

# Climate and Extreme Weather Event Analysis

using various time-series forecasting methods

Lighthouse Labs Data Science, April 2022  
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On an IP project in Eskay Creek BC, Nov 2021



Ski Touring in Rogers Pass BC, Jan 2022

# Focus

## Weather Extremes

- 100-year weather event: *1% chance of happening in any given year*
- Weather extremes have become more frequent across most land regions.
- The Increasing frequency of these events: **43.08% above mean from 1910**

Sources: CEI, IPCC, NCEI, IPCC

# Why

## Mitigation of Loss (Economic and Human)

***"People's perception of extreme but ambiguous weather can be processed through partisan lenses - their views and beliefs alter the way they perceive the weather."***

***"Particularly intense events -- a 100-year flood -- might be most capable of influencing attitudes."***

***"Efforts to connect extreme events with climate change may do more to rally those with more conservative views"***

Source: Dr Ben Lyons, University of Exeter, on Climate Change Denial:

# How

## Connect Historical Trends with Weather Extremes

Connect extreme weather events to historical weather data through the medium of time-series forecasting:

1. **Analyse historical weather data** of locations that experienced 1/50 year to 1/1000 year events in 2021
2. **Time series analysis and prediction** of a single 1/100 event in 2021
3. **Compare models**, is there a measurable relationship?

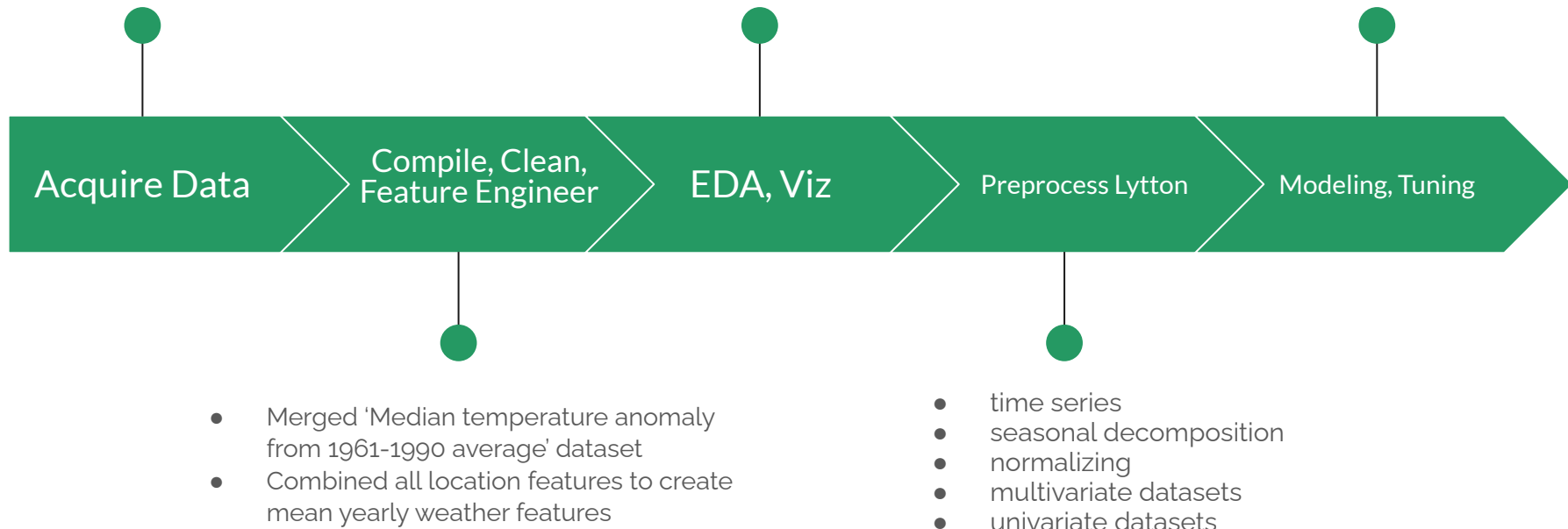
# Approach

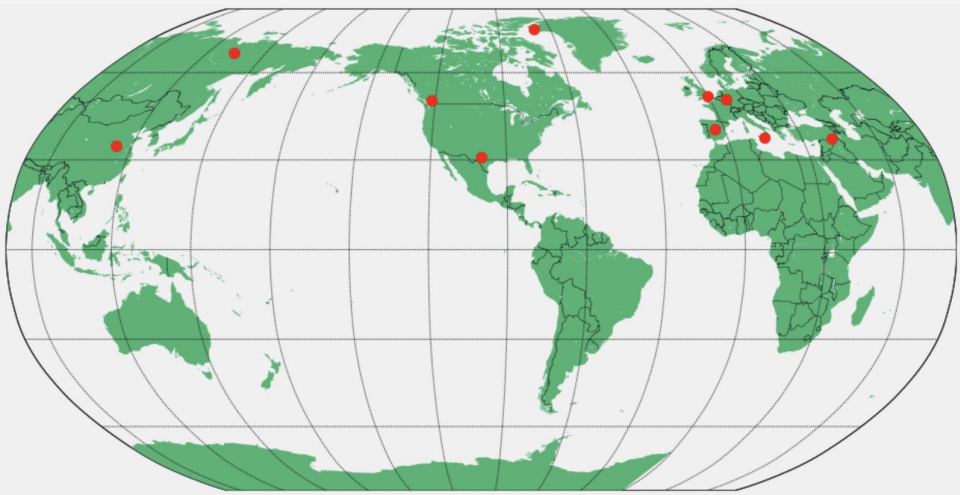
- Visual Crossing API:
- 10 locations, 10 weather features
- 1971-01-01 to 2021-12-31

- Explored all weather data
- Visualizations of trends

Modeling:

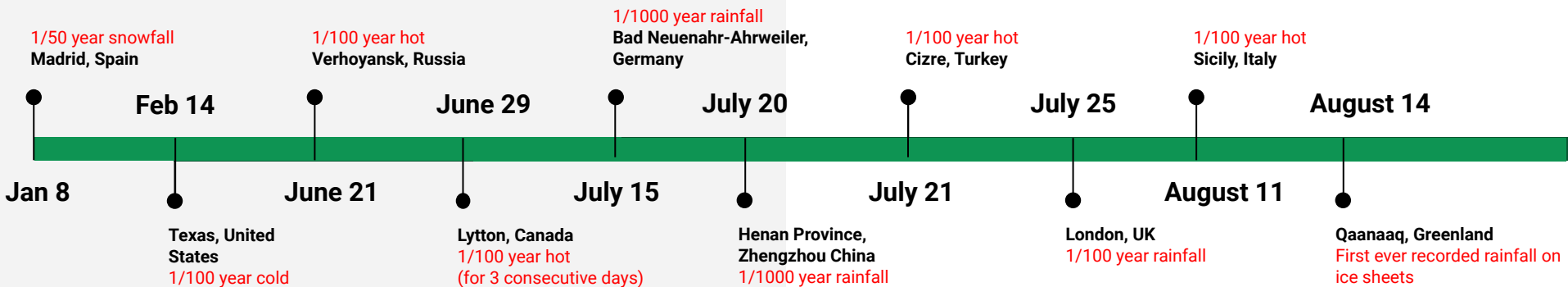
- Classic ML
- ARIMA (univariate and auto)
- Prophet
- LSTM
- Tuning: grid search





# Timeline:

## Climate 'hotspots' in 2021



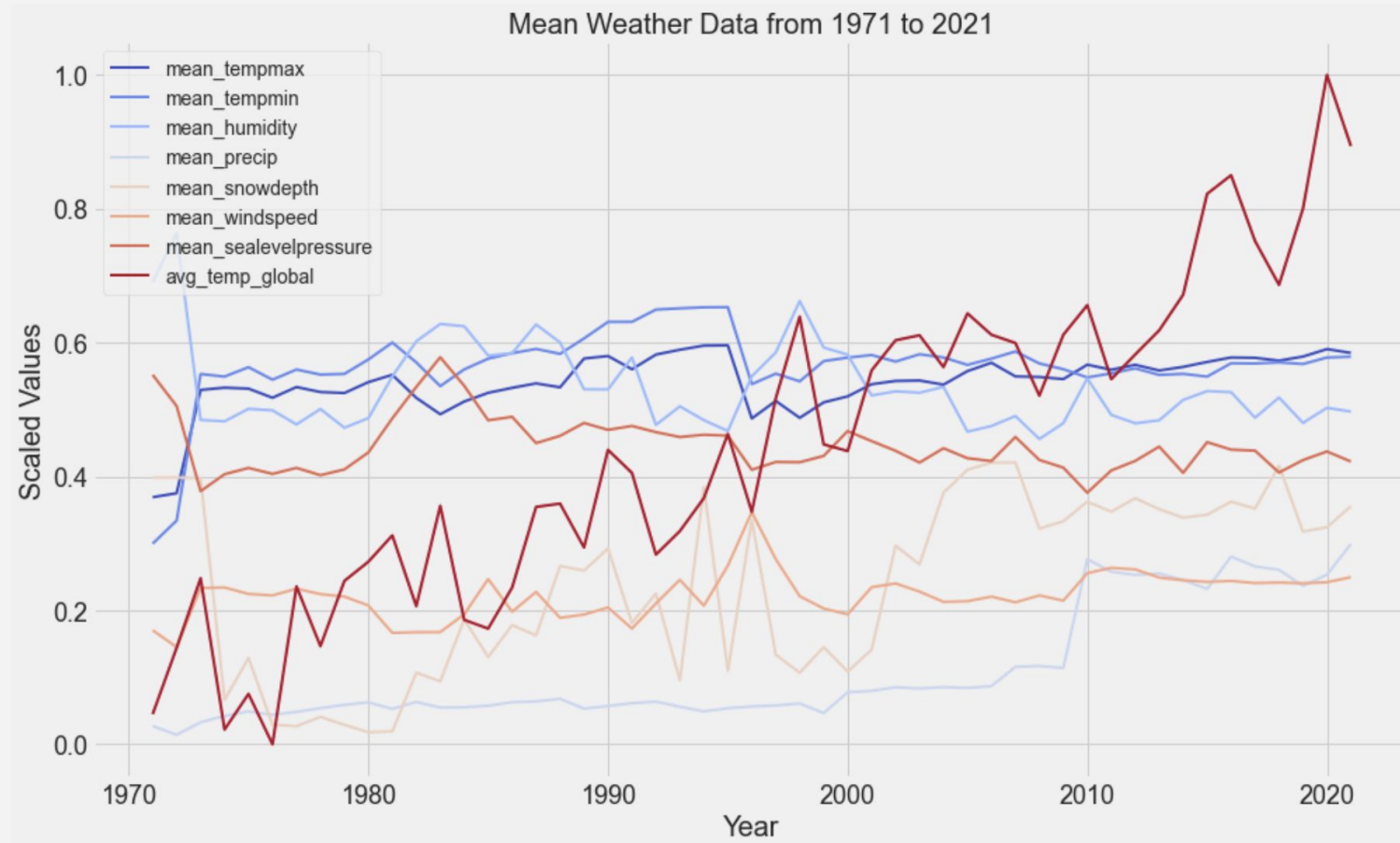
# All weather Data: Yearly Visualization and Observations

Positive trends  
(1971-2021):

avg\_temp\_global  
(+0.85C)

mean\_precip  
(+0.27mm/day)

mean\_snowdepth  
(+0.25 cm/day)



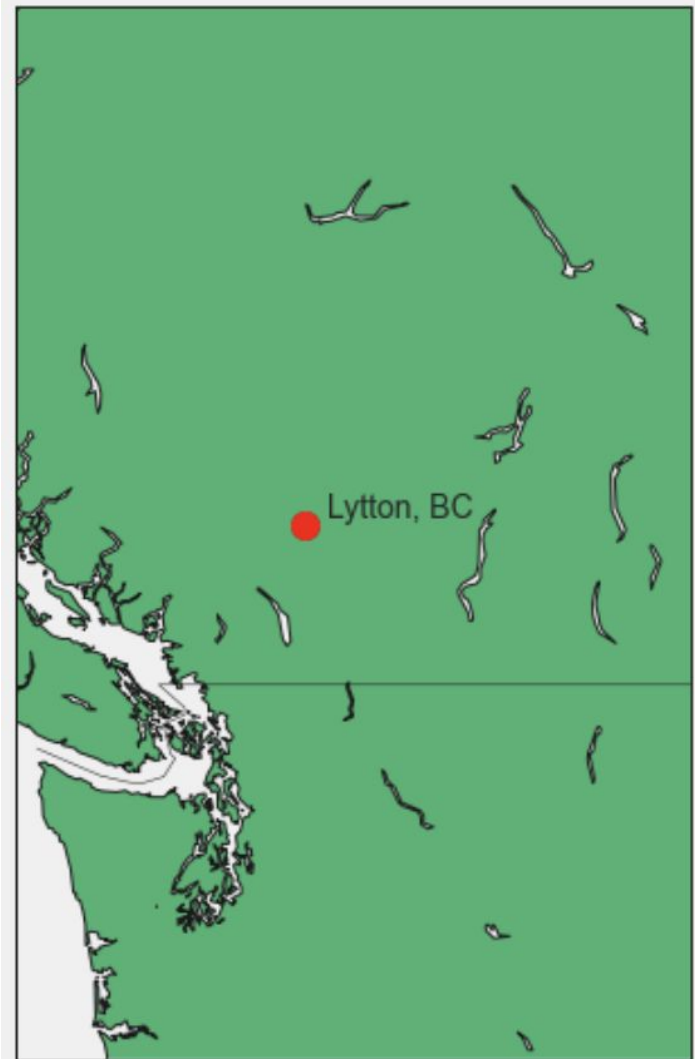


# Lytton BC - 1/100 year max temp

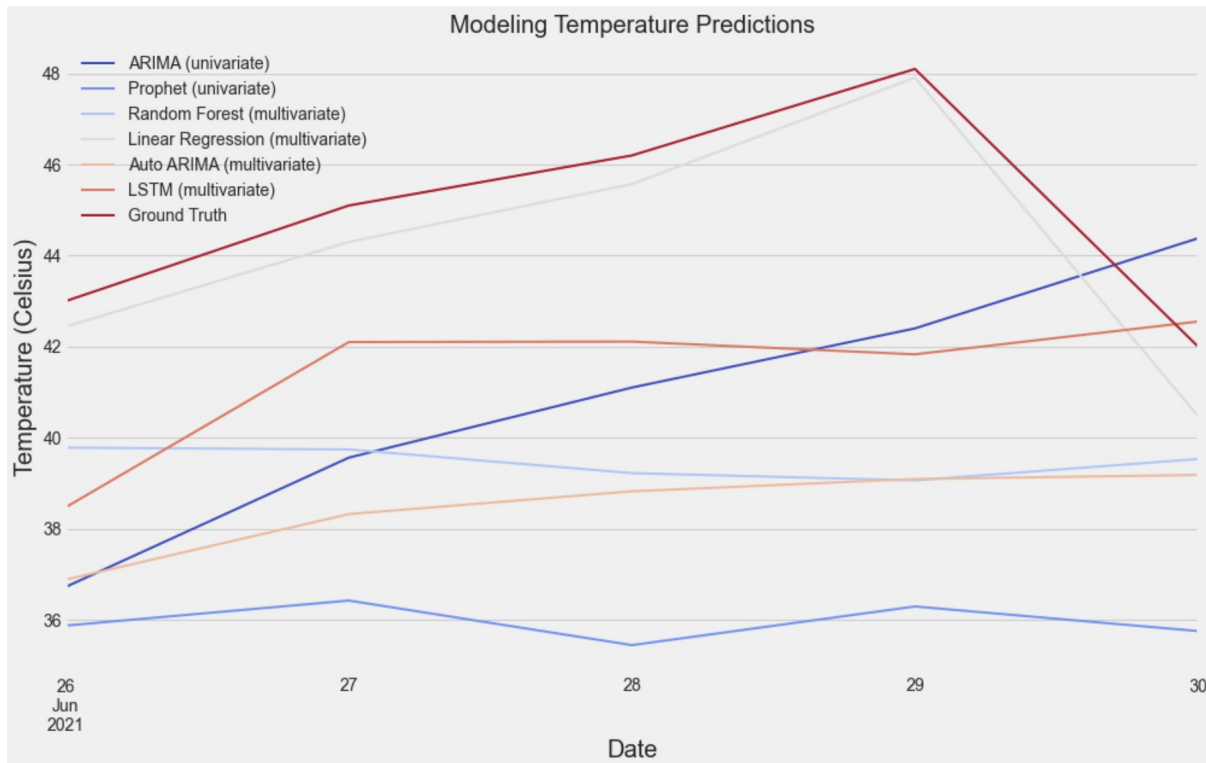
June 29th Lytton, BC : 1/100  
temperature break for 3 days  
straight hitting a scorching **49.6 C**:

Goal:

1. Predict temperature between the dates of 2021-06-25 to 2021-06-30, using historical data predating this period
2. Achieve robust model using univariate and multivariate datasets



# Results: Forecasting Lytton BC



Error Metric: **RMSE**

Model	RMSE
Arima (univariate)	5.183
Prophet (univariate)	9.171
Random Forest (multivariate)	5.927
Linear Regression (multivariate)	0.863
Auto ARIMA (multivariate)	6.738
LSTM (multivariate)	4.144



## Reflections

### What worked?

VC API for PULL  
request for  
thorough dataset

### What didn't?

gridsearch  
hyperparameter  
tuning on LSTM  
(and others: time  
sensitive)

### What's next?

Weather  
forecasting for all  
10 chosen  
locations



# The End!

Thank you for Listening