



# Water Level Predictions through AI Models

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Advisors: Daniel Grizenda, Prof. Kyle Chard

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# About me

- Rising Senior at Glenbrook South High School
- Prior Knowledge



- Coursework
  - Honors CS and AP CS A
  - Fundamentals of AI through Oakton College



Personal Website:  
<https://lucasraicu.github.io>

# Past Research Projects

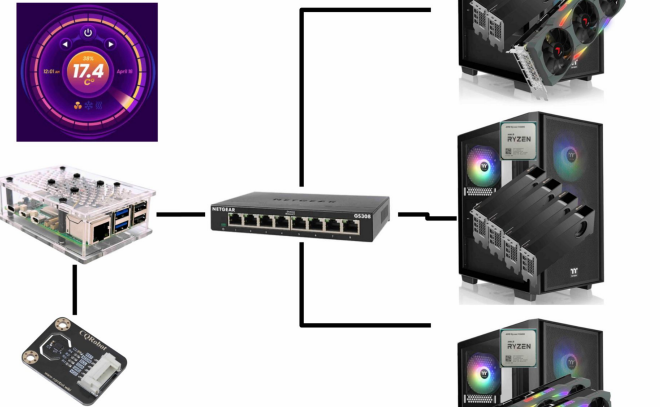
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We have extracted all transactions from [Binance.us](#) exchange for the time period of September 2019 to July 2023, with second to second updates of OHLC (Open, High, Low, Close), and Volume in USD. Timestamps are in Unix time. Timestamps without any trades or activity have their data fields filled with NaNs. If a timestamp is missing, or if there are jumps, this may be because the exchange for its API was down, the exchange for its API did not exist, or some other unforeseen technical error in data reporting or gathering. Data is updated nightly, across all data and plots. All effort has been made to deduplicate entries and verify the contents are correct and complete.

Coin	Year	Month	Week	Day	Hour	Minute	Second
1INCHUSD	<a href="#">CSV</a>	<a href="#">Plot</a>	<a href="#">CSV</a>	<a href="#">Plot</a>	<a href="#">CSV</a>	<a href="#">Plot</a>	<a href="#">CSV</a>
AAVEUSD	<a href="#">CSV</a>	<a href="#">Plot</a>	<a href="#">CSV</a>	<a href="#">Plot</a>	<a href="#">CSV</a>	<a href="#">Plot</a>	<a href="#">CSV</a>
ACHUSD	<a href="#">CSV</a>	<a href="#">Plot</a>	<a href="#">CSV</a>	<a href="#">Plot</a>	<a href="#">CSV</a>	<a href="#">Plot</a>	<a href="#">CSV</a>
ADAUSD	<a href="#">CSV</a>	<a href="#">Plot</a>	<a href="#">CSV</a>	<a href="#">Plot</a>	<a href="#">CSV</a>	<a href="#">Plot</a>	<a href="#">CSV</a>
ALGOUSD	<a href="#">CSV</a>	<a href="#">Plot</a>	<a href="#">CSV</a>	<a href="#">Plot</a>	<a href="#">CSV</a>	<a href="#">Plot</a>	<a href="#">CSV</a>
ALICEUSD	<a href="#">CSV</a>	<a href="#">Plot</a>	<a href="#">CSV</a>	<a href="#">Plot</a>	<a href="#">CSV</a>	<a href="#">Plot</a>	<a href="#">CSV</a>
ALPINEUSD	<a href="#">CSV</a>	<a href="#">Plot</a>	<a href="#">CSV</a>	<a href="#">Plot</a>	<a href="#">CSV</a>	<a href="#">Plot</a>	<a href="#">CSV</a>
ANKRUSD	<a href="#">CSV</a>	<a href="#">Plot</a>	<a href="#">CSV</a>	<a href="#">Plot</a>	<a href="#">CSV</a>	<a href="#">Plot</a>	<a href="#">CSV</a>
ANTUSD	<a href="#">CSV</a>	<a href="#">Plot</a>	<a href="#">CSV</a>	<a href="#">Plot</a>	<a href="#">CSV</a>	<a href="#">Plot</a>	<a href="#">CSV</a>
APELUSD	<a href="#">CSV</a>	<a href="#">Plot</a>	<a href="#">CSV</a>	<a href="#">Plot</a>	<a href="#">CSV</a>	<a href="#">Plot</a>	<a href="#">CSV</a>



## SmartHeater

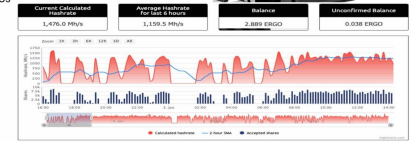


### Hardware:

- Remote temperature monitoring
  - Raspberry Pi 4 w/ 2GB RAM, STS35 temperature sensor
- SmartHeaters
  - Appliance #1: 4x NVIDIA A2000 GPUs
  - Appliance #2: 2x NVIDIA A2000, 1x 3080ti GPUs
  - Appliance #3: 2x NVIDIA 3080ti GPUs
- Network: 1Gb/s Switch with CAT6 RJ45 cables
- Cost: \$5000

Power Consumed: 1.6A ~ 10A @ 120V (200W ~ 1200W)  
Noise: 36 dBA ~ 42 dBA

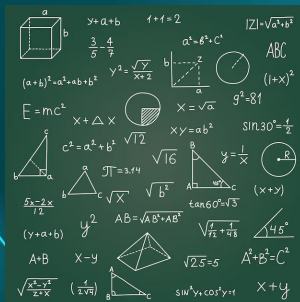
Power cost per month: \$21 ~ \$130  
Income per month: \$0 ~ \$80 (0 ~ 0.06 ERG/hr)  
Total cost per month: \$21 ~ \$50  
Heat Generated: 682 BTU/hr ~ 4092 BTU/hr



Research Link:  
<http://crypto.cs.iit.edu/datasets>

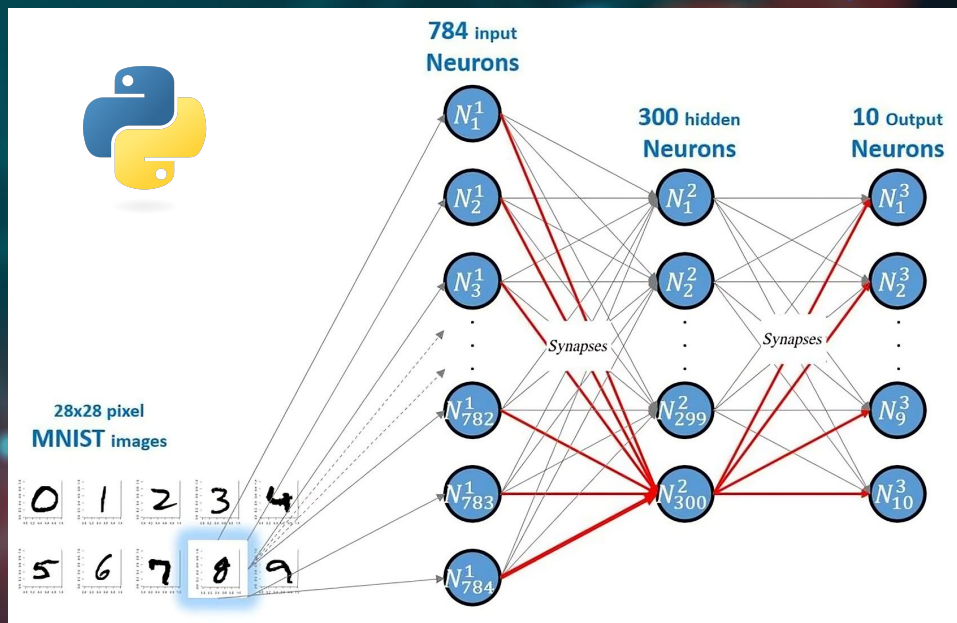


# Preliminary Work (MNIST)

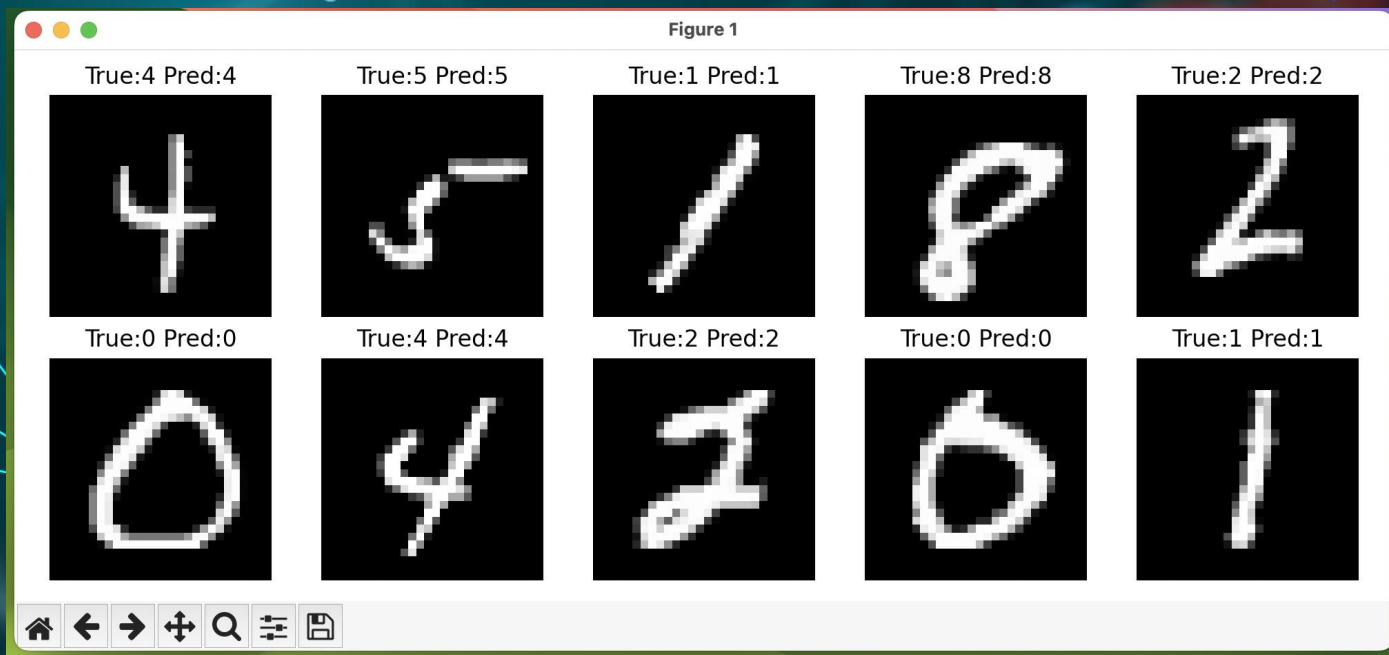


Methods

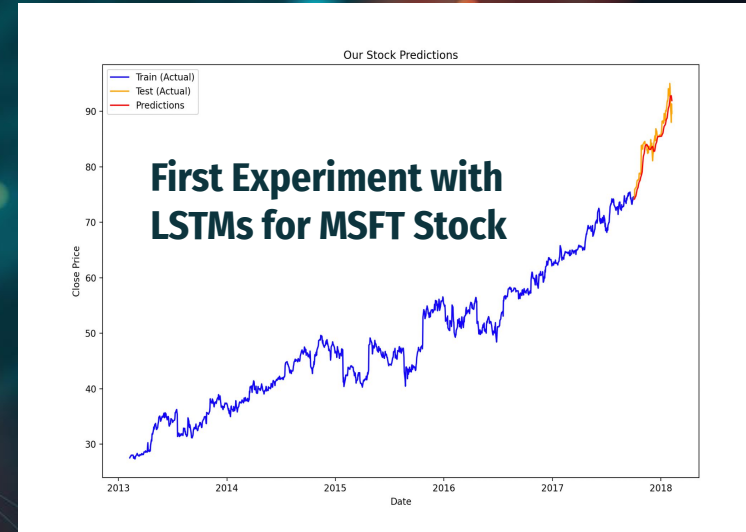
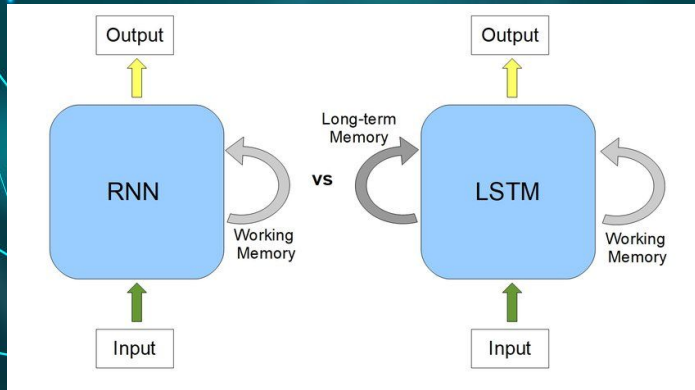
 PyTorch



# Preliminary Work (MNIST)

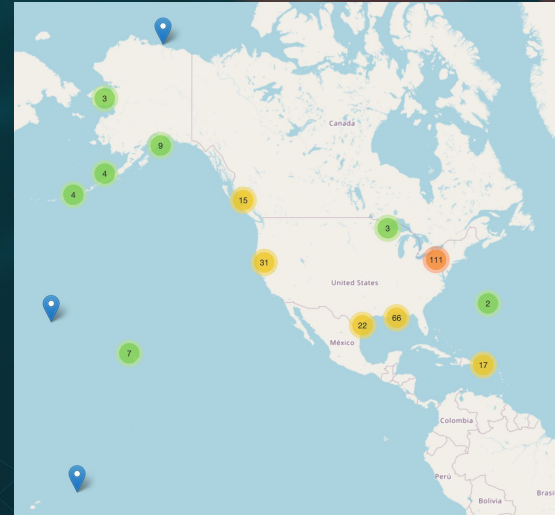


# LSTMs as an Option



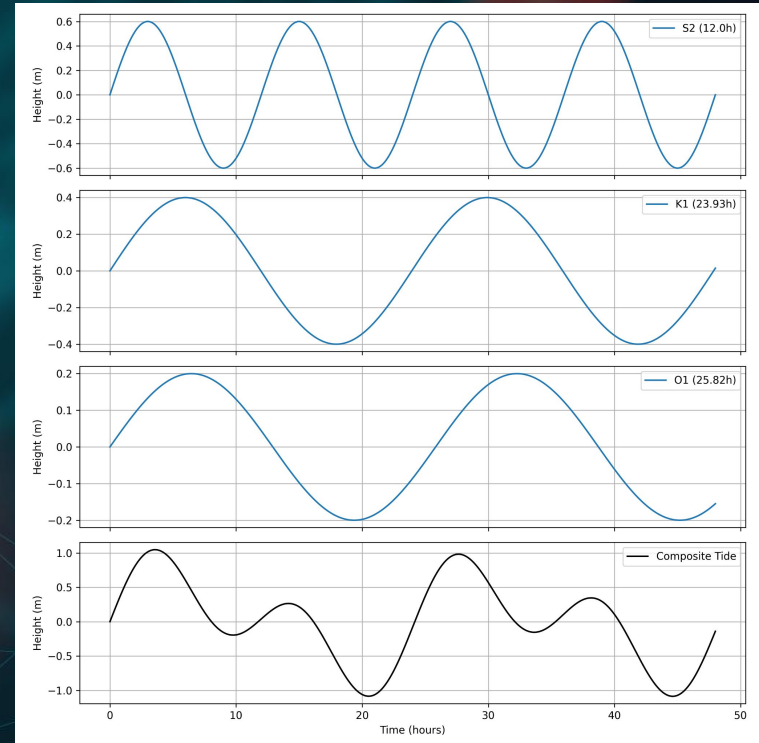
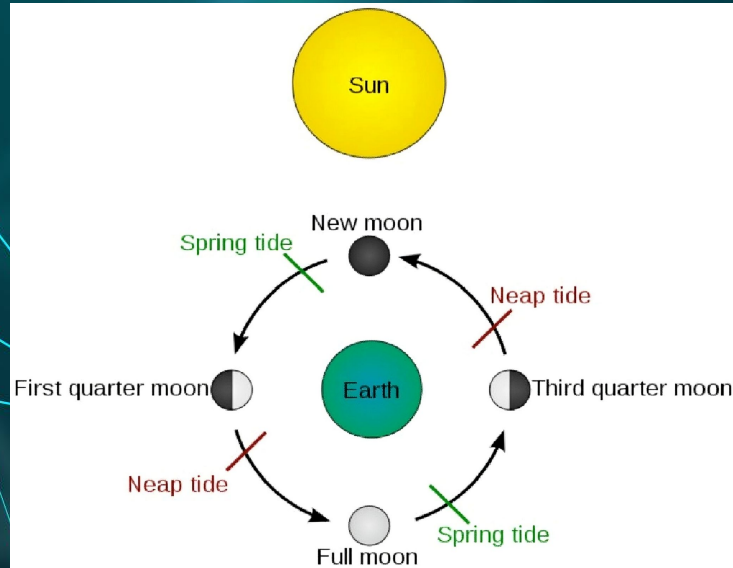
# Project Overview

- Goal: temporal-spatial water-level data -> machine learning -> accurate future trend predictions



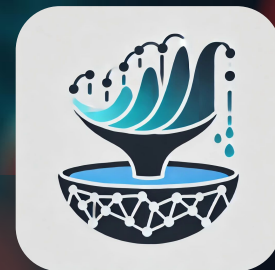


# Harmonic Analysis

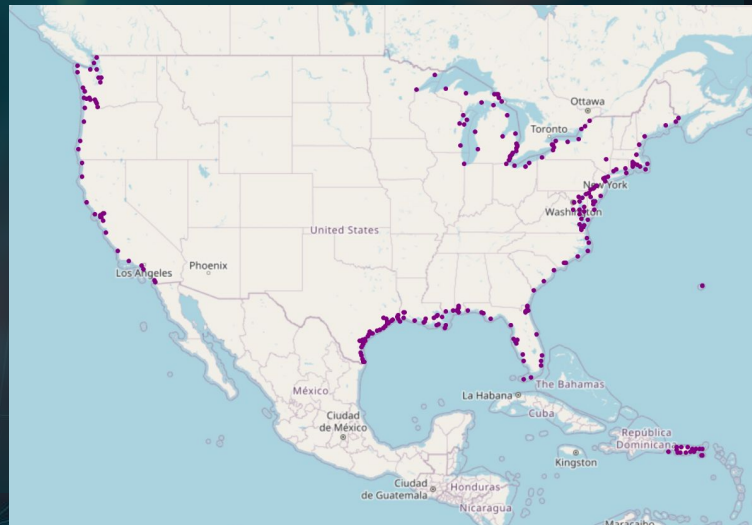




# Fountain Framework



- Github Repository
  - Data (82gb)
    - 217 coastal water level stations
    - Over 127 million data points (6-minute granularity)
  - Scripts
    - Training and results
    - Visualization



# Data Format (FOUNTAIN)

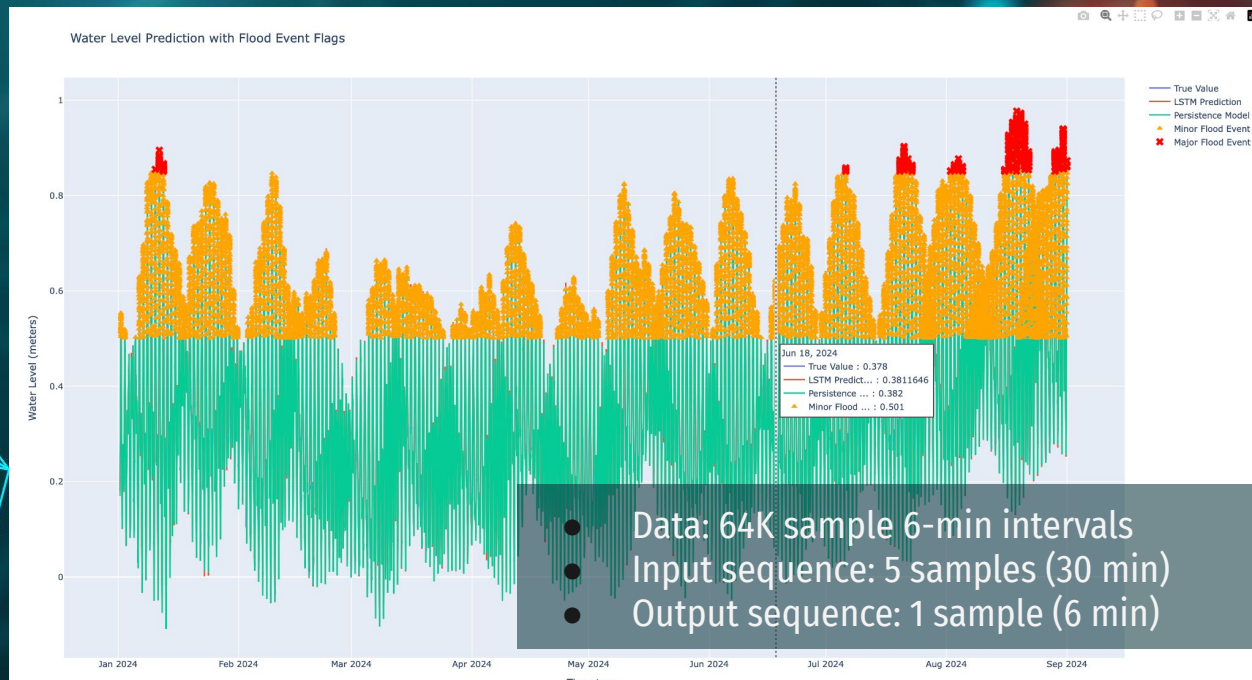
## Stations Info (tsv)

~/Documents/summer-2025/fountain/data/processed/noaa/stations/stations.tsv																
	tidal	greatlakes	shefcode	state	timezone	timezonecorr	id	name	lat	lng	affiliations	tideType	established	removed	origyear	missing_percent
1	True	False	NWWH1	HI	HAST	-10	1611400	Nawiliwili	21.9544	-159.3561	NWLON	Mixed	1954-11-24 00:00:00.0	1991-02-16 00:00:00.0		1.6903284477206767e-06
2	True	False	00UH1	HI	HAST	-10	1612340	Honolulu	21.303333	-157.864528	NWLON	Mixed	1905-01-01 00:00:00.0	1989-01-20 00:00:00.0	0.0	
3	True	False	PRHH1	HI	HAST	-10	1612401	Pearl Harbor	21.3675	-157.963898	PORTS	Mixed	2023-05-31 00:00:00.0	2023-05-31 00:00:00.0		
4	True	False	MOKH1	HI	HAST	-10	1612480	Mokuoloe	21.433056	-157.79	NWLON	Mixed	1957-05-03 00:00:00.0	1989-01-21 00:00:00.0	0.0	
5	True	False	KLIH1	HI	HAST	-10	1615680	Kahului, Kahului Harbor	20.895	-156.469167	NWLON	Mixed	1946-12-19 00:00:00.0	1989-01-29 00:00:00.0	0.0	

## Sorted Station Data (.tsv) - Nawiliwili

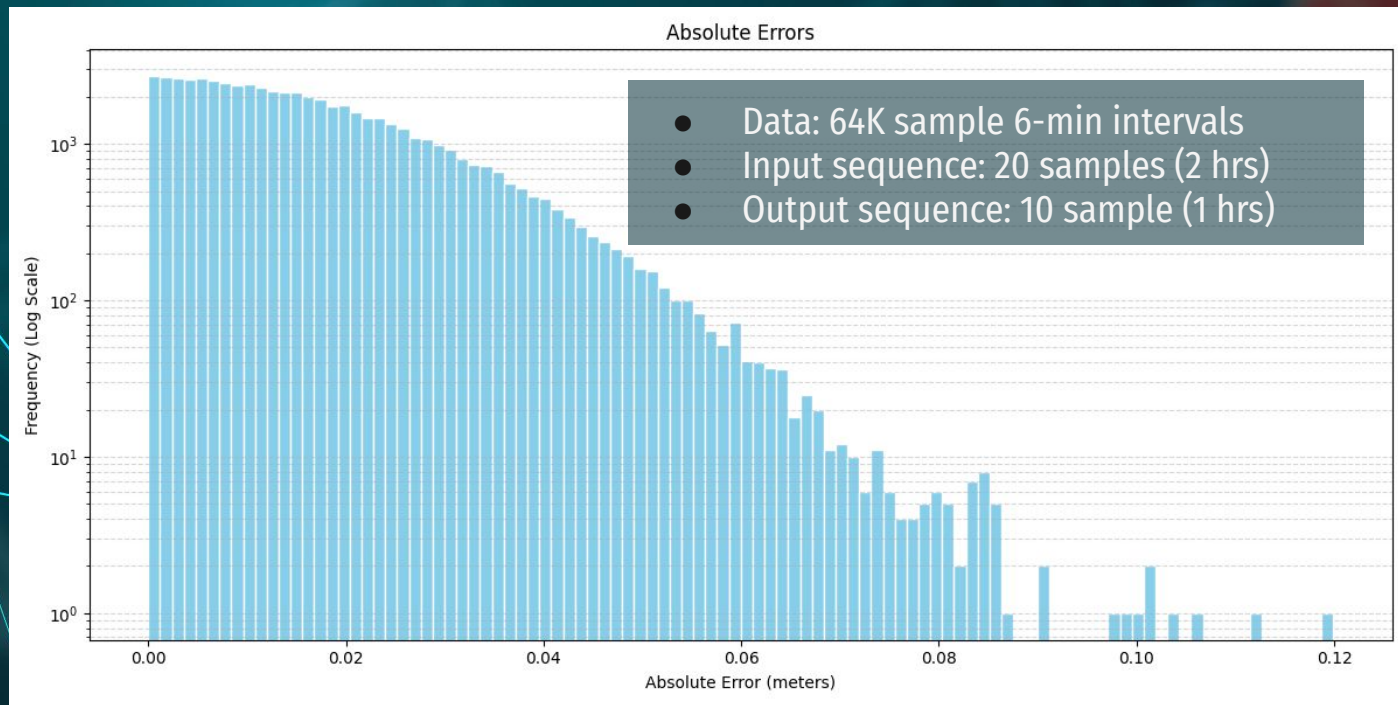
~/Documents/summer-2025/fountain/data/lucas/model_data_less_than_20_missing_no_igld_no_dups_1611400_sorted.tsv											
1	time	value	sigma	quality	inferred	flat	roc	threshold	station	datum	
2	2018-01-01 00:00:00	0.273	0.002	v	0	0	0	0	1611400	mlw	
3	2018-01-01 00:06:00	0.278	0.003	v	0	0	0	0	1611400	mlw	
4	2018-01-01 00:12:00	0.277	0.003	v	0	0	0	0	1611400	mlw	
5	2018-01-01 00:18:00	0.276	0.006	v	0	0	0	0	1611400	mlw	

# Visualization (Nawalili)





# Visualization (cont.)

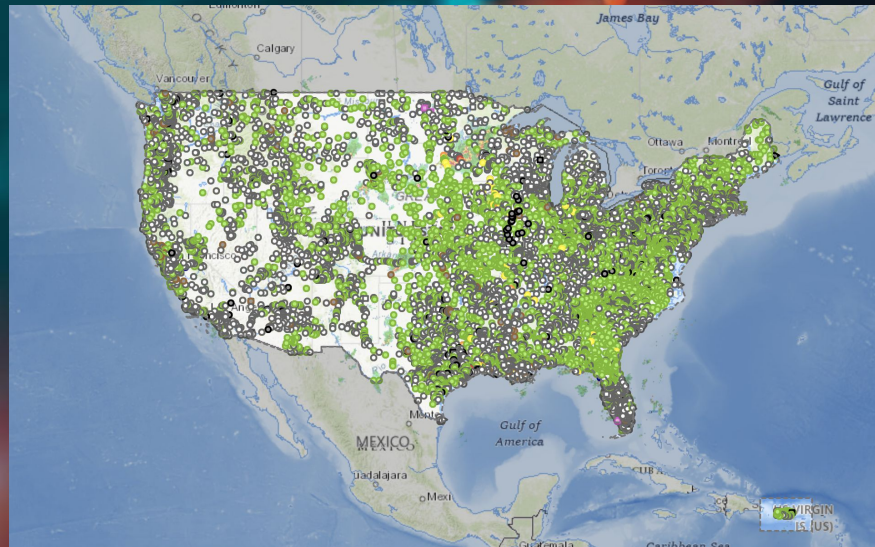
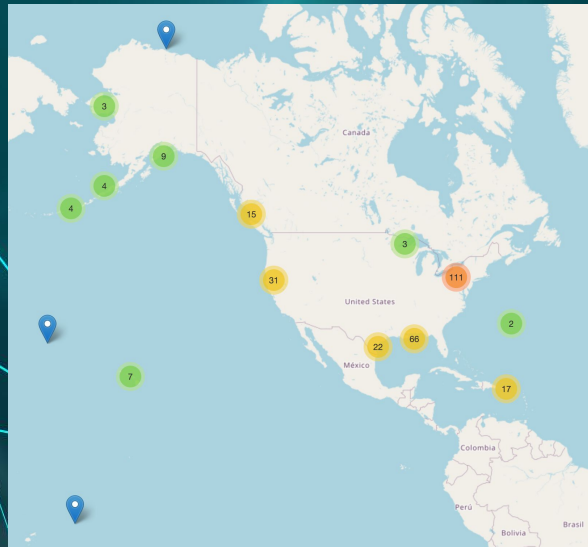




# Next Steps

- LSTM Parameters
  - Hidden Layers (2), inputs (input sequence), outputs (1)
    - Input sequence (5, 240, 720, 1200, 1680): 30-min, 1-day, 3-day, 5-day, 7-day (in 6 min samples)
    - Output sequence (1): 6-min, 1-day, 3-day, 5-day, 7-day
  - Loss functions
    - MSE: Mean-Squared Error
    - RMSE: Root Mean Squared Error
- Testbed
  - Hardware: MacOS, 6-core Intel CPU 2.6GHz, 16GB RAM
  - Time to train 500K 6-min samples for two epochs: 2hrs
  - Will need more compute resources: Chameleon, Mystic, etc
- Other Models
  - Dynamic Graph Neural Networks (DGNN)

# Long-term Goals: Coastal vs River Predictions



# Questions

