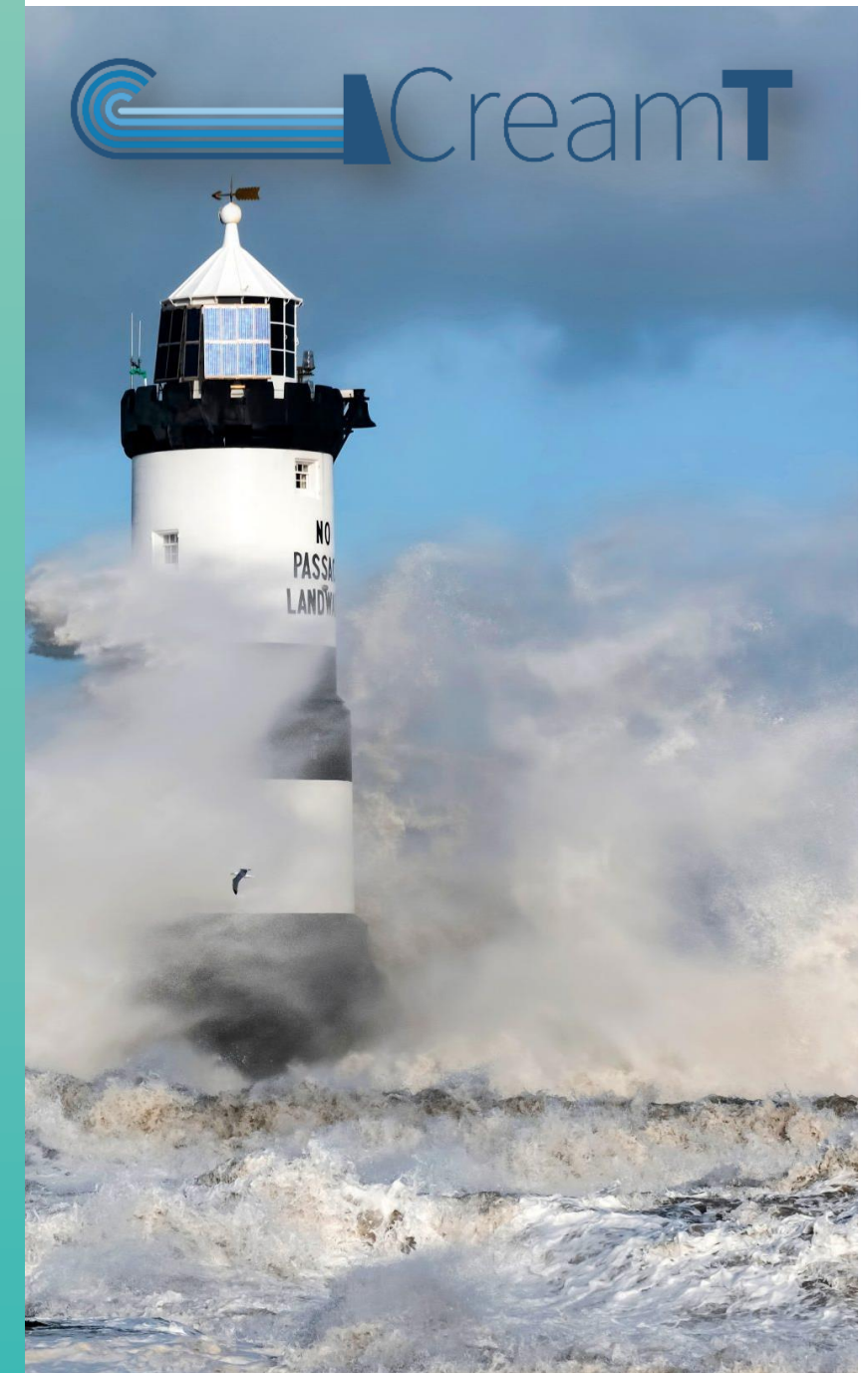


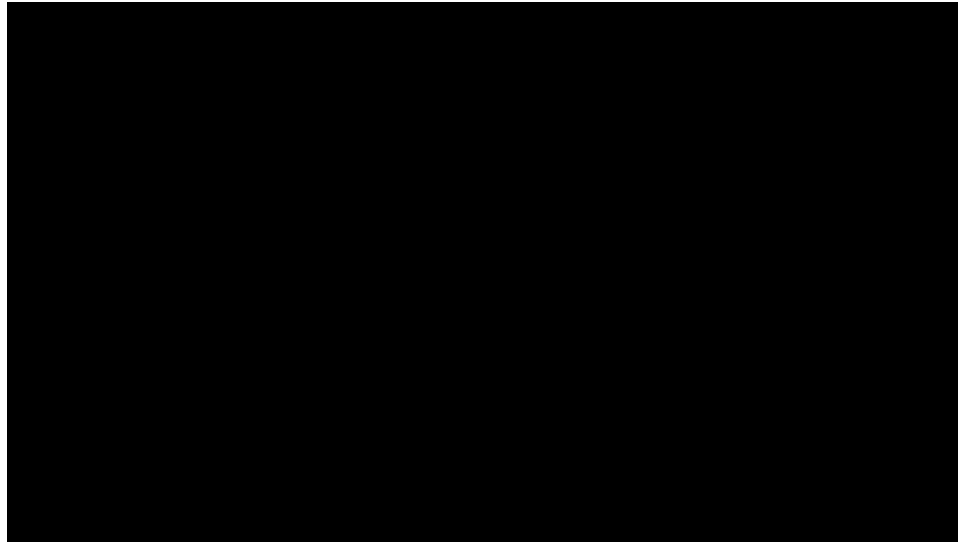
Mitigating global coastal ocean risks using Internet of Things

Lou Darroch, Tom Gardner, Emma Slater, Mags Yelland, John Walk, Andy Matthews, Chris Cardwell, Owain Jones, Liz Bradshaw, Justin Buck, Andrew Hale, Matt Cazaly, Chris Thompson, Rob Jennings, Quyen Luong, Jordan Atherton, Richard Downer, Kay Thorne, Alvaro Lorenzo Lopez and Jenny Brown



Wave overtopping





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

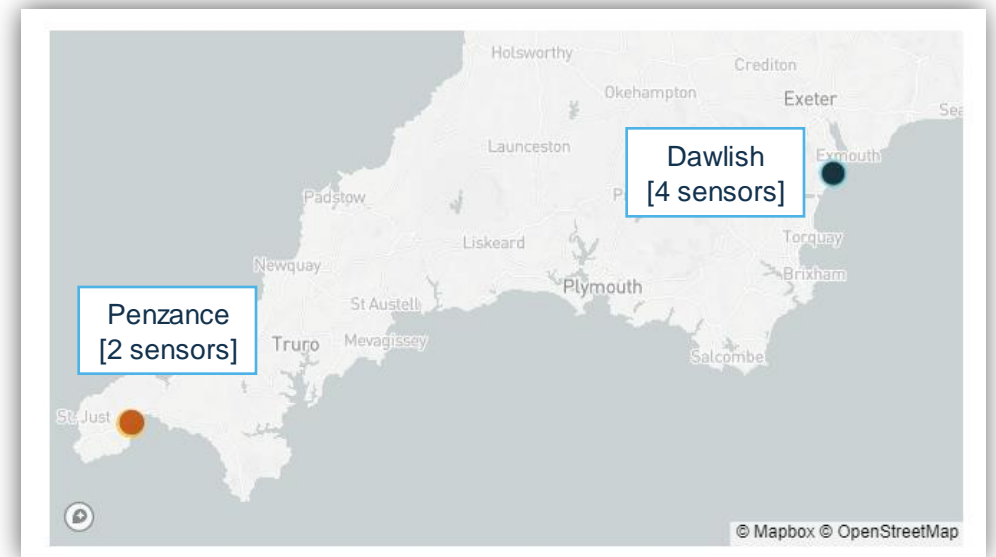



Department
for Environment
Food & Rural Affairs



Natural
Environment
Research Council

Demonstrations at two high
energy sites

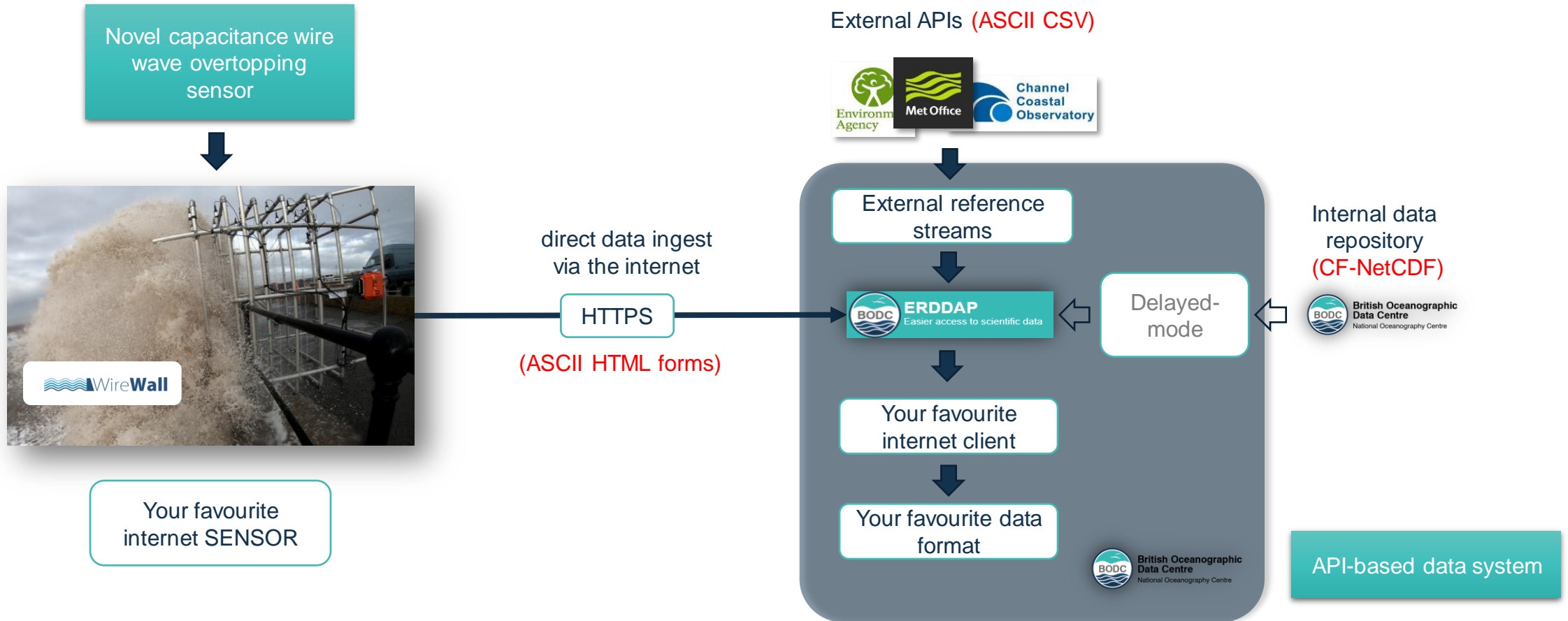


Internet of Things

“Dumb objects becoming connected”



NOTE the different formats!



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

ERDDAP demo & results

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

- 10 minutes from measurement to data access

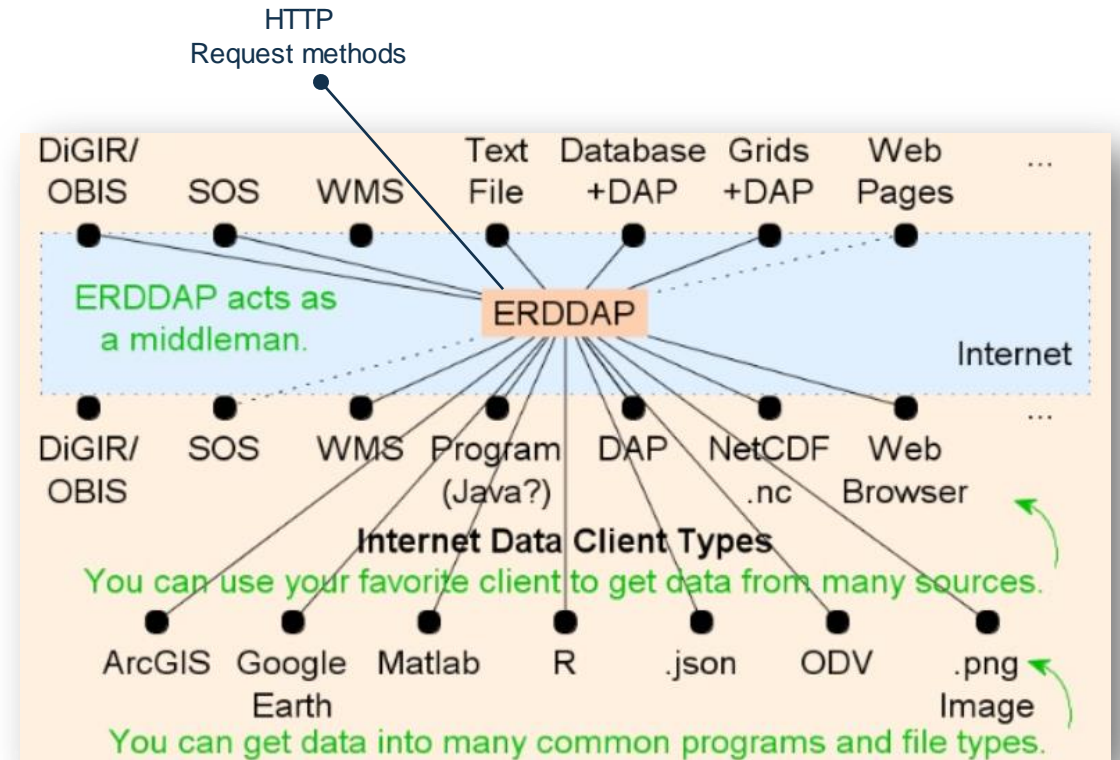


Why ERDDAP?

- A data brokerage service providing access via a single interface
- Open source, strong community support (**low maintenance**)
- Currently used by over 90 institutes worldwide

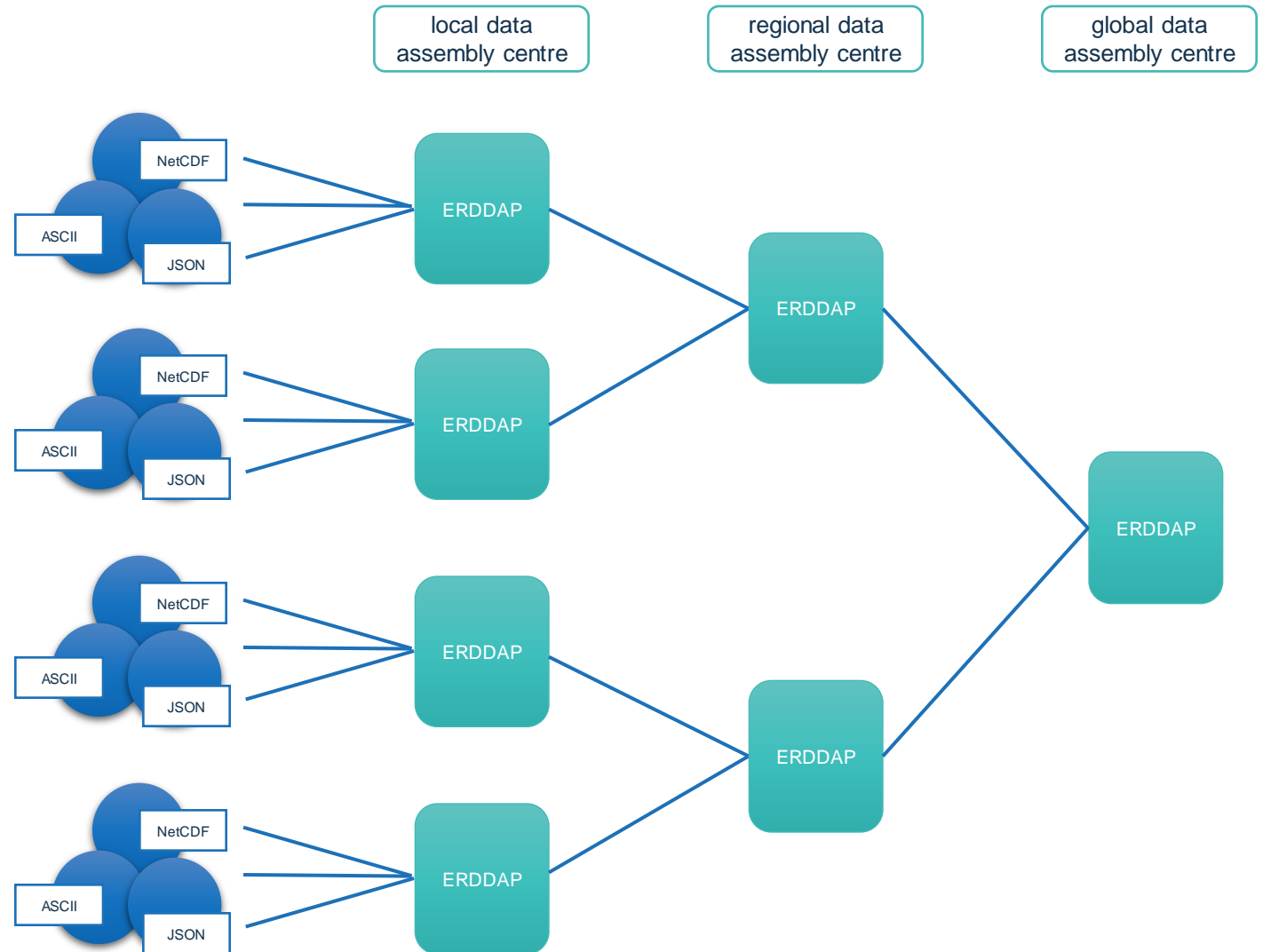
Is it FAIR?

- Need to use programmatic ways to move towards FAIR compliance (**machine-2-machine actionable data**)
- ERDDAP enables us to help make our IoT sensors FAIR and beyond at the ERDDAP interface



Interoperable

- Easy to federate ERDDAP nodes
- Locally to help loads
- Globally across nodes



Reusable

- Fix metadata to community standards

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_pasxxxxxxxx

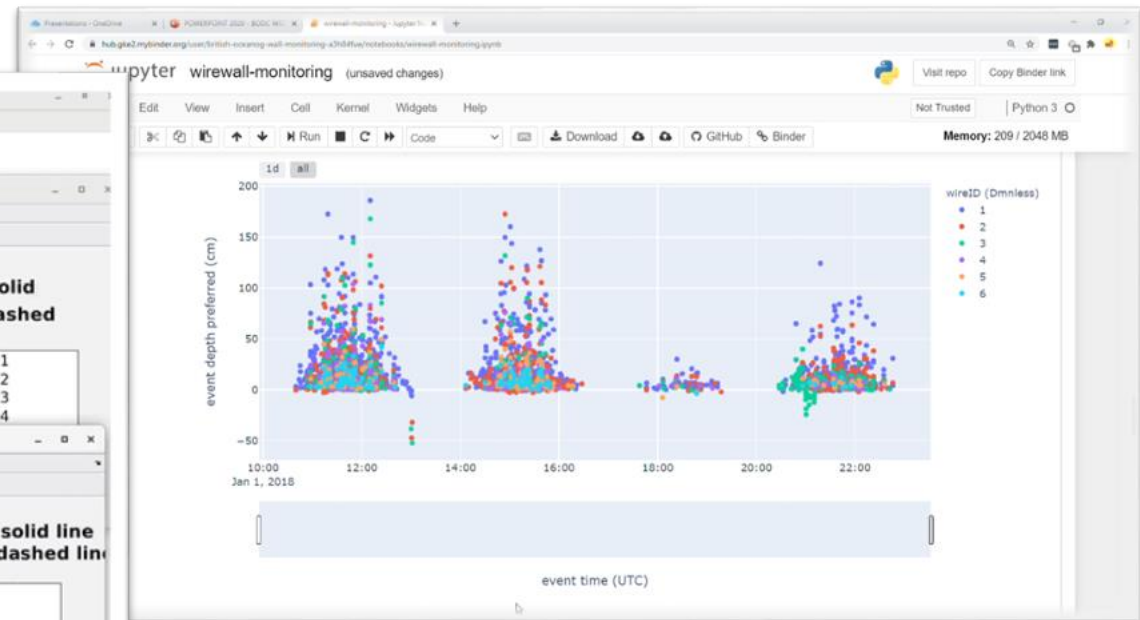
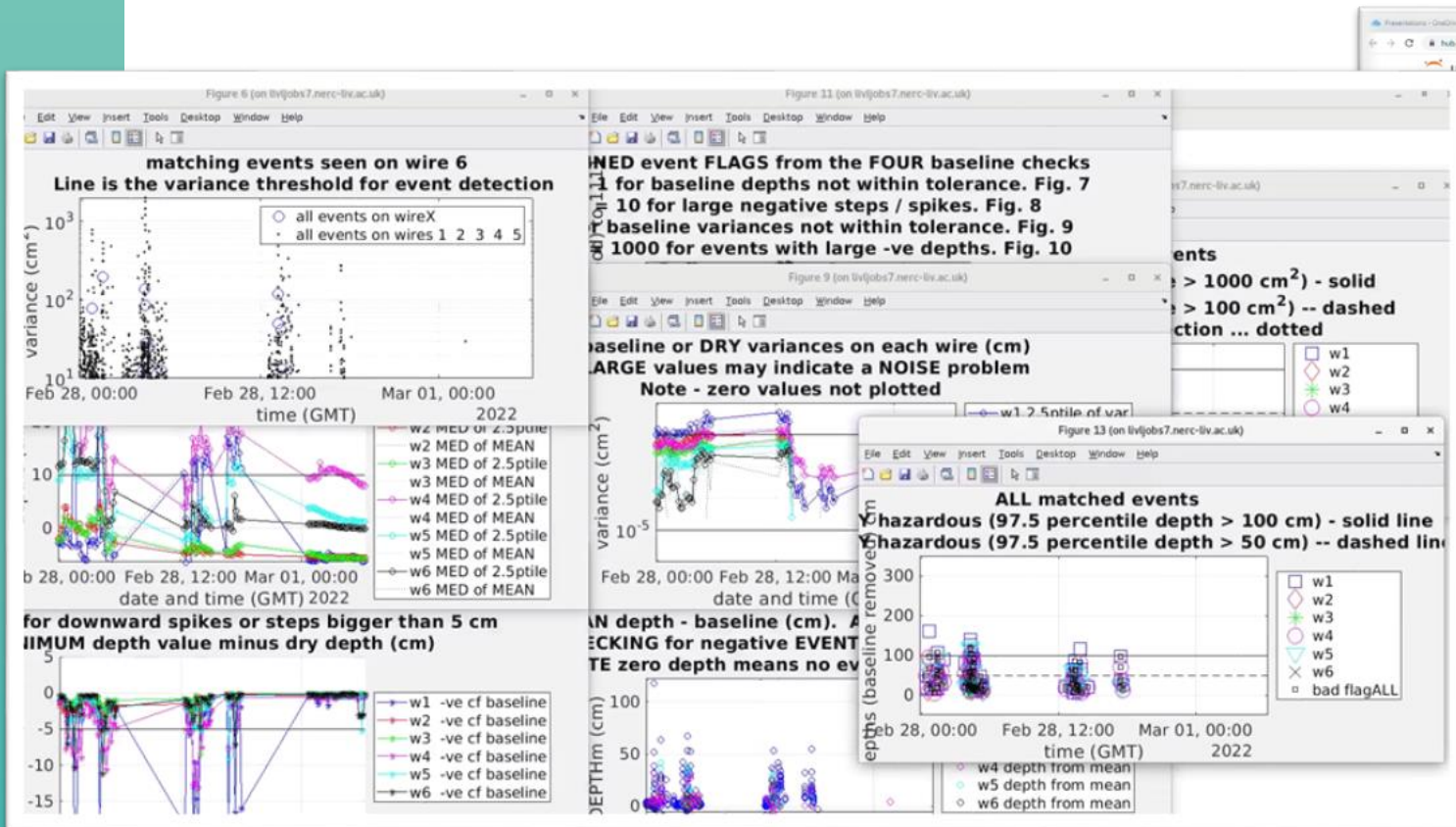
Data in ERDDAP:

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

Accessible

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



Jupyter notebooks/python

Matlab

Findable

- Is or can be registered in searchable resources

schema.org

ISO 19115-2

```
C:\Users\lorr > Downloads > CreamT_747f_b818_8edf_iso19115 (1).xml
1 <?xml version="1.0" encoding="UTF-8"?>
2 <gmi:MI_Metadata xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
3 xsi:schemaLocation="https://www.isotc211.org/2005/gmi https://data.noaa.gov/resources/iso19139/schema.x
4 xmlns:xlink="http://www.w3.org/1999/xlink"
5 xmlns:gco="http://www.isotc211.org/2005/gco"
6 xmlns:gmd="http://www.isotc211.org/2005/gmd"
7 xmlns:gmx="http://www.isotc211.org/2005/gmx"
8 xmlns:gml="http://www.opengis.net/gml/3.2"
9 xmlns:gss="http://www.isotc211.org/2005/gss"
10 xmlns:gts="http://www.isotc211.org/2005/gts"
11 xmlns:gsr="http://www.isotc211.org/2005/gsr"
12 xmlns:gmi="http://www.isotc211.org/2005/gmi"
13 xmlns:srv="http://www.isotc211.org/2005/srv">
14 <gmd:fileIdentifier>
15 <gco:CharacterString>CreamT_747f_b818_8edf</gco:CharacterString>
16 </gmd:fileIdentifier>
17 <gmd:language>
18 <gmd:LanguageCode codeList="https://data.noaa.gov/resources/iso19139/schema/resources/Codelist/gmxCode
19 </gmd:language>
20 <gmd:characterSet>
21 <gmd:MD_CharacterSetCode codeList="https://data.noaa.gov/resources/iso19139/schema/resources/Codelist
22 </gmd:characterSet>
23 <gmd:hierarchyLevel>
24 <gmd:MD_ScopeCode codeList="https://data.noaa.gov/resources/iso19139/schema/resources/Codelist/gmxCode
25 </gmd:hierarchyLevel>
26 <gmd:hierarchyLevel>
27 <gmd:MD_ScopeCode codeList="https://data.noaa.gov/resources/iso19139/schema/resources/Codelist/gmxCodeLists.xml#gmd:MD_ScopeCode"
28 </gmd:hierarchyLevel>
29 <gmd:contact>
30 <gmd:CI_ResponsibleParty>
31 <gmd:individualName>
32 <gco:CharacterString>Emma Slater</gco:CharacterString>
33 </gmd:individualName>
34 <gmd:organisationName>
35 <gco:CharacterString>BODC</gco:CharacterString>
36 </gmd:organisationName>
```

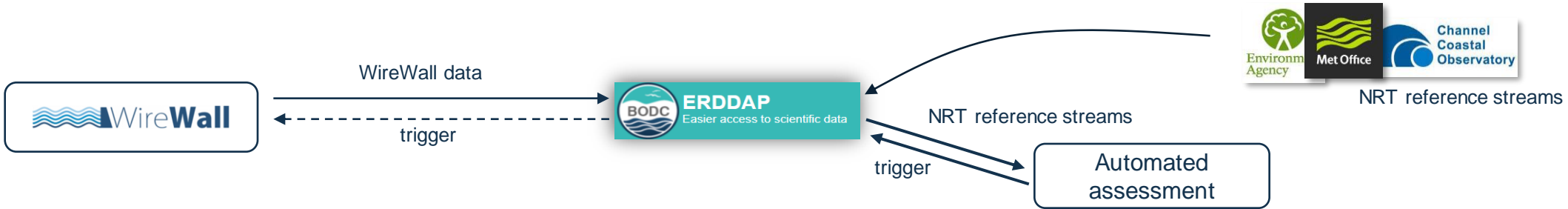
```
view-source:https://linkedsystems.uk/erddap/info/CreamT_747f_b818_8edf/index.html
Apps Files - OneDrive NERC Webmail and... Admin Float - Login Site | F... LD_BODC - OneDrive
2892 <script type="application/ld+json">
2893 {
2894   "@context": "http://schema.org",
2895   "@type": "Dataset",
2896   "name": "CreamT flood web service: [Dawlish_1A] NRT overtopping waves station Dawlish Garden (D01)",
2897   "headline": "CreamT_747f_b818_8edf",
2898   "description": "Near real-time wave overtopping timeseries data from NOC WireWall station Dawlish Garden (D01).",
2899   "url": "https://linkedsystems.uk/erddap/tabledap/CreamT_747f_b818_8edf.html",
2900   "includedInDataCatalog": {
2901     "@type": "DataCatalog",
2902     "name": "ERDDAP Data Server at BODC",
2903     "sameAs": "https://linkedsystems.uk/erddap"
2904   },
2905   "keywords": [
2906     "author",
2907     "cal",
2908     "calOFFSET",
2909     "calSCALE",
2910     "command",
```

<https://datasetsearch.research.google.com/>

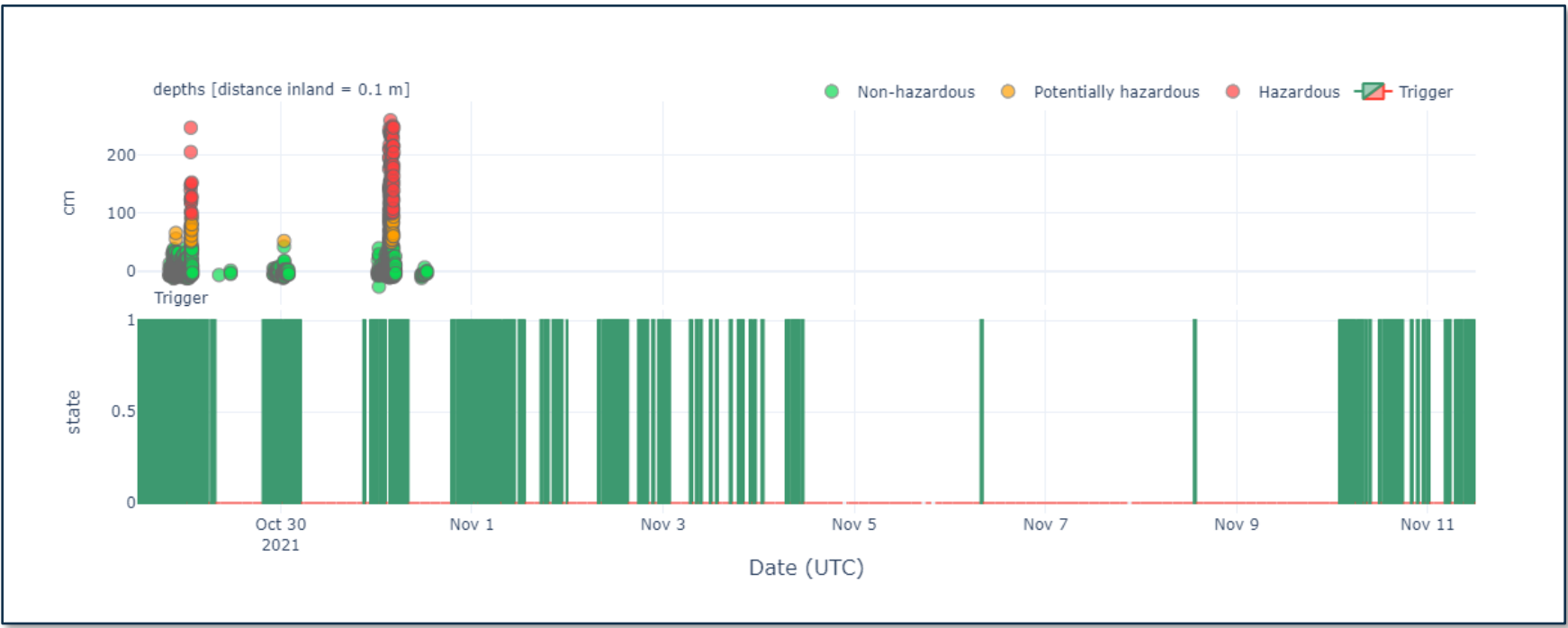
Other aspects of FAIR

- Assign licenses
- Each dataset has unique identifier
- Create Bagit PID archive files
- Assign PIDs into metadata
- Provenance
- and beyond.....

Two-way communication (SMART monitoring)



https://linkedsystems.uk/erddap/tabledap/CreamT_NRT_Triggers_16c9_cbb4_e94b.html



Risk informed decision making (applicable)

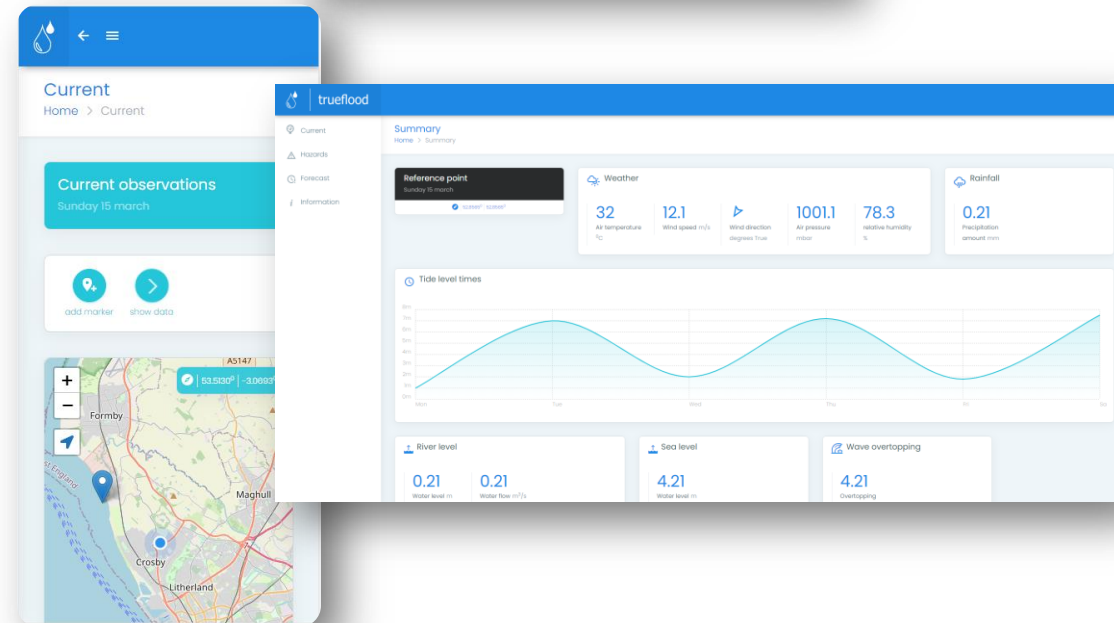
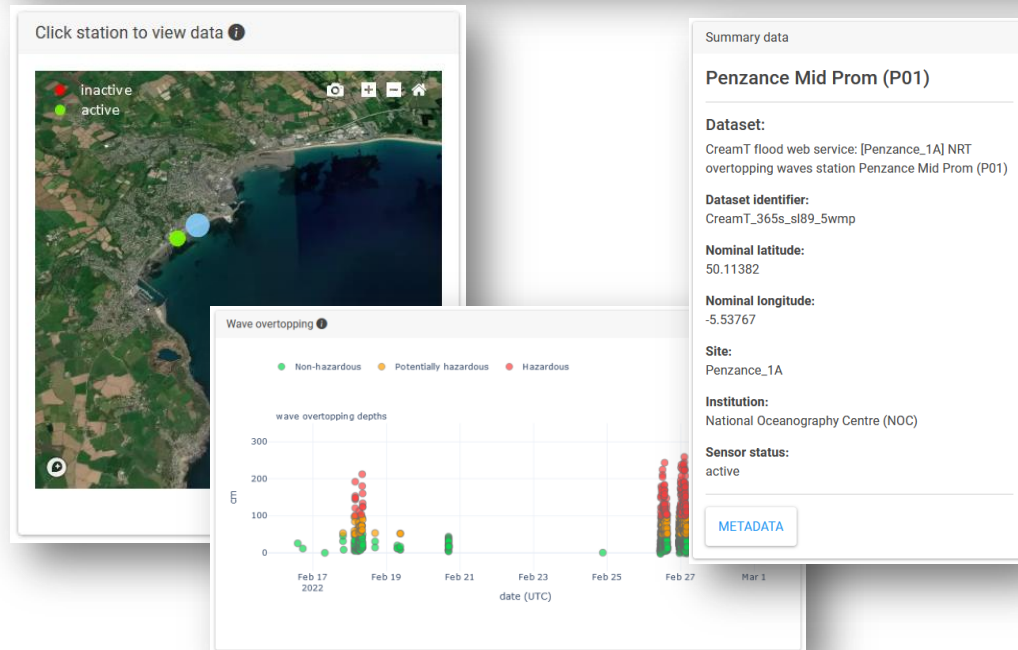
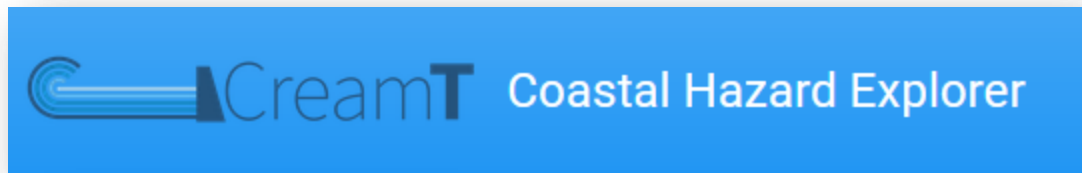
- Build application layers



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



<https://trueflood.app/>



lorr@noc.ac.uk