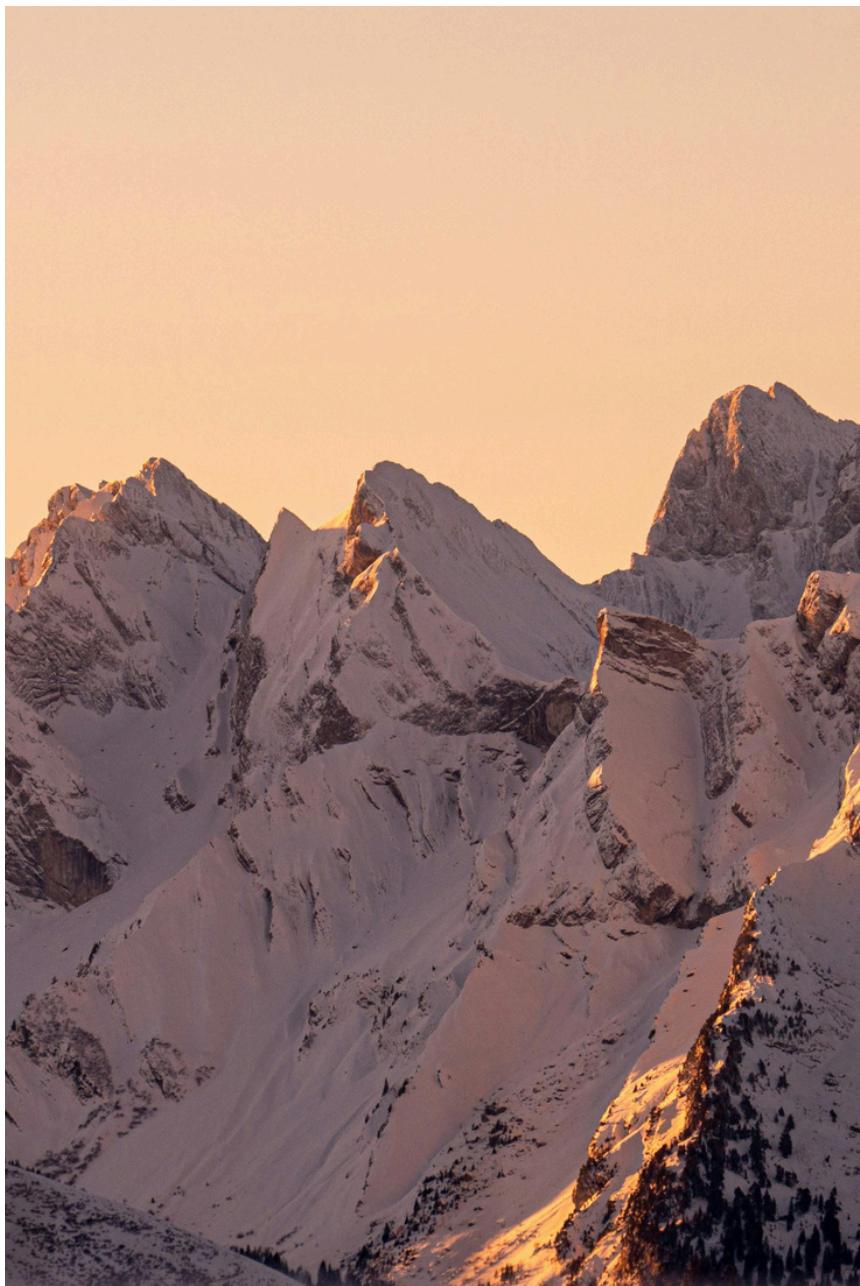


Summer 2025



(Dubost, 2024; Forrest, 2024)



INTEGRATION OF ATMOSPHERIC AND OCEANIC DATA FOR APPLICATIONS

Holli Meyers
University of Washington

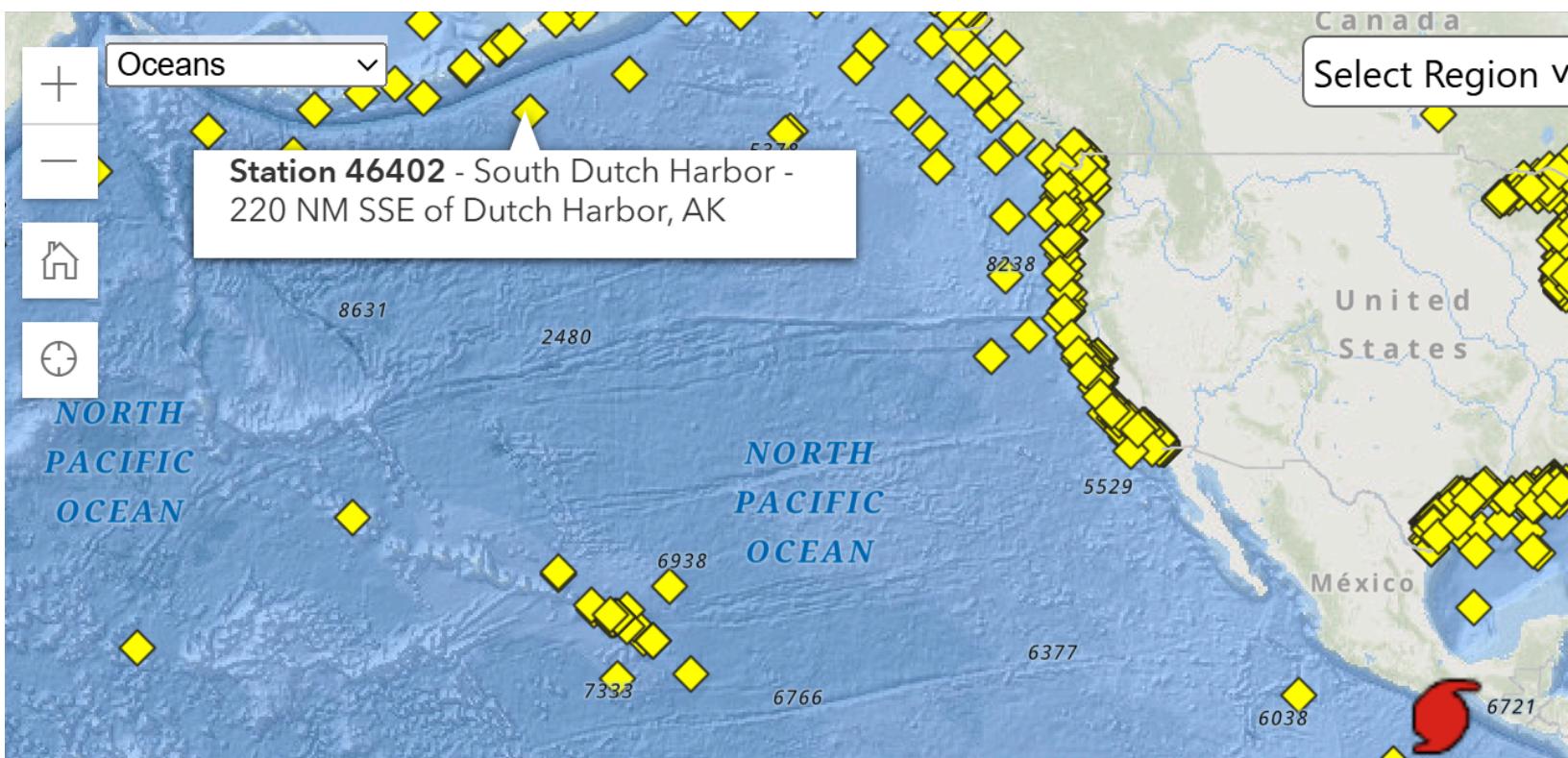


PROJECT INSPIRATION

Independent research project focused around information architecture, inspired by the shortcomings of Apple and Samsung's mobile weather apps, which include moon phases but omit ocean tidal information, requiring a separate web browser to look up high and low tide patterns.

LAT deg	LON deg	YYYY yr	MM mo	DD day	hh hr	mm mn	WDIR degT	WSPD m/s	GST m/s	WVHT m	DPD sec	APD sec	MWD degT	PRES hPa	PTDY hPa	
12.000	-23.000	2025	06	18	21	00	47	4.7	5.9	MM	MM	MM	MM	1017.1	MM	
21.000	-23.000	2025	06	18	19	00	MM	MM	MM	MM	MM	MM	MM	MM	MM	
15.000	-38.000	2025	06	18	19	00	65	8.1	9.3	MM	MM	MM	MM	1017.5	MM	
0.000	-10.000	2025	06	18	20	00	159	5.4	MM	MM	MM	MM	MM	MM	1016.4	MM
0.000	-3.051	2025	06	18	20	00	187	5.3	MM	MM	MM	MM	MM	MM	1016.6	MM
37.24	-122.88	2025	06	18	20	30	333	8.4	9.7	2.3	8	MM	MM	1014.8	MM	
37.24	126.02	2025	06	18	21	00	160	5.0	MM	0.0	4	MM	MM	MM	MM	
34.79	125.78	2025	06	18	21	00	100	4.0	MM	0.5	7	MM	MM	MM	MM	
34.00	127.50	2025	06	18	21	00	90	2.0	MM	0.5	7	MM	MM	MM	MM	
34.77	128.90	2025	06	18	21	00	240	6.0	MM	0.5	7	MM	MM	MM	MM	
37.54	130.00	2025	06	18	21	00	200	3.0	MM	0.5	6	MM	MM	MM	MM	
36.35	129.78	2025	06	18	21	00	230	3.0	MM	0.5	5	MM	MM	MM	MM	
36.25	125.75	2025	06	18	21	00	150	6.0	MM	0.5	5	MM	MM	MM	MM	
8.000	67.000	2025	06	18	20	00	242	6.7	MM	MM	MM	MM	MM	MM	MM	

(National Data Buoy Center, n.d.-b)



Importance

* As the effects of climate change increase, our environment is to continue facing extreme and variable weather patterns that will be life altering. Thus, it's important the public has easily accessible access to real-time data to stay informed.

Data Barriers

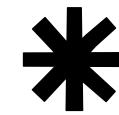
* Real-time environmental data can only be accessed on their government agency sites. Few of which can actually be easily found and understood by the general public, and none provide a consolidated overview of the information.

CURRENT APPLICATIONS

Popular weather applications provide traditional data but vary in depth, usability, and features. Some offer detailed forecasts with health and environmental insights, while others focus on warnings and radar maps. **None provided ocean insights.**

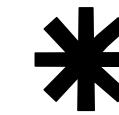
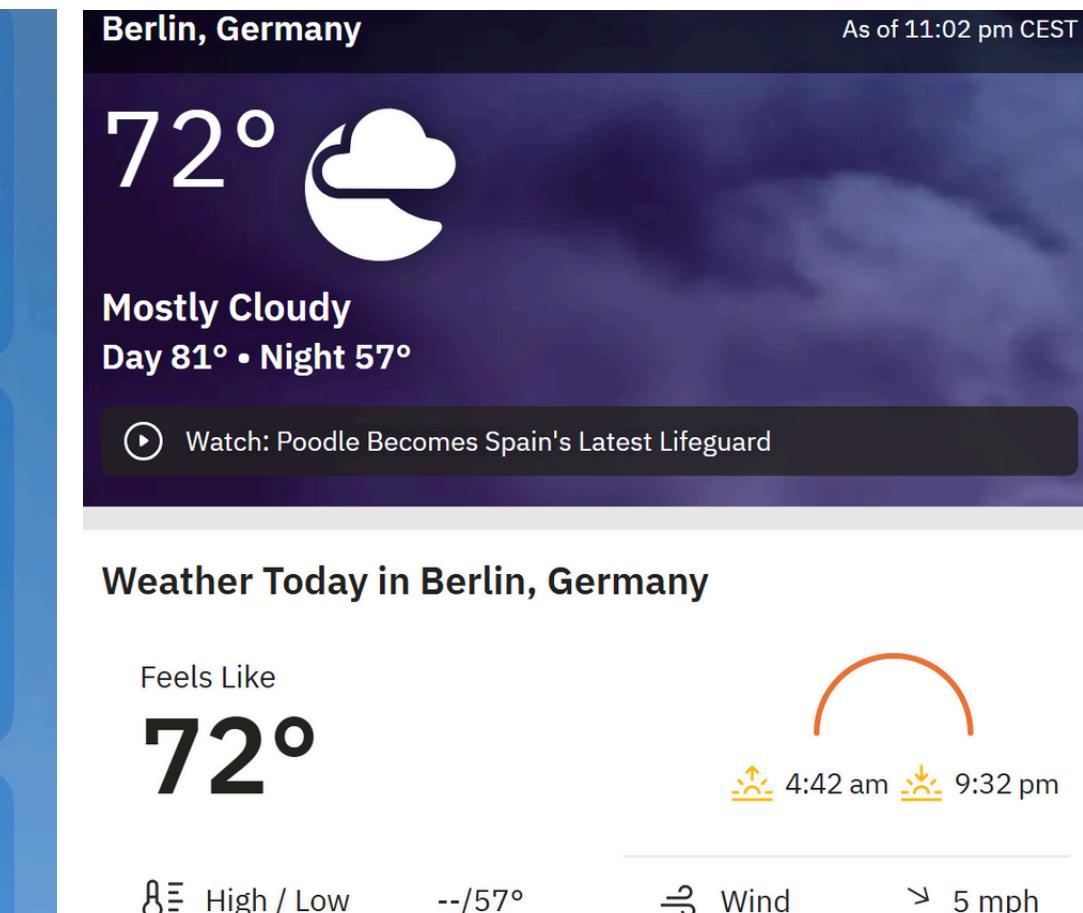
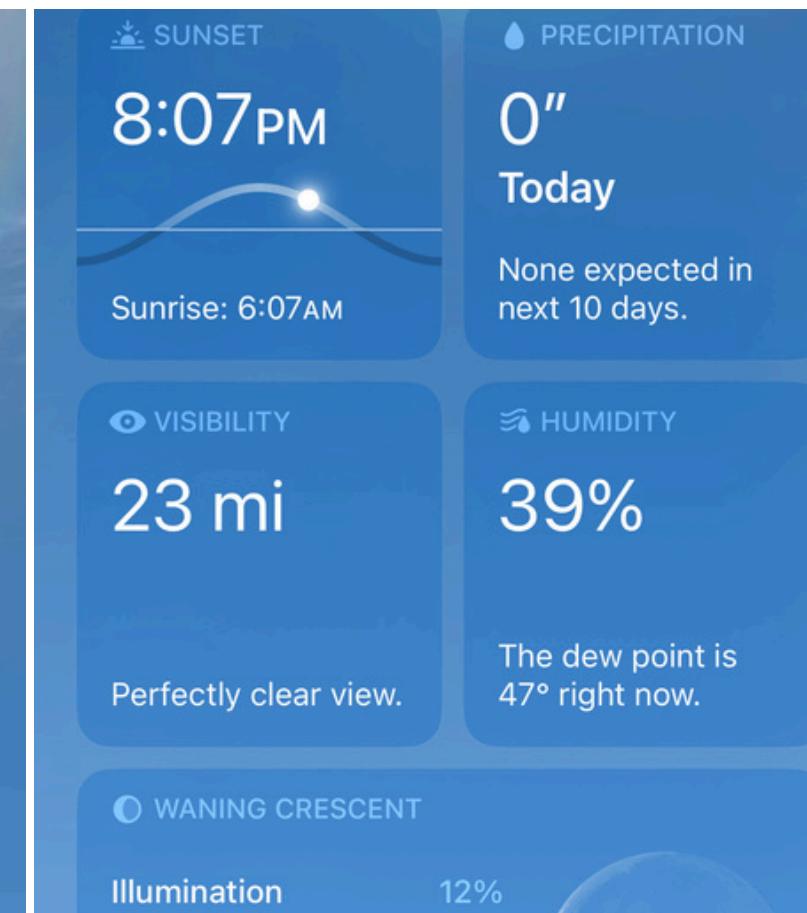


(Apple, n.d.; The Weather Channel, n.d.)



Mobile Applications

Includes Apple and Samsung Weather Apps.



Web Applications

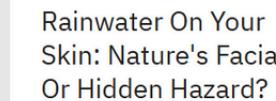
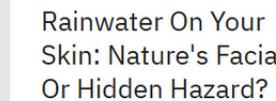
Includes The Weather Channel, AccuWeather, and The National Oceanic and Atmospheric Administration (NOAA).



Erick Rapidly Intensifies Into A Hurricane



Keeping You Healthy



Rainwater On Your Skin: Nature's Facial Or Hidden Hazard?

Yes, You Can Sunburn Your Eyes: Symptoms, The Best Defense



(Cone, 2013; Lindsey, 2022)



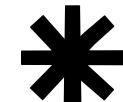
PURPOSE

What easier way to solve this fragmented, accessibility problem amongst weather applications than integrating a new portable information structure.

As a result, the project organized, structured, and labeled traditional weather information from atmospheric sources and combined new data sources that contain oceanic information to centralize the data for future application use.

SOURCES

Verified data takes 1-4 weeks to process. Therefore, all real-time data used here for instant observations and estimates is considered preliminary, unvalidated, and subject to change.



Preliminary Data Quality

CO-OPS uses their Continuous Operational Real-Time Monitoring System (CORMS) that provides quality control (QC) and system monitoring functions.

NDBC applies automated and manual QC procedures. Automated checks (detect gross errors, verify ranges, continuity, and relational consistency) go through the NWS Telecommunication Gateway (NWSTG). Then, within 24 hours of the automated release, the data is manually checked by an analyst (graphical analyses and sensor comparisons).

All data checks have overrides in place for storms or other unusual environmental phenomena.

Atmospheric Data

National Weather Service (NWS), NOAA

API Request

National Data Buoy Center (NDBC), NOAA

TXT File

AirNow, Environmental Protection Agency (EPA)

API Request

Sensor Observation Service (SOS), CO-OPS, NOAA

API Request
CSV File

Oceanic Data

Center for Operational Oceanographic Products and Services (CO-OPS), NOAA

API Request
XML and JSON File

The screenshot shows a GitHub repository named 'weather-app' which is public. The repository has 0 stars, 0 forks, and 0 watches. The code tab is selected. The README file contains the following text:

Graduate Capstone

```
[ ] 1 # fetch tide predictions from CO-OPS API
2
3 import requests
4 import json
5 from datetime import datetime, timedelta
6 import pandas as pd
7
8 if 'merged_nearby_stations_df' not in globals() or merged_nearby_stations_df.empty:
9     print("Nearby CO-OPS stations are unavailable at this time.")
10 else:
11     today = datetime.now() # date range for yesterday and today
12     yesterday = today - timedelta(days=1)
13
14 begin_date_str = yesterday.strftime('%Y%m%d')
15 end_date_str = today.strftime('%Y%m%d') # format string YYYYMMDD
16
17 tide_predictions_url = "https://api.tidesandcurrents.noaa.gov/api/prod/
18 datagetter"
19
about_tides = "Tides refer to the rising and falling of the sea. Which is caused by the gravitational pull of the moon and the sun. Tides are very
```

PROCESS

To develop a new portable information structure, a Python Notebook file was created in Google Colab and saved to a GitHub repository for code documentation.

The structure compiles atmospheric data (available in current weather apps) and oceanic data (available only on government sites).

To make the information portable, several sources were integrated by combining them into one JSON structure so that technical users can better understand the information and easily apply the structure to their application.

For sources that were unable to be directly integrate with each other, like those with less precise geolocations, separate JSON structures were formed to represent their different topics.

CODE OVERVIEW

Geocode Location

Provided by a U.S. city/state, the user's location is processed with the geopy library to translate the location string into coordinates.

Fetch and Parse Data

API calls were made with the requests library and used the location coordinates. End points retrieved include forecasts (7-day, hourly), gridpoints (localized model data), and active weather alerts by state code.

Keys and identifiers obtained include stations (station_id, buoy_id), geospatial identifiers (lat, lon, gridX, gridY, gridId), time-based identifiers (timestamp, datetime), and location Identifiers (office, stateCode).

File Structure

Unnecessary keys (@context, icon, temperatureTrend) and empty fields were removed from the new JSON files, and restructured into a normalized schema.

```
# check if data was found after iterating through stations
if found_data:
    reformatted_predictions = []
    if tide_predictions_result and 'predictions' in tide_predictions_result:
        predictions_list = tide_predictions_result['predictions']

    if predictions_list:
        # save json file
        output_filename = "user_data_noaa_coops_tide.json"

    try:
        reformatted_predictions = []
        for prediction in predictions_list:
            reformatted_predictions.append({
                "time_LST": prediction.get('t'),
                "water_level_ft": prediction.get('v')
            })

        # structure json file
        output_data = {
            "user_location": {
                "latitude": latitude,
                "longitude": longitude,
                "date": datetime.now().strftime('%Y-%m-%d')
            },
            "tide_predictions": {
                "background": {
                    "about": about_tides,
                    "nearest_station": {
                        "station_info": nearest_station_info,
                        "data": {
                            "predictions": reformatted_predictions
                        }
                    }
                }
            }
        }
    except Exception as e:
        print(f"An error occurred: {e}")
        print(f"Reformatted Predictions: {reformatted_predictions}")
        print(f"Output Data: {output_data}")

# save json file
with open(output_filename, 'w') as f:
    json.dump(output_data, f, indent=4)
```



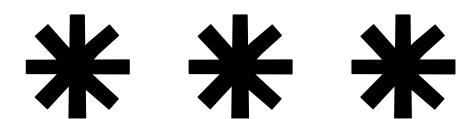
(Akyurt, 2025; Urlapova, n.d.; Zhukov, 2021; Zola, 2022)



RESEARCH SPONSOR

Dr. Steven Gustafson

Assistant Teaching Professor
Information School, University of Washington



THANK YOU



[linkedin.com/in/hollimeyers/](https://www.linkedin.com/in/hollimeyers/)



github.com/hollimey/capstone-application



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