Apple Ocean Integration

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Purpose

The Apple Weather app contains a variety of environmental information, except for marine data.

To enhance the app's functionality and user experience we aimed to integrate ocean data into the application to bring just as important, real-time environmental information to users.

With the integration of ocean data, users will have easier and more centralized access to the marine information. Allowing them to improve their awareness of marine environments.

Structure Requirements

Our information structure needs:

- Date and time - so users can look at data by desired timeframes
- Marine data - tidal levels, water surface temperatures, etc
- Location data - for tracking the nearest water station and it’s relevant data

Existing Information Structure

The existing information structures come from NOAA, downloaded and extracted from a TXT file, and through a REST API for Apple’s app format.

Currently, the data is in table format with columns for date, time, predicted levels, preliminary levels, and verified levels. Location-related information lies in the metadata

In future development, Apple could partner with NOAA to receiving live data through an API in a live version of the widget.

FAIR Assessment

Findability

NOAA provides multiple pathways to find their data and use unique station identifiers

Accessibility

Data is free-to-download by the public and live data is viewable, but not immediately downloadable

Interoperability

Data is downloadable in formats easily usable (csv and txt)
Graphs are also downloadable in various image formats

Reusability

Able to transform/process data into new information structure that contains more info (including metadata) directly in the info structure

Improved Structure

About

The information structure is in a TXT file and provides values for ocean data. Users can quickly view the ocean information near beaches or at sea.

The new structure has the main parts of the existing structure (date, time, location).

Any Apple user will be able to see the widget displaying the data visually in a graph.

Improved Structure

Station Number

Represents the number of the vessel the ocean observation came from.

Significant Wave Height

Meaning the average height of the highest one-third of the waves.

Sea Surface Temperature

Water temperature of the epipelagic zone, known as the first 200 meters of the water column.

Lat and Lon

Wave Period

The time between wave crests of the most energetic waves in the spectrum. Measurement describes the primary swell affecting an area.

Visibility

The distance over which an object or light can be clearly seen at sea.

Date and Time

Wave Direction

Indicates the direction from which the waves are coming, measured relative to true north.

Sea-Level Pressure

Tide

Refers to the vertical height of the ocean's surface relative to a reference level.

Improved Structure

Latest Oceanic Observations

Displayed are real-time marine and coastal observations from buoy stations operated by the National Oceanic and Atmospheric Administration (NOAA), other government agencies, universities, and research institutions. These observations are compiled through NOAA's National Data Buoy Center.

Station #	LAT	LON	YYYY	MM	DD	HH	MM	WDIR	WSPD	GST	WVHT	DPD	APD	MWD	PRES	WTMP	VIS	TIDE
13002	21.000	-23.000	2025	00	03	19	00	MM	MM	MM	MM	MM	MM	MM	MM	23.2	MM	MM
13008	15.000	-38.000	2025	00	03	19	00	55	5.8	6.7	MM	MM	MM	MM	1017.3	24.6	MM	MM
14048	-8.000	65.000	2025	00	03	19	00	137	8.9	10.7	MM	MM	MM	MM	1012.4	27.4	MM	MM
14049	-12.000	65.000	2025	00	03	19	00	99	10.0	11.9	MM	MM	MM	MM	1014.2	25.7	MM	MM
15001	-10.000	-10.000	2025	00	03	19	00	131	7.6	8.7	MM	MM	MM	MM	1016.8	25.3	MM	MM
15006	-6.000	-10.000	2025	00	03	19	00	140	7.0	9.1	MM	MM	MM	MM	1015.7	26.6	MM	MM
15009	0.000	-3.051	2025	00	03	18	00	179	5.4	MM	MM	MM	MM	MM	1013.7	26.0	MM	MM
1801589	37.39	-122.95	2025	30	03	18	30	199	6.5	7.2	2.3	12	MM	MM	1016.3	12.5	11.3	MM
22101	37.24	126.02	2025	00	03	19	00	250	5.0	MM	0.5	6	MM	MM	MM	14.8	MM	MM
22102	34.79	125.78	2025	00	03	19	00	220	4.0	MM	0.5	5	MM	MM	MM	17.2	MM	MM

Data extracted from NOAA's TXT file type and reformatted for....

Improved Structure

→ **Apple's Swift formatted app**

Example format in JSON

```
{
    "location": {
        "latitude": 34.0522,
        "longitude": -118.2437,
        "is_coastal": true,
        "ocean_zone_id": "US-PAC-001"
    },
    "ocean_forecast": {
        "water_temp": {
            "value": 21.2,
            "unit": "C",
            "source": "NOAA Buoy #46221"
        },
        "wave_height": {
            "value": 2.5,
            "unit": "m",
            "confidence": 0.9
        },
        "tide": {
            "next_high": "2023-10-05T18:24:00Z",
            "level": 1.8
        },
        "timestamp": "2023-10-05T14:00:00Z",
        "data_quality_score": 0.88
    }
}
```

System Functionality

Detects user's current location coordinates to nearest marine station.

Location Services

10-day and hourly forecasts display accurate variables and values, and updates in real-time.

Forecast Estimates

Shows based on government source(s), and provides detailed information when opened.

Severe Alerts

Quality Assessment

Performance Goals

- Real-time data refreshes
- Efficient data retrieval: deliver timely and accurate ocean information from data source
- Responsive/interactive UI

Quality Goals

- User-friendly interface: features dynamic, interactable graphs
- Comprehensive ocean information: widget provides 10-day forecasts, severe weather alerts (tsunamis, coastal flooding, etc.), and detailed metrics like tide levels, wave height, and sea surface temperature

Quality Assessment

Performance Testing

- API response time: ocean data retrieval completes within 300ms under normal network conditions.

Quality Testing

- Voice over support: all information is announced correctly.
- User journey: adding a city, checking the forecast, and viewing a radar should be intuitive. This can be measured with session analytics

Functional Testing

- Location services: detects user's current location coordinates accurately.
- Forecast estimates: 10-day and hourly forecasts display accurate variables and values, and updates in real-time.
- Severe alerts: show based on government source(s), and provides detailed information when opened.

Thanks