Towards a common API for Earth Observation

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The Age of the Data Society

- Our personal day to day experience is surrounded by the collection of data on our activities
  - Tracked by Smart Phones (empower users + provide more personal data to companies)
  - On-line Shopping and Banking
  - We give away data on ourselves freely through on-line social interaction.

- Data is collected, analysis is performed, value is added, new data is generated…

- We have become Digital Omnivores
  - We expect data to be available and free
  - We expect to perform whatever analysis is required to be performed and available through our phone or tablet

Technology Convergence - Synergies

- Cloud Computing
  - Storage and Processing in the Cloud, scalable on demand
  - Computing everywhere: Web Browser is the OS
  - Personal computing devices increasing (Phones and Tablets)
  - Open Source = Community Source Development

- Multiple Data Sources at Many Different Scales (Maritime Version)
  - Velocity: Event Processing, Data Feeds from Sensors
  - Volume: Satellite Observations, Sea State Forecasts, AIS data
  - Variety: Many Different Observation Platforms

- Future Internet – Already Here
  - Network Technologies: Mobile Broadband getting cheaper and available
  - The Internet of Things: Sensors + Web Server + IPv6

Open Data – Unleashing Public Data

Open Data is the idea that certain data should be freely available to everyone to use and republish as they wish, without restrictions from copyright, patents or other mechanisms of control.

EU Commission state that Open Data will help

- Address societal changes. Intelligent processing of is essential for addressing societal challenges. For example using air pollution data analytics for traffic management
- Exploit business and economic opportunities. Public data is an essential raw material for new information products and services ranging from location based services to weather forecasts for smart phones
- Accelerate Scientific progress. E-science is essential for meeting the challenges of the 21st century

But… Open doesn't mean it's easy to use…

Open Data + APIs

Ireland is in a strong position in the area of Open Data and Web APIs

- Marine Institute quick to adopt USA technology that provides web APIs to Earth Science Data: ERDDAP.
- ERDDAP is now being adopted throughout the EU for the publishing of Marine Data.

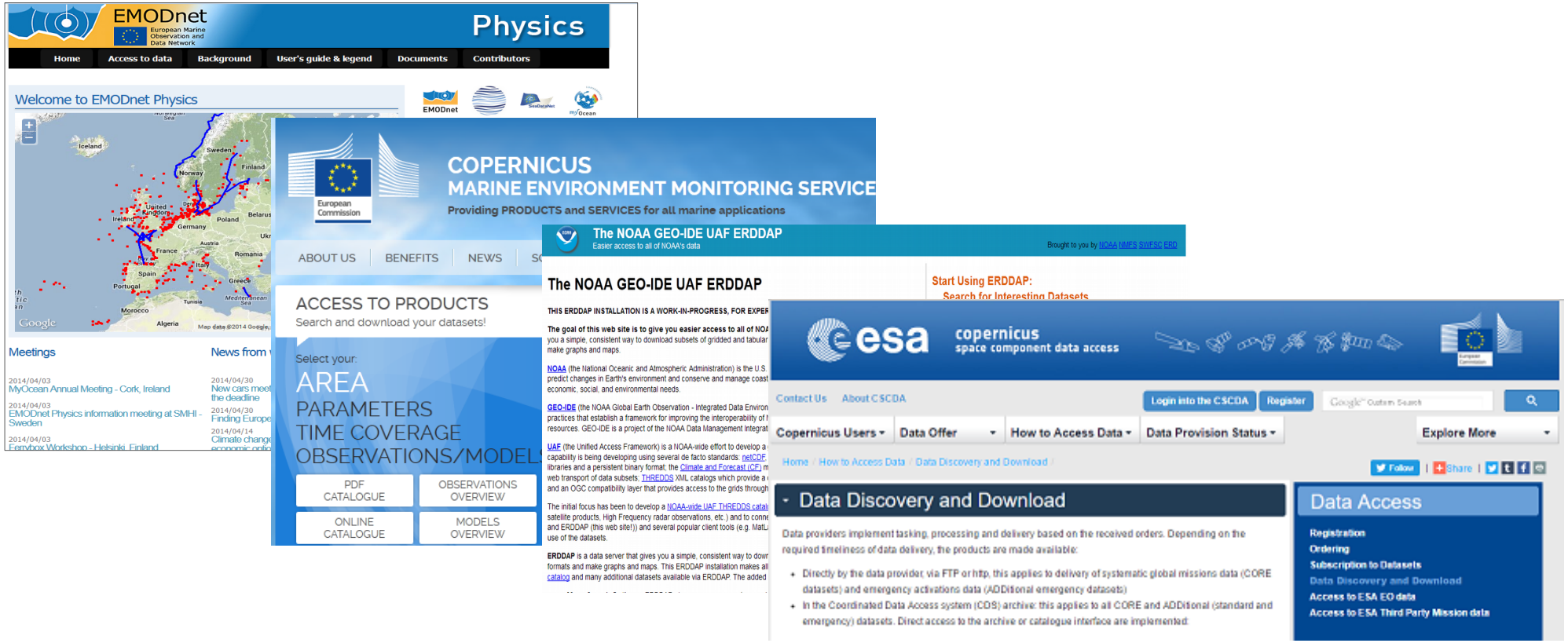
ICHEC are starting to use the technology to make datasets it is producing available via APIs:

- Earth Observation for Ireland from the Sentinel Satellites.
- The output from Climate Change Models.

A common web API eases the development of applications tapping into multiple data sources:

- Easy access to required time/location.
- Unit normalisation.
- Choice of data format.

Improved Interoperability and Data Accessibility

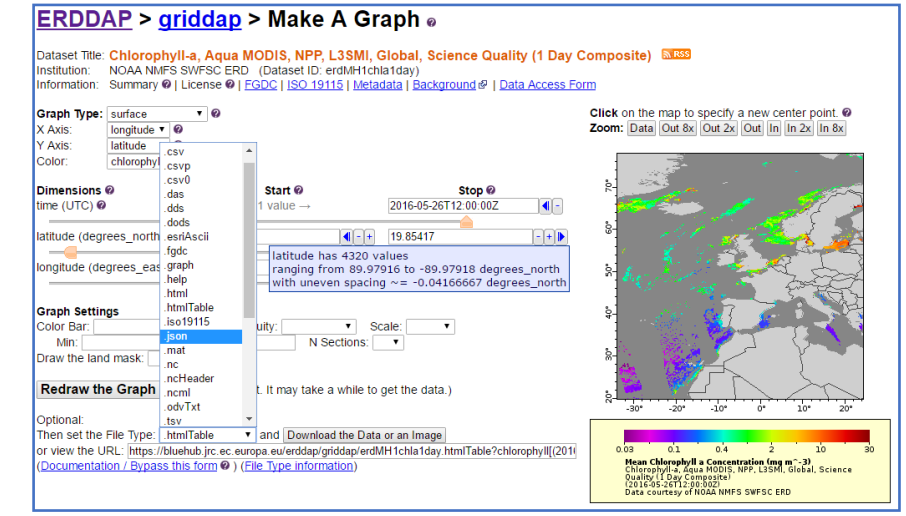


Example of and OData URI exposed by the Data Hub Service broken down into its component parts:

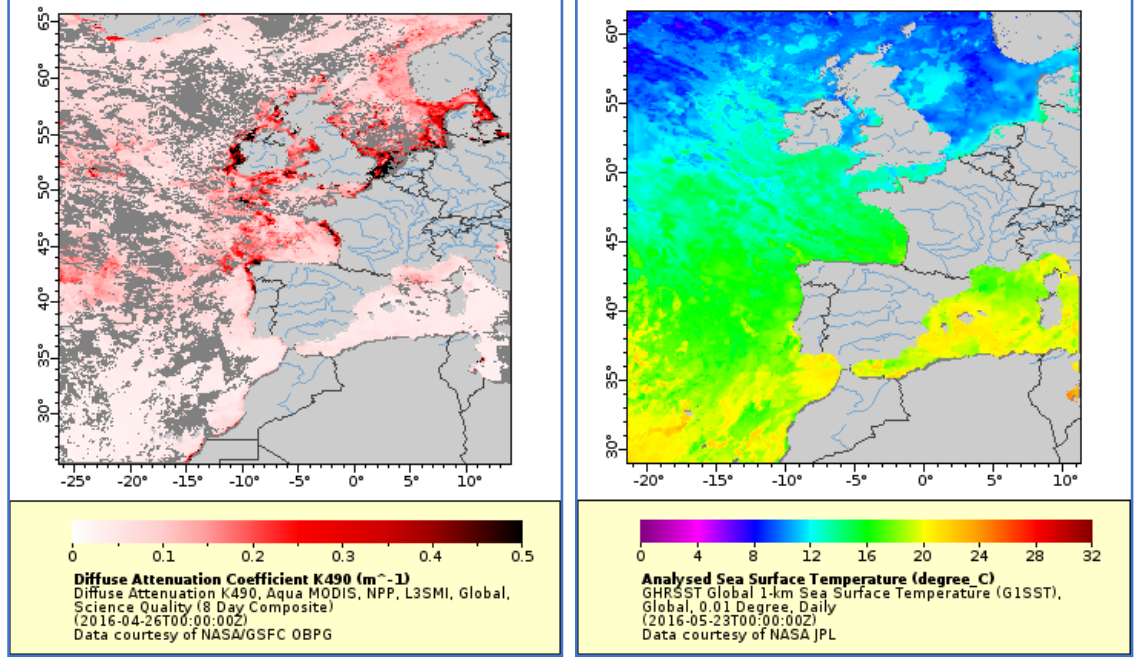
```
https://scihub.copernicus.eu/dhus/odata/v1/Products?$skip=10&$top=50&$format=xml
\_____________________________________/\_____/\_____________________________/
                   |                      |                 |
            service root URI        resource path      query options
```

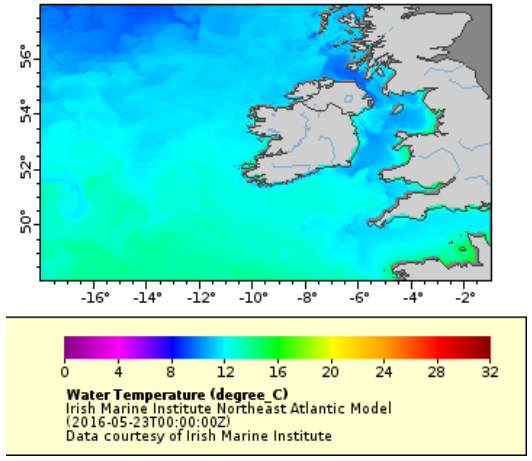
ERDDAP from NOAA is State of the Art

Grid DAP Data	Sub-set	Table DAP Data	Make A Graph	WMS	Source Data Files	Acces-sible	Title	Sum-mary	FGDC, ISO, Metadata
		data	graph			public	OBIS - ARGOS Satellite Tracking of Animals		F I M
	set	data	graph			public	NOAA NOS SOS, EXPERIMENTAL - Air Temperature		F I M
data			graph	M		public	NOAA Global Coral Bleaching Monitoring Products		F I M
data			graph	M	files	public	Chlorophyll a, North Pacific, NOAA VIIRS, 750m resolution (1 Day Composite)		F I M
data			graph	M	files	public	Chlorophyll a, North Pacific, NOAA VIIRS, 750m resolution (3 Day Composite)		F I M
data			graph			public	NOAA/NCDC Blended 6-Hourly 0.25-degree Sea Surface Winds		F I M
data			graph	M		public	NOAA/NCDC Blended 6-Hourly 0.25-degree Sea Surface Winds, Lon+/-180		F I M
data			graph			public	Wind, Metop-B ASCAT, 0.25°, Global, Near Real Time, 2013-now (1 Day)		F I M
data			graph			public	Wind, Metop-B ASCAT, 0.25°, Global, Near Real Time, 2013-now (3 Day)		F I M

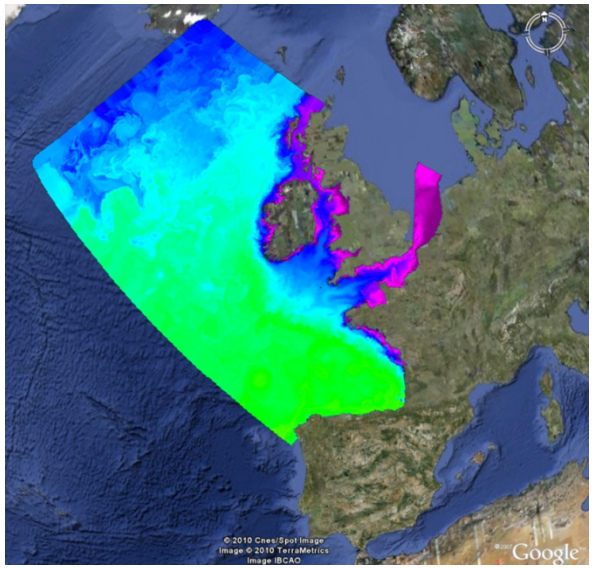


https://bluehub.jrc.ec.europa.eu/erddap/griddap/erdMH1kd4908day.png?k490[(2016-04-26T00:00:00Z)][(65.81249):(25.60417)][(-26.31249):(13.89583)]





ERDDAP Open Source – WEB-API to Public Data



Above: The NE Atlantic ocean model. Run on a 460 node high performance computer once a day. Three day forecast

Right: Model output is available through a number of channels (including myocean.eu). In this case the data is available as Linked Data via ERDDAP

mda.marine.ie
Marine Domain Awareness (MDA) ERDDAP Server - Marine Institute (Ireland)

ERDDAP > List of All Datasets

Or, Do a Full Text Search for Datasets: Search

Or, Search for Datasets by Category:
cdm_data_type, institution, ioos_category, keywords, long_name, standard_name, variableName

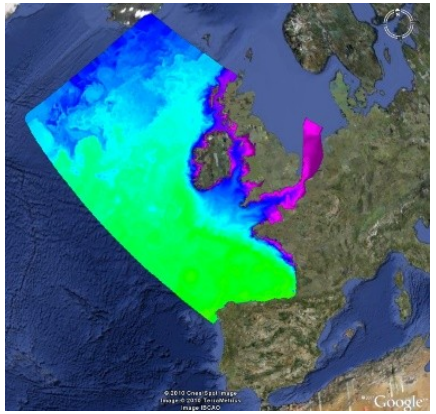
Or, Search for Datasets with Advanced Search

Pick a Dataset

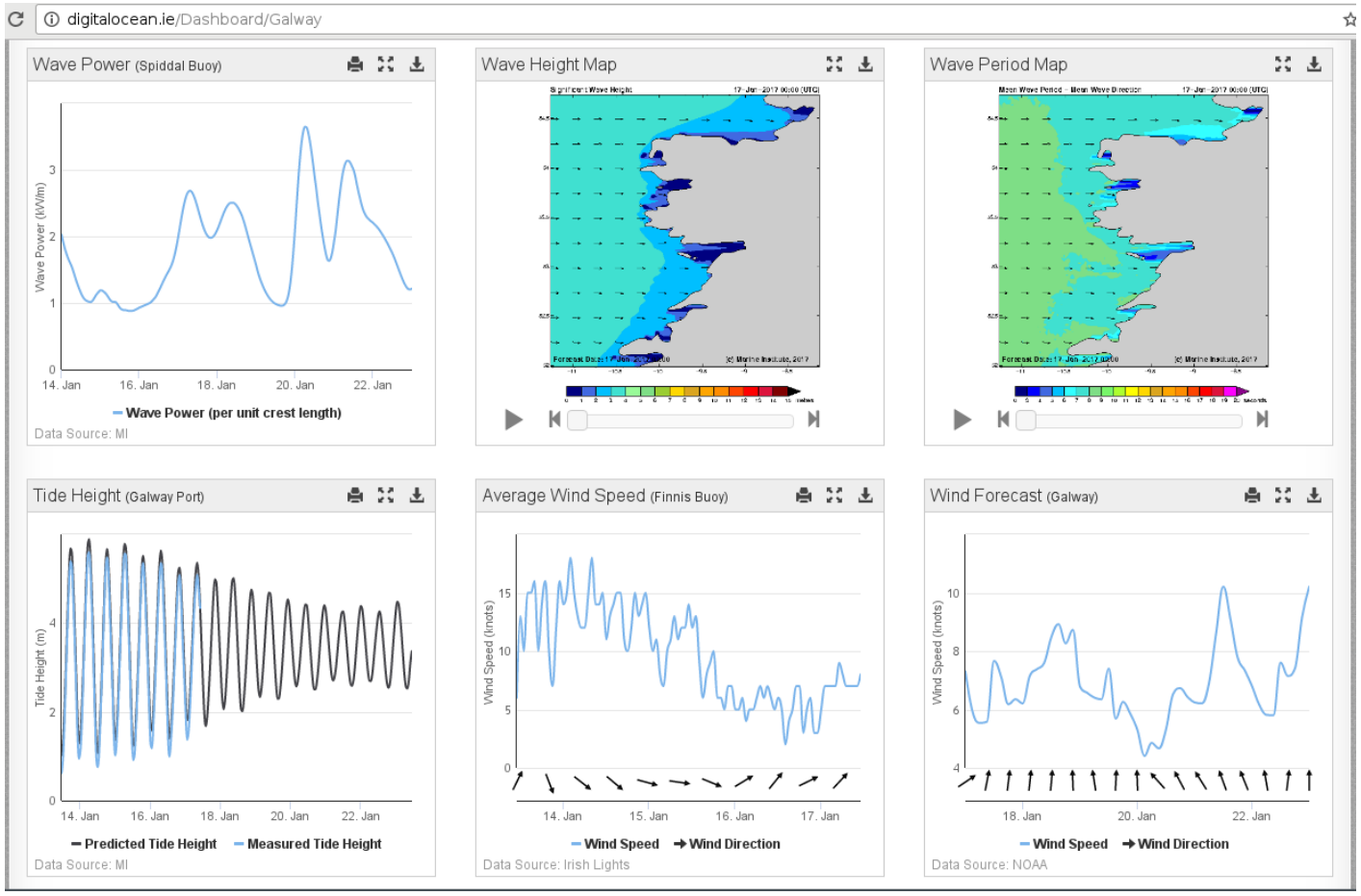
76 matching datasets, listed in alphabetical order.

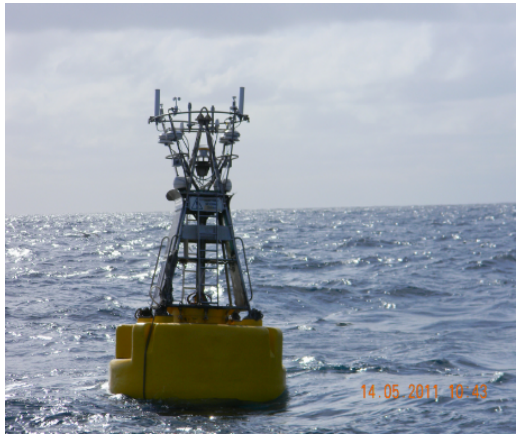
Grid DAP Data	Sub-set	Table DAP Data	Make A Graph	WMS	Title	Sum-mary	FGDC, ISO, Metadata	Back-ground Info	RSS	Institution	Dataset ID
data			graph	M	Biloxi_ms (Digital Elevation Models, biloxi ms)		F I M	background	RSS	NOAA NGDC	noaa_pfeg_41f5_b791_e2a3
data			graph	M	Chlorophyll-a, Aqua MODIS, NPP, Global, Science Quality (1 Day Composite)		F I M	background	RSS	NOAA CoastWatch ...	noaa_pfeg_cf3d_bbd8_469b
data			graph	M	Chlorophyll-a, Aqua MODIS, NPP, Global, Science Quality (8 Day Composite)		F I M	background	RSS	NOAA CoastWatch ...	erdMHchla8day
data			graph	M	Currents, Geostrophic, Aviso, Global (1 Day Composite)		F I M	background	RSS	NOAA CoastWatch ...	noaa_pfeg_1c19_97ba_192a
data			graph	M	Distance from Nearest Coastline: 0.01-Degree Grid		F I M	background	RSS	NASA GSFC	hawaii_92a1_b23f_19c0
data			graph	M	East Atlantic SWAN Wave Model		F I M	background	RSS	Irish Marine In ...	marine_erddap_c556_a137_8143
data			graph	M	GHRSST Global 1-km Sea Surface Temperature (G1SST), Global, 0.01 Degree, Daily		F I M	background	RSS	NASA JPL	noaa_pfeg_e63b_d9e5_8f1a
data			graph	M	GHRSST Level 4 AVHRR_OI Global Blended Sea Su ... perature Analysis, Global, 0.25 Degree, Daily		F I M	background	RSS	NOAA/NESDIS/NCDC	noaa_pfeg_c8b0_ceea_0b43
	set	data	graph		IBTS Trawl Surveys		F I M	background	RSS	Marine Institute	milbts
data			graph	M	Irish Marine Institute Connemara Model CONN2D		F I M	background	RSS	Irish Marine In ...	marine_erddap_2b28_4212_66a0
data			graph	M	Irish Marine Institute Connemara Model CONN3D		F I M	background	RSS	Irish Marine In ...	marine_erddap_54bb_b1bc_07a0
	set	data	graph		Irish National Tide Gauge Network		F I M	background	RSS	Marine Institute	IrishNationalTideGaugeNetwork
	set	data	graph		Irish Wave Buoys		F I M	background	RSS	Marine Institute	IWaveBNetwork
	set	data	graph		Irish Wave Buoys 30 Min		F I M	background	RSS	Marine Institute	IWaveBNetwork30Min
	set	data	graph		Irish Weather Buoy Network		F I M	background	RSS	Marine Institute	IWBNetwork
data			graph	M	MeteoGalicia - Model Roms - Galicia (ROMS METEO)		F I M	background	RSS	NOAA NESDIS CWC ...	noaa_aoml_1416_2063_c592
	set	data	graph		MI Tide Prediction		F I M	background	RSS	Marine Institute	IMI-TidePrediction
	set	data	graph		MI Wave Forecast at buoy locations		F I M	background	RSS	Marine Institute	IMI-WaveBuoyForecast
data			graph	M	Model Monthly Means		F I M	background	RSS	Irish Marine In ...	marine_erddap_1d46_5d7b_5d36
data			graph	M	Navy Global Environmental Model (NAVGEM), 0.5 degree, 10 m Wind		F I M	background	RSS	FNMOC	noaa_pfeg_45de_9682_238d
data			graph	M	Navy Global Environmental Model (NAVGEM), 0.5 degree, Pressure MSL		F I M	background	RSS	FNMOC	noaa_pfeg_d543_8870_bc7f
data			graph	M	Navy Operational Global Atmospheric Prediction System (NOGAPS), 1 degree, 10 m Wind		F I M	background	RSS	FNMOC	noaa_pfeg_5d13_ca69_c715
data			graph	M	Navy Operational Global Atmospheric Prediction System (NOGAPS), 1 degree, Pressure MSL		F I M	background	RSS	FNMOC	noaa_pfeg_99b9_1fdc_b0d1
	set	data	graph		NDBC Standard Meteorological Buoy Data		F I M	background	RSS	NOAA NDBC, Coas ...	cwwcNDBCMet
data			graph	M	Near Real Time Geostrophic Currents		F I M	background	RSS	CoastWatch Cari ...	noaa_pfeg_fe3f_242d_e1d4
	set	data	graph		NOAA NDBC SOS - currents		F I M	background	RSS	NOAA NDBC	ndbcSosCurrents
	set	data	graph		NOAA NDBC SOS - sea_floor_depth_below_sea_surface		F I M	background	RSS	NOAA NDBC	ndbcSosWLevel
	set	data	graph		NOAA NDBC SOS - sea_water_salinity		F I M	background	RSS	NOAA NDBC	ndbcSosSalinity
	set	data	graph		NOAA NDBC SOS - sea_water_temperature		F I M	background	RSS	NOAA NDBC	ndbcSosWTemp
	set	data	graph		NOAA NDBC SOS - waves		F I M	background	RSS	NOAA NDBC	ndbcSosWaves
	set	data	graph		NOAA NDBC SOS - winds		F I M	background	RSS	NOAA NDBC	ndbcSosWind
	set	data	graph		NOAA NOS SOS, EXPERIMENTAL - Air Temperature		F I M	background	RSS	NOAA NOS	nosSosATemp
	set	data	graph		NOAA NOS SOS, EXPERIMENTAL - Barometric Pressure		F I M	background	RSS	NOAA NOS	nosSosBPres
	set	data	graph		NOAA NOS SOS, EXPERIMENTAL - Conductivity		F I M	background	RSS	NOAA NOS	nosSosCond
	set	data	graph		NOAA NOS SOS, EXPERIMENTAL - Currents		F I M	background	RSS	NOAA NOS	nosSosCurrents
	set	data	graph		NOAA NOS SOS, EXPERIMENTAL - Salinity		F I M	background	RSS	NOAA NOS	nosSosSalinity
	set	data	graph		NOAA NOS SOS, EXPERIMENTAL - Water Level		F I M	background	RSS	NOAA NOS	nosSosWLevel
	set	data	graph		NOAA NOS SOS, EXPERIMENTAL - Water Temperature		F I M	background	RSS	NOAA NOS	nosSosWTemp

Example: digitalocean.ie – Machine to Machine



Operational Ocean Model – Data Feed





Near Real Time Ocean Weather Buoy Feed (M6 – Buoy)

Data served via API's so dashboard is a HTML & JavaScript Web site

Wrapping up...

- Open Data isn’t necessarily easy to use: volume, granularity, units, format all require preprocessing before use by an application.
- Preprocessing should ideally be done at the source to prevent any mis-handling and because personal computing devices may be underpowered.
- A web API to access bite-sized preprocessed data is a boon for applications: lowers the entry bar for innovation, outreach.
- A common web API across a thematic/domain is even better. Embrace existing standards or help develop the missing ones.