Offshore Wind Data Analysis For Improved Wind Forecasting

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INTRO: **WindDataProc** is a versatile offshore data quality & analysis algorithm that can process and integrate raw weather data from multiple sources. Its primary purpose is to convert this data into a format that is useful for the AIRU-WRF – an AI-powered wind forecasting model developed by Rutgers researchers to enhance and downscale RU-WRF to higher spatial and temporal resolutions. It has been shown that the accuracy of AIRU-WRF may improve as more multi-site data are added. Yet, the quality and reliability of such data remain key issues – this is the motivation of WindDataProc.

METHODS

- WindDataProc processes and integrates publicly available raw data from offshore wind buoys.
- WindDataProc comprises a rigorous data quality control process to identify and filter missing and invalid data points.
- WindDataProc employs a careful combination of logical statements and statistical methods such as cubic spline interpolation and wind profile law, all compiled, validated, and tested in MATLAB.
- The output of WindDataProc is a reliable, multi-site meteorological dataset, which is ready for use within wind forecasting models.

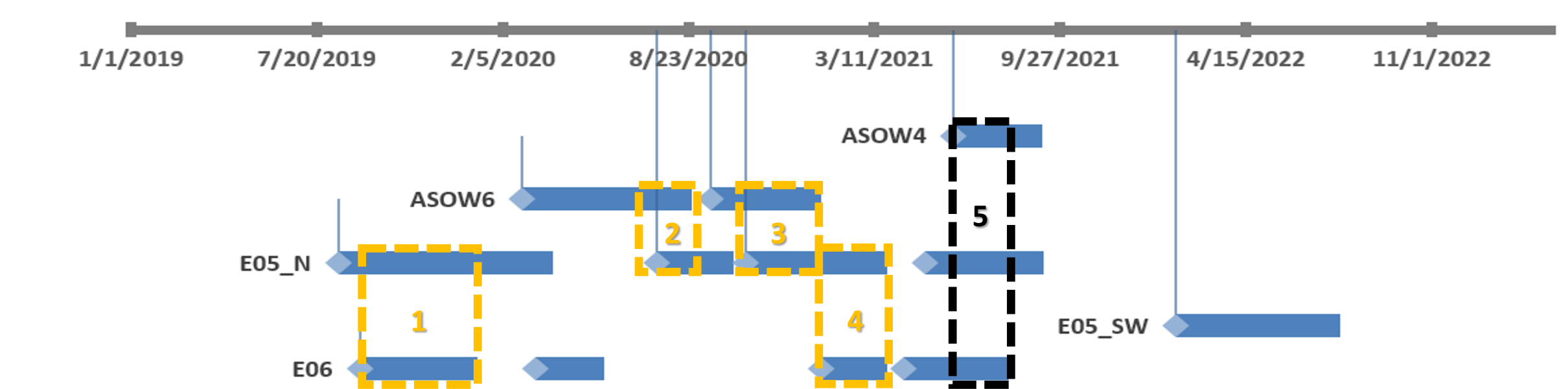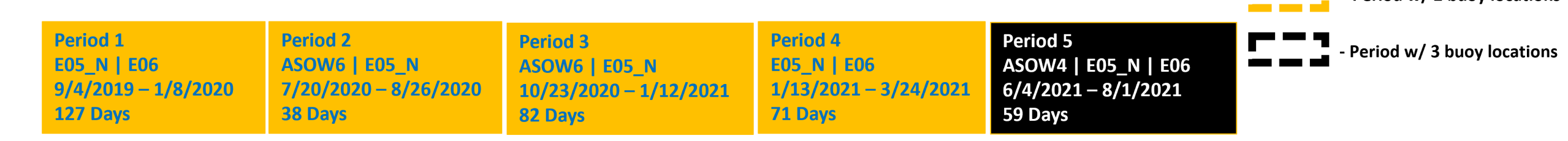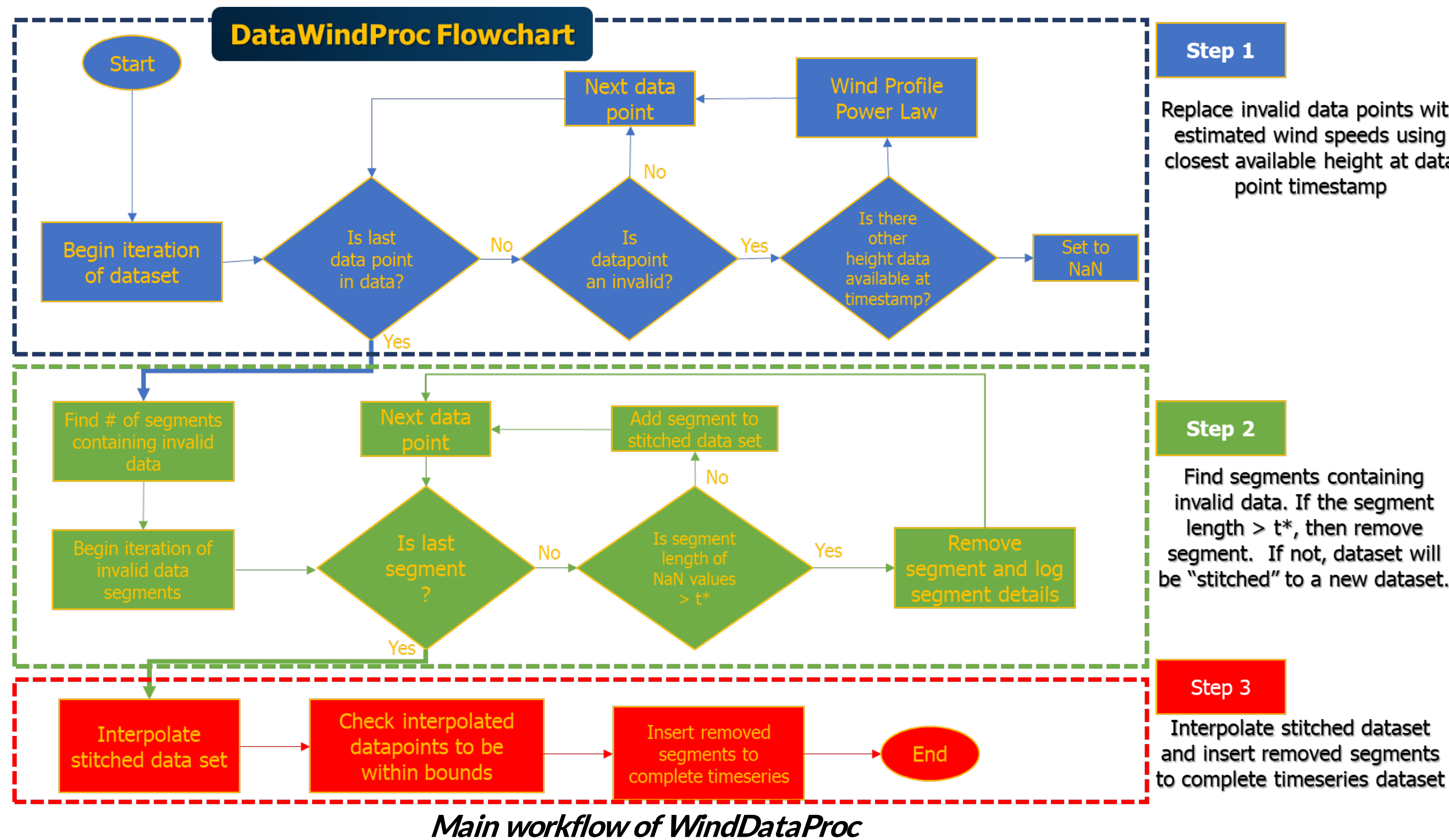*Map of offshore wind buoys used in this project*

#	Buoy	Coordinates
1	NYSERDA E05	39.97, -72.72
2	NYSERDA E05 SW	39.48, -73.59
3	NYSERDA E06	39.55, -73.43
4	ASOW-1	39.3094, -74.10917
5	ASOW-4	39.2025, -74.08194
6	ASOW-6	39.2717, -73.8892
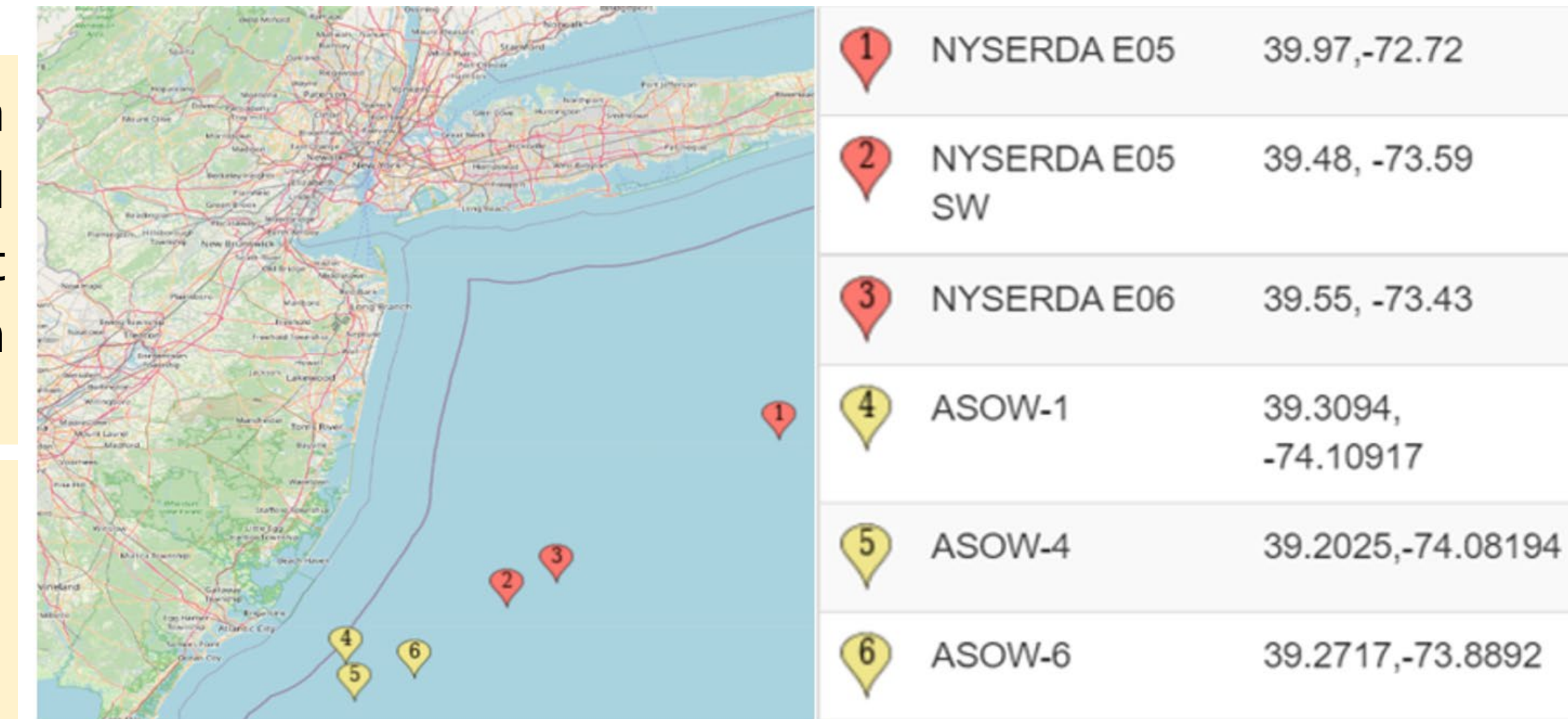
RESULTS

Sample result from WindDataProc

Main workflow of WindDataProc

Step 1
Replace invalid data points with estimated wind speeds using closest available height at data point timestamp

Step 2
Find segments containing invalid data. If the segment length > t*, then remove segment. If not, dataset will be "stitched" to a new dataset.

Step 3
Interpolate stitched dataset and insert removed segments to complete timeseries dataset

Available Buoy Data Post Processing

Output from WindDataProc

KEY FINDINGS

➤ **Limited public data availability:** As more publicly available offshore measurements come online, we expect an even more complete output from WindDataProc.

➤ **Raw data sources may benefit from using WindDataProc:** WindDataProc can significantly improve the quality of raw data, by interpolating different types of missing values and invalid data points.

➤ **WindDataProc can handle diverse raw data:** WindDataProc has been designed and tested to handle data stored in different formats and data structures followed by different data management protocols.