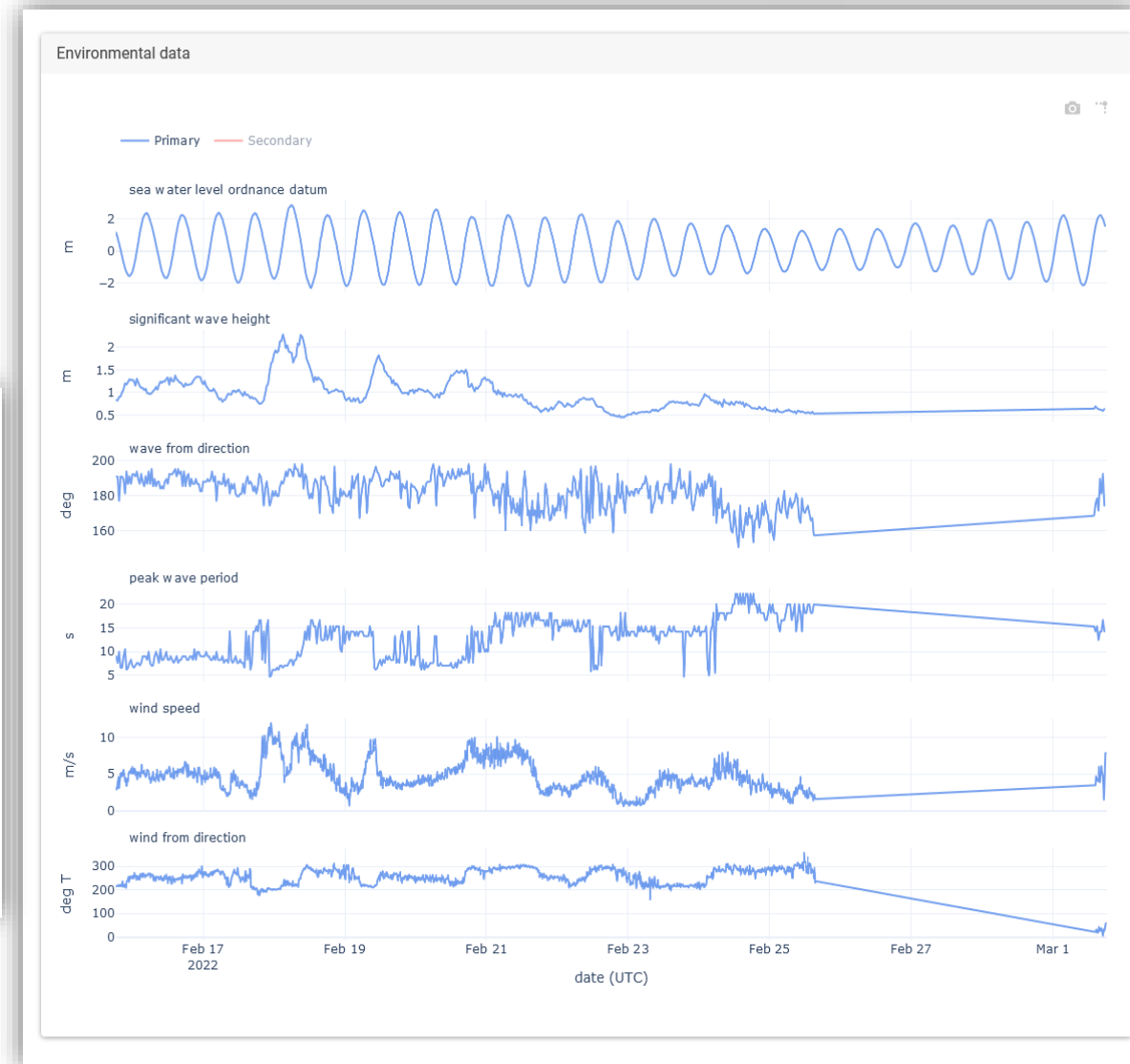
<https://linkedsystems.uk/erddap/tabledap/>

# ERDDAP demo & results

- 10 minutes from measurement to data access
- Nowcast current data
- Possible to plug n' play WireWall in strategic locations

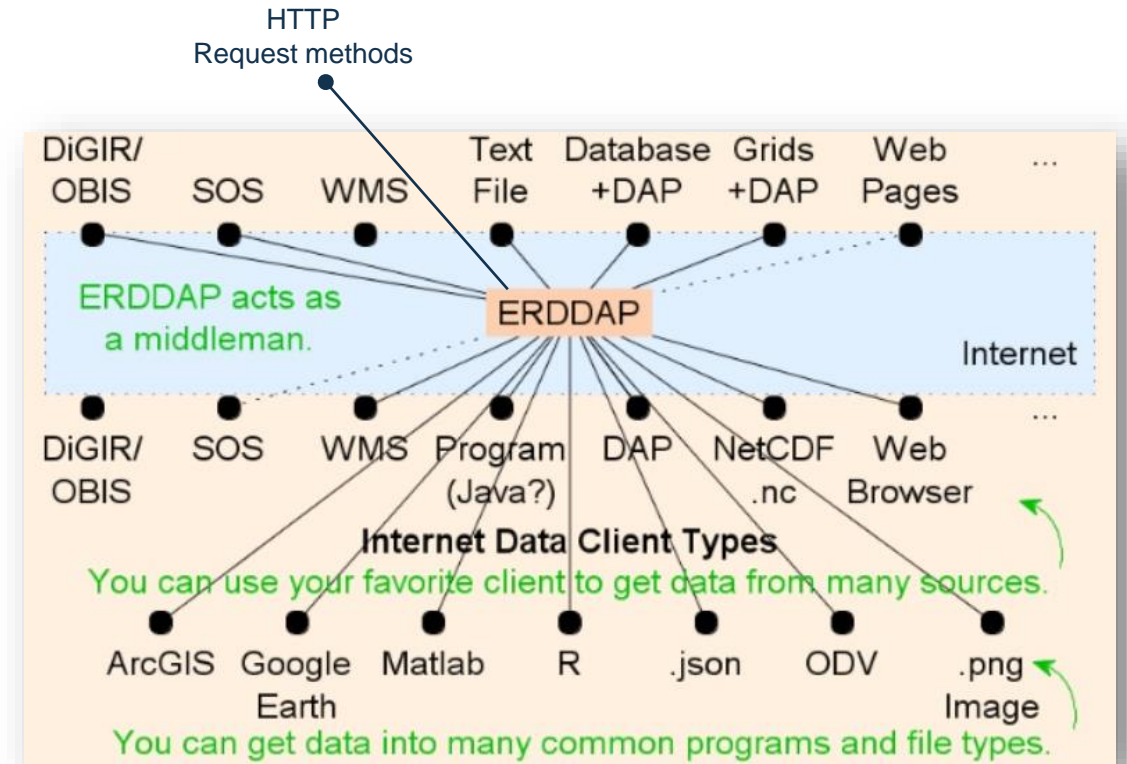


<https://linkedsystems.uk/erddap>



# What is ERDDAP?

- **Application Programming Interface (API)**
- Brokers lots of different formats
- Open source, no databases > low maintenance
- Machine 2 machine communication protocols (Rest)



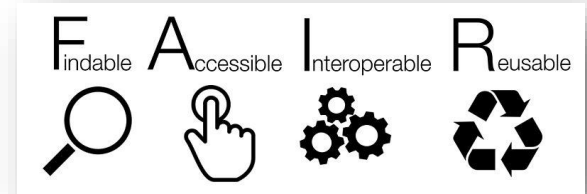
ease of access without costly infrastructure

# Data mapping

**Data sent:** [http://linkedsystems.uk/erddap/tabledap/CreamT\\_747f\\_b818\\_8edf.insert?stationID=D01&sampleNUM=1&sampleNUM10=1&time=1606961703&wireID=1&instrumentID=BODC\\_TEST&eIVAR=0.4657&author=Johnsmith\\_pasxxxxxxx](http://linkedsystems.uk/erddap/tabledap/CreamT_747f_b818_8edf.insert?stationID=D01&sampleNUM=1&sampleNUM10=1&time=1606961703&wireID=1&instrumentID=BODC_TEST&eIVAR=0.4657&author=Johnsmith_pasxxxxxxx)

## Data in ERDDAP:

variable	latitude		double	
attribute	latitude	_ChunkSizes	int	1
attribute	latitude	_CoordinateAxisType	String	Lat
attribute	latitude	actual_range	double	48.0049, 49.1192
attribute	latitude	ancillary_variables	String	POSITION_SEADATANET_QC
attribute	latitude	axis	String	Y
attribute	latitude	grid_mapping	String	crs
attribute	latitude	ioos_category	String	Location
attribute	latitude	long_name	String	Latitude
attribute	latitude	sdn_P02_name	String	Horizontal spatial co-ordinates
attribute	latitude	sdn_P02_urn	String	SDN:P02::ALAT
attribute	latitude	sdn_parameter_name	String	Latitude north
attribute	latitude	sdn_parameter_urn	String	SDN:P01::ALATZZ01
attribute	latitude	sdn_uom_name	String	Degrees north
attribute	latitude	sdn_uom_urn	String	SDN:P06::DEGN
attribute	latitude	standard_name	String	latitude
attribute	latitude	units	String	degrees_north
attribute	latitude	valid_max	double	90.0
attribute	latitude	valid_min	double	-90.0

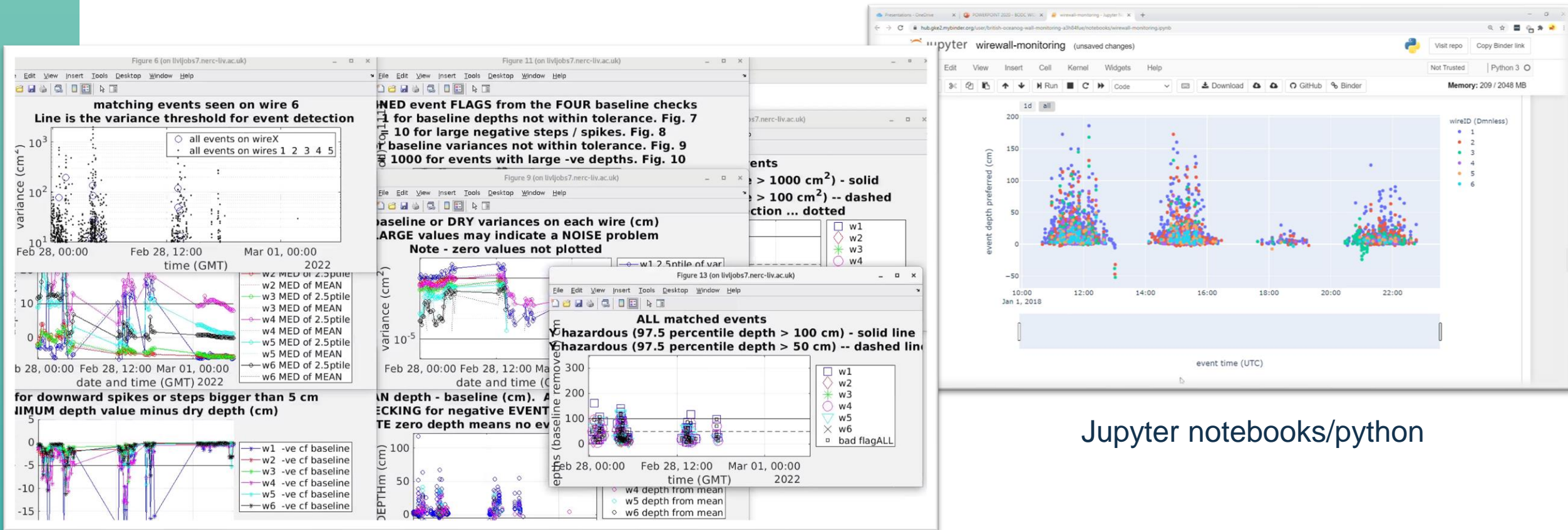


[https://linkedsystems.uk/erddap/info/CreamT\\_747f\\_b818\\_8edf/index.html](https://linkedsystems.uk/erddap/info/CreamT_747f_b818_8edf/index.html)



# Health monitoring

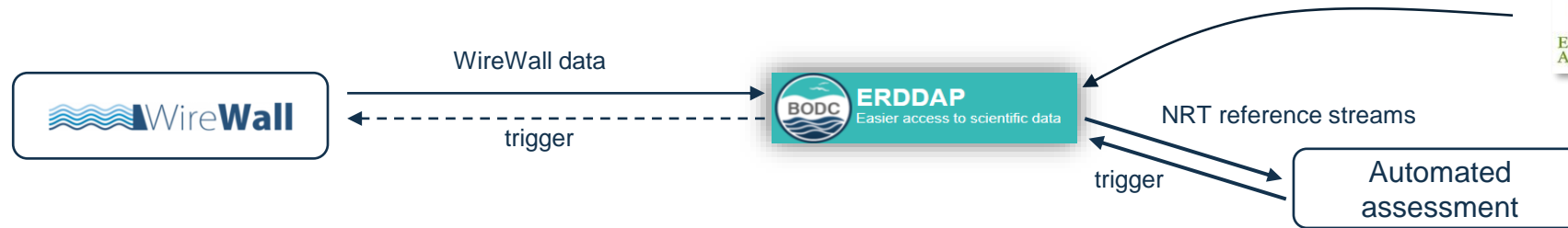
- Retrieved using Restful communication protocols
- e.g. Build easy health assessments modules for near real-time monitoring



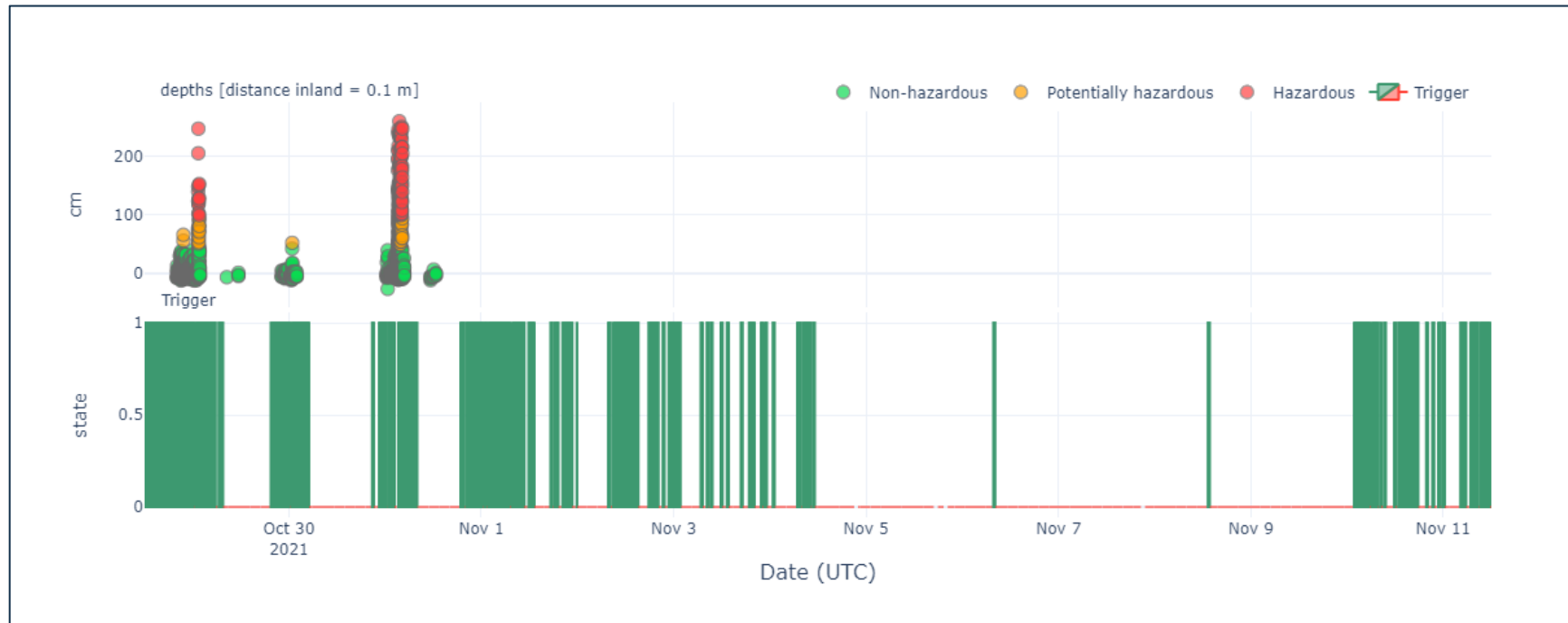
Jupyter notebooks/python

Matlab

# Two-way communication (SMART monitoring)



[https://linkedsystems.uk/erddap/tabledap/CreamT\\_NRT\\_Triggers\\_16c9\\_cbb4\\_e94b.html](https://linkedsystems.uk/erddap/tabledap/CreamT_NRT_Triggers_16c9_cbb4_e94b.html)



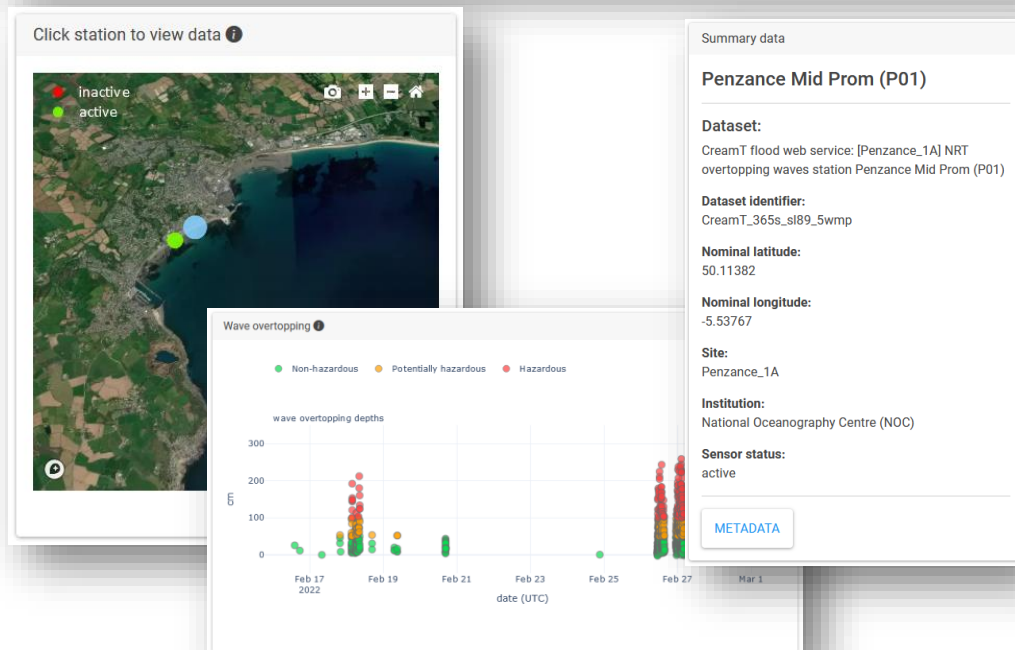
## Risk informed decision making

- Build application layers



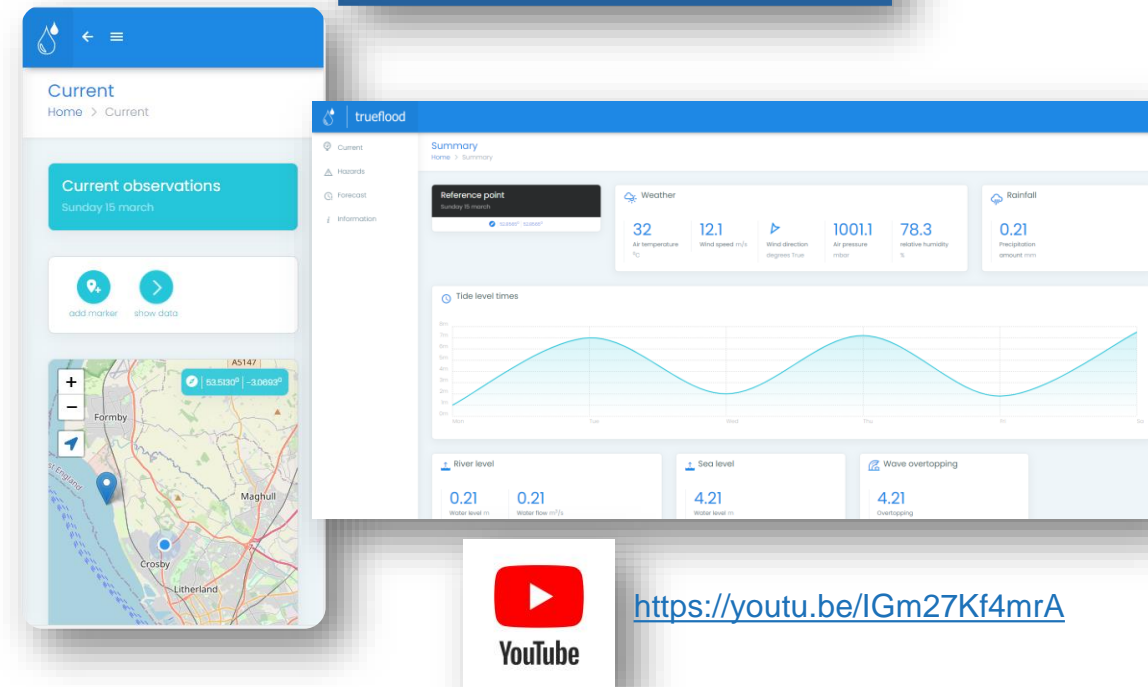
<https://noc-coastal-hazards-explorer.app/>

**CreamT Coastal Hazard Explorer**



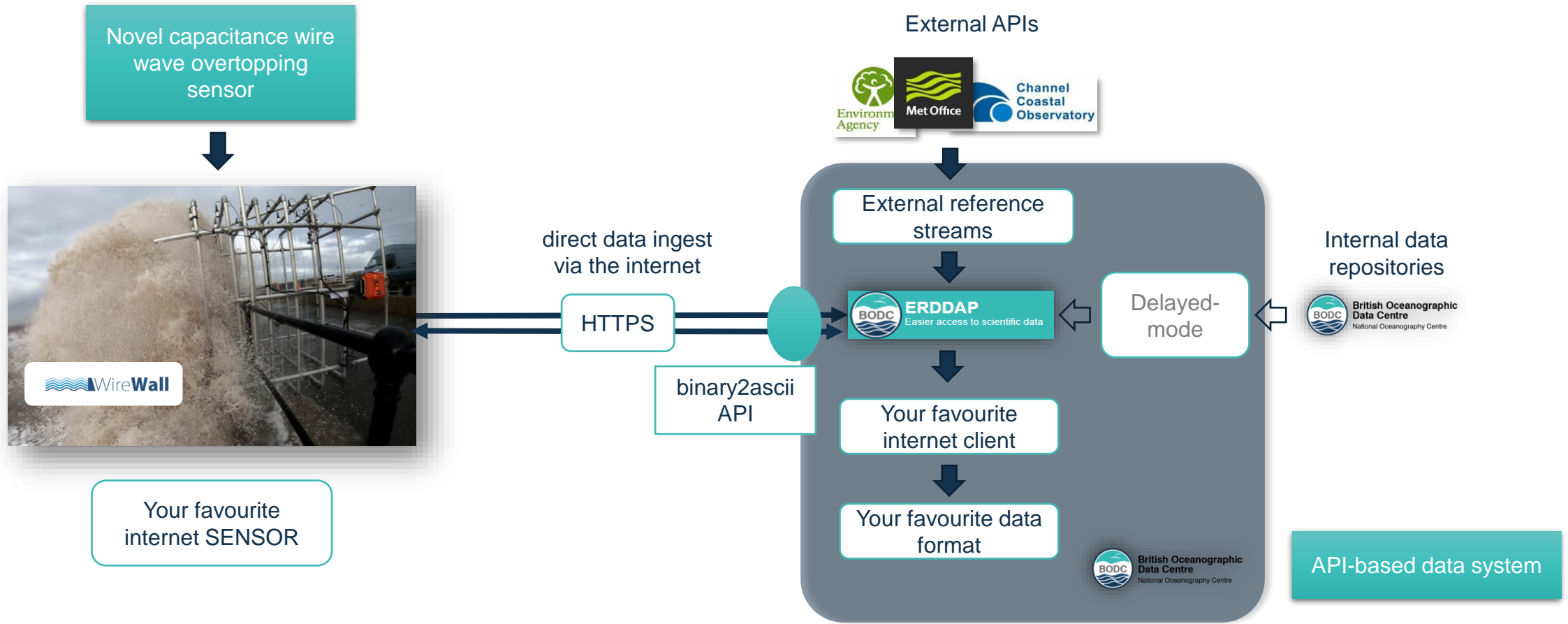
<https://trueflood.app/>

**trueflood**



# Battery power and data integrity

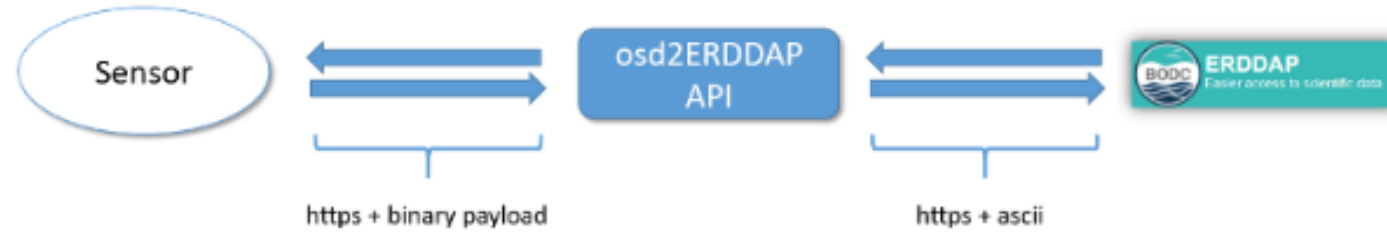
- Conversion from Binary to ascii can be quite power hungry at the sensor
- But https important for data integrity



<https://linkedsystems.uk/erddap/tabledap/>



# Battery power and data integrity



```
HTTP/1.1 200 OK
Date: Thu, 31 Mar 2022 14:49:12 GMT
Server: gunicorn
Strict-Transport-Security: max-age=31536000; includeSubDomains
X-Content-Type-Options: nosniff
X-Frame-Options: sameorigin
X-XSS-Protection: 1; mode=block
Content-Type: text/html; charset=utf-8
Vary: Accept-Encoding
Content-Encoding: gzip
Content-Length: 104
Connection: close

{
  "stationID": "Dawlish",
  "time": "2022-03-31T14:40:03Z",
  "endTime": "2022-03-31T16:40:03Z",
  "state": 1,
  "timestamp": "2022-03-31T14:40:04.050Z"
}
```

# Summary

- IoT makes it possible to nowcast current data
- IoT makes it possible to plug n' play in specific locations
- APIs brings ease of access without costly infrastructure
- Data mapping enables analysis on other software platforms

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