

An abstract graphic on the left side of the slide, featuring a complex, wavy pattern of black and white lines that resemble a topographical map or a stylized landscape. The pattern is contained within a rectangular frame with decorative corner elements.

**AER LINGUS**

# **ENHANCING WEATHER FORECASTING FOR AVIATION OPERATIONS**

A time series analysis

# OVERVIEW

## Problem:

1. Deicing an aircraft adds time to trip
2. The FAA says for all aircraft, structural icing can occur when moisture is present in the air at temperatures between  $4^{\circ}$  and  $-10^{\circ}\text{C}$ .
3. Even if the plane has to go through deicing once, it adds time to trip.

**Solve:** To address additional time needed we work with the control center to create a deicing schedule. This can result in a flight delay or delayed boarding to wait for an open slot on the deicing pad.

## How:

1. Make recommendations based on the data.
2. Build a model that can accurately forecast the weather by the hour.



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# 01 FIRST SECTION

Business Understanding





# EQUIPMENT

## TYPE I

### DEICE

Designed to remove ice after it begins to accumulate on the airframe.

## TYPE IV

### ANTI-ICE

Before entering icing conditions and is designed to prevent ice from forming.

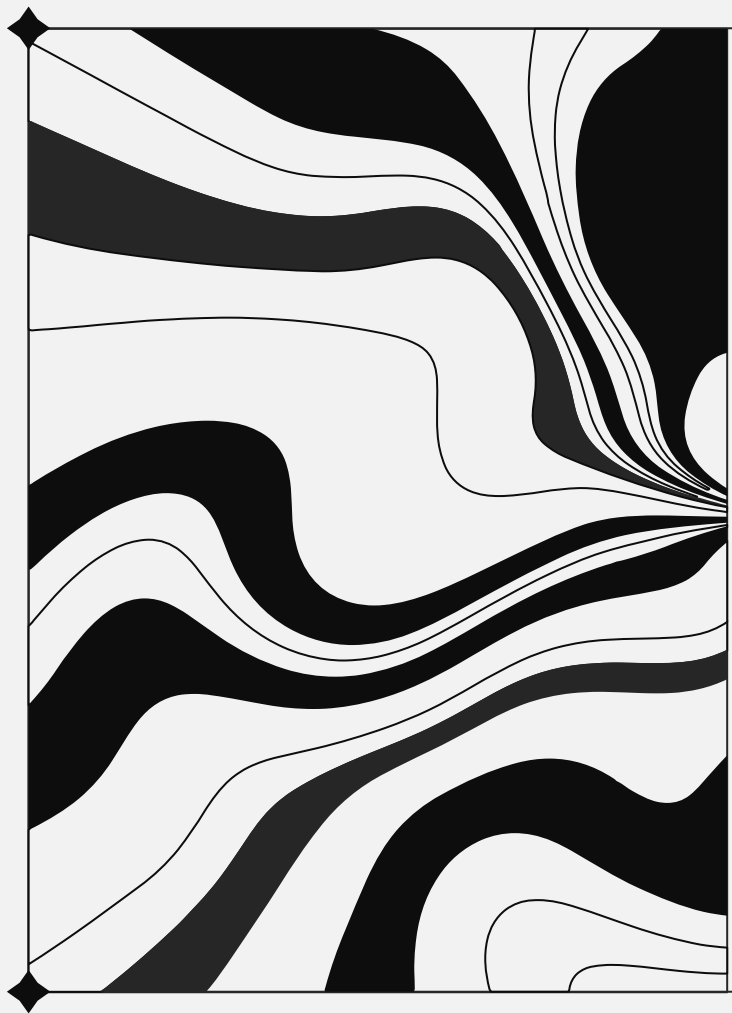
# WHEN SHOULD PILOTS DEICE OR ANTI-ICE?

- Planes will be de-iced and anti-iced as close to takeoff as possible to prevent more snow and ice from building up while plane is grounded. If it's just a buildup of frost, the process might only take 5-10 minutes to complete. During more severe weather, it can take 10-60 minutes.
- If the plane sits past its holdover time the fluid can be contaminated with snow and ice and you won't have the clean surface **AND** you have to restart the whole process over again.



# **HOLDOVER TIME!**

- The time from spraying to rolling down the runway
- precipitation, temperature and type of aircraft



**02**

# **SECOND SECTION**

The Data and Exploratory  
Data Analysis



# The Data

Met Eirann Meteorological Service 1990–2020



**STATION**

Dublin Airport



**TIME**

Hourly  
Convert to Datetime

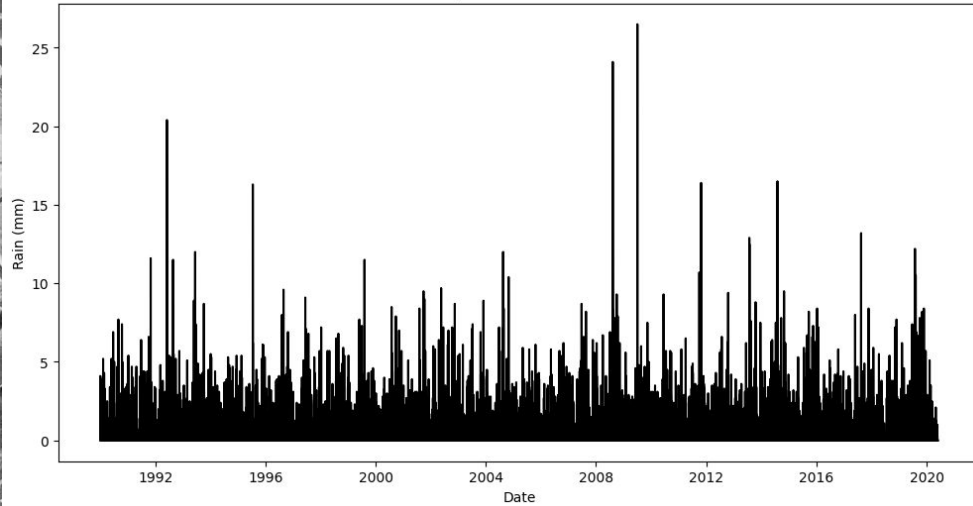


**Y**

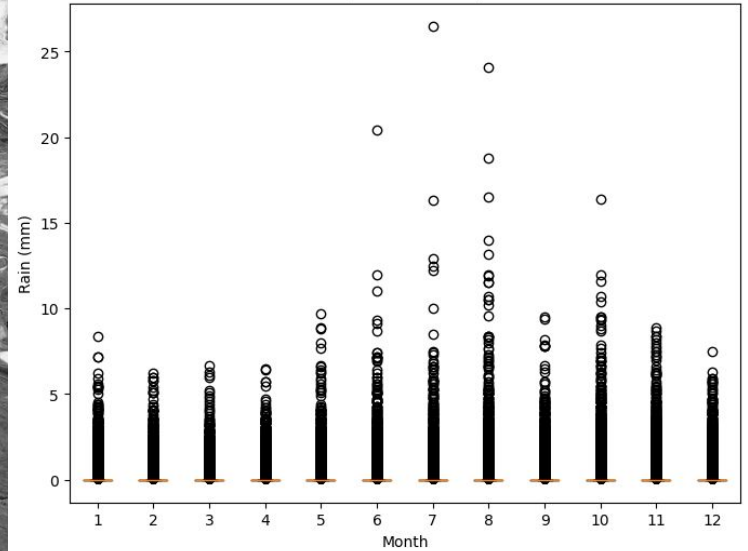
Temperature and  
Rainfall  
No missing values  
Convert to numerical

# DOES IT RAIN A LOT IN DUBLIN, IRELAND? LOL

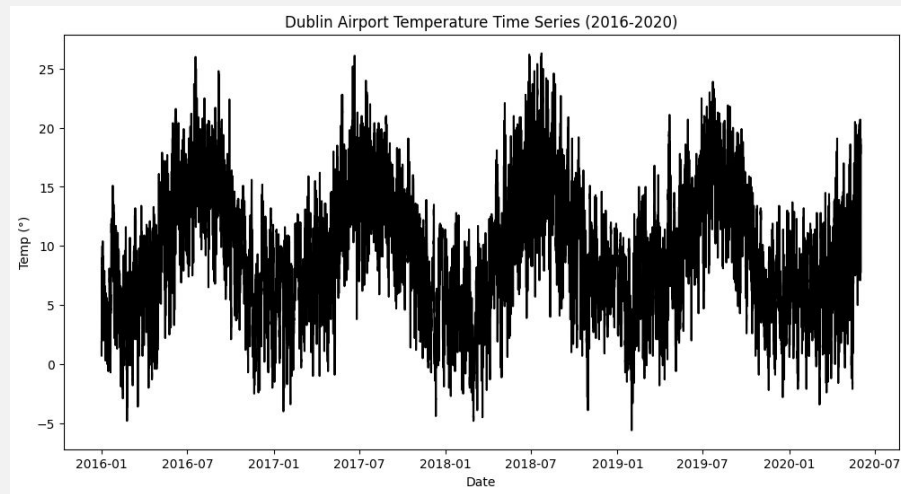
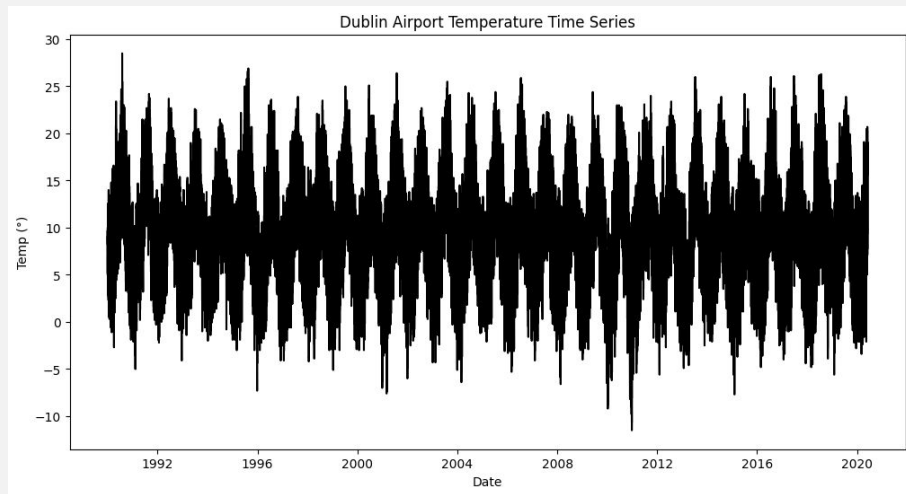
Dublin Airport Rainfall Time Series



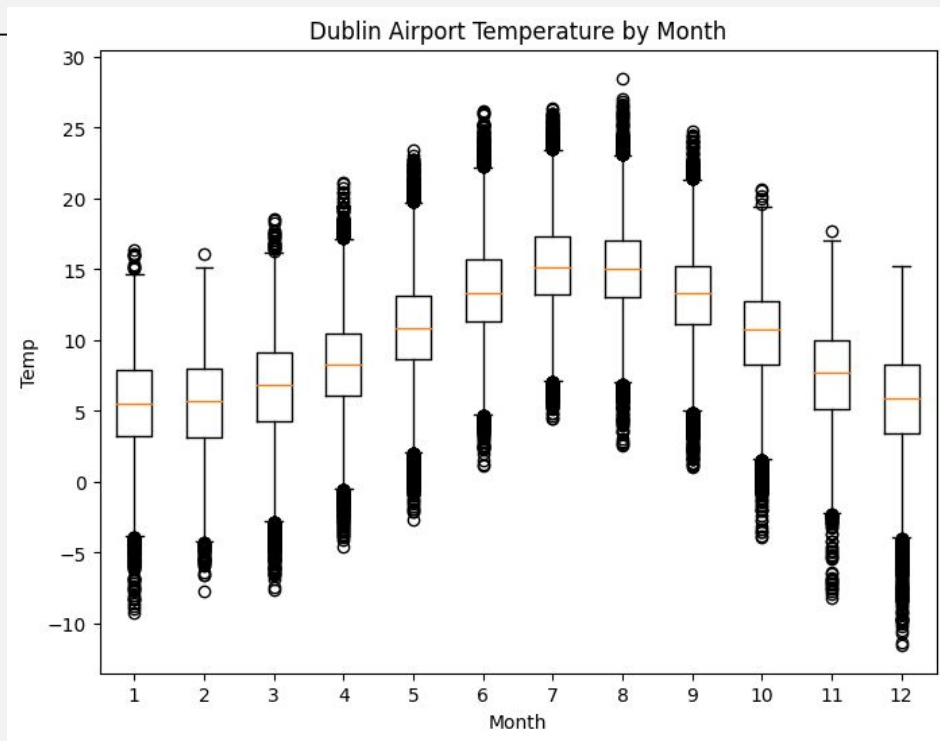
Dublin Airport Rainfall by Month



# WHAT'S THE TEMPERATURE LIKE?



# WHAT'S THE TEMPERATURE LIKE?





# 03 THIRD SECTION

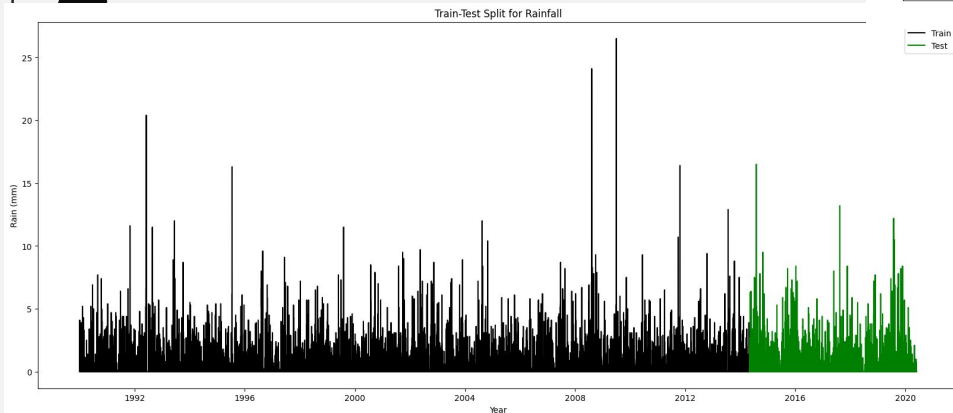
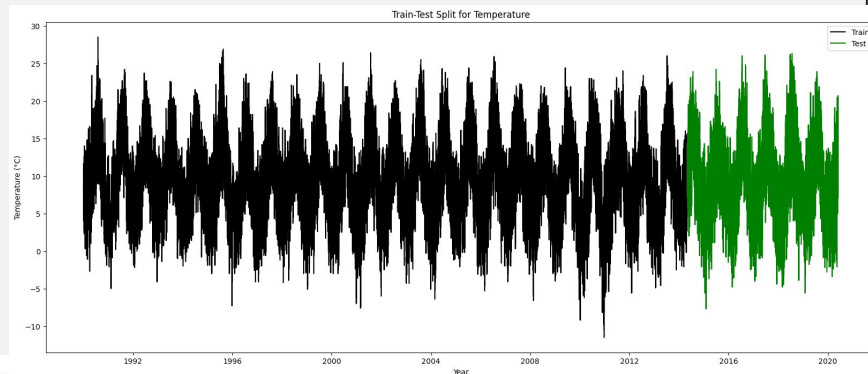
Choosing the best model

# TRAIN-TEST SPLIT

ADF p-values

Rain = 0

Temp = -5.89



# CHOOSING THE BEST MODEL

**01**

**NAIVE**

Rain: .40mm  
Temp: .94°C

**02**

**RANDOM WALK**

Rain: .44  
Temp: 5.41°C

**03**

**RANDOM WALK  
ARIMA**

Rain: .44  
Temp: 4.99°C

**04**

**AUTOREGRESSION**

Rain: .43  
Temp: 4.99°C

**05**

**MOVING AVERAGE**

Rain: .43  
Temp: 4.99°C

**06**

**NEURAL PROPHET**

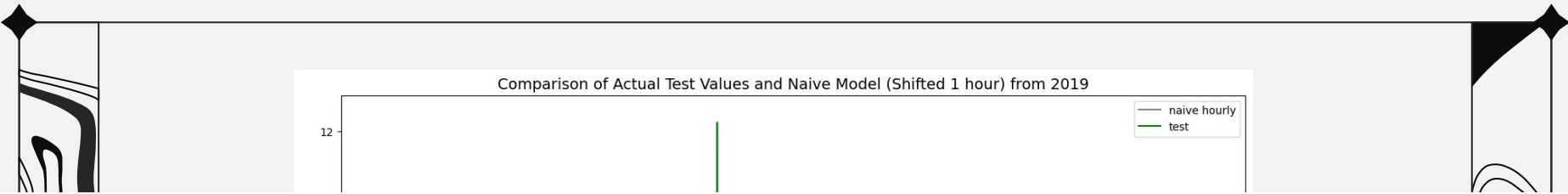
Rain: .43  
Temp: 4.11°C

"I win."

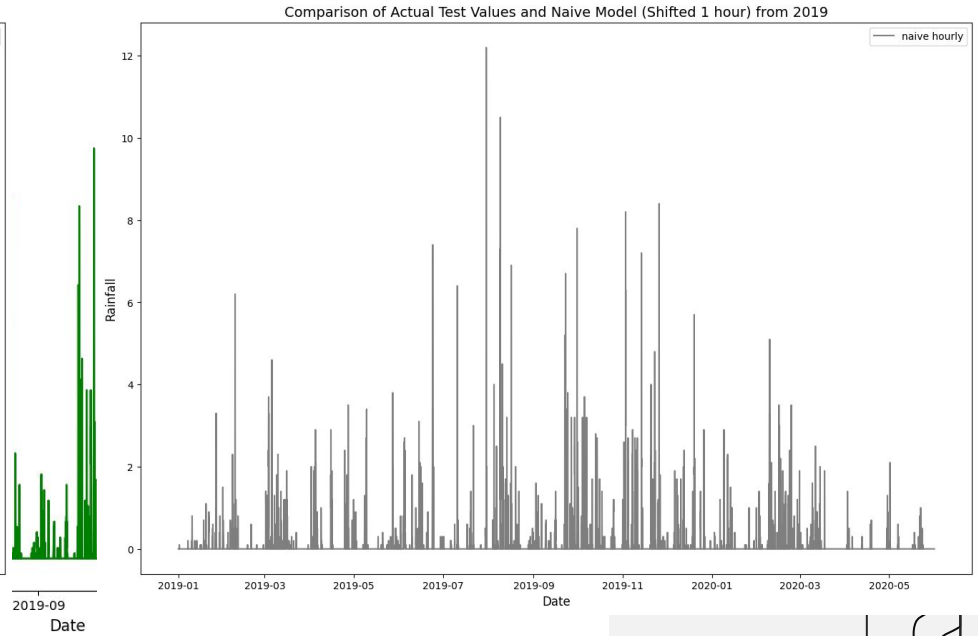
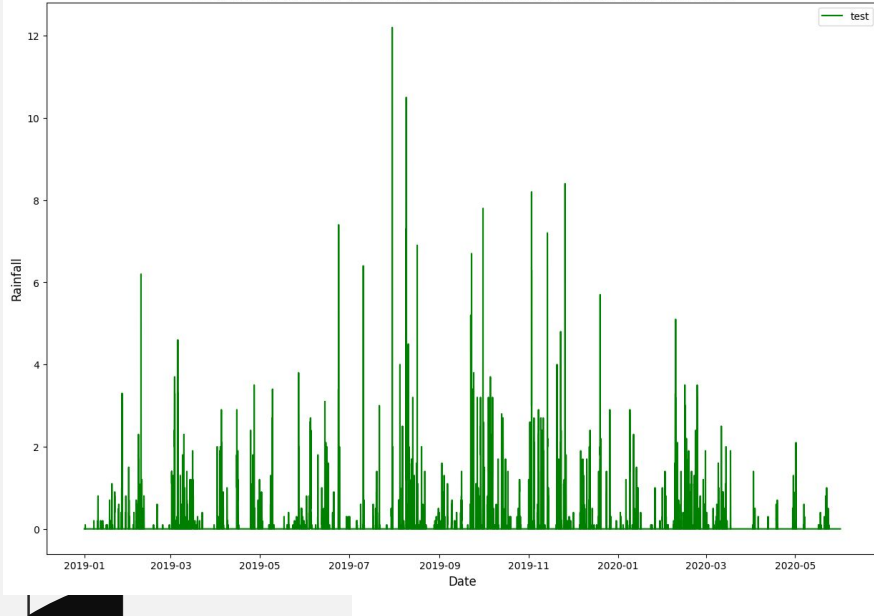
**—THOMAS BAYES**





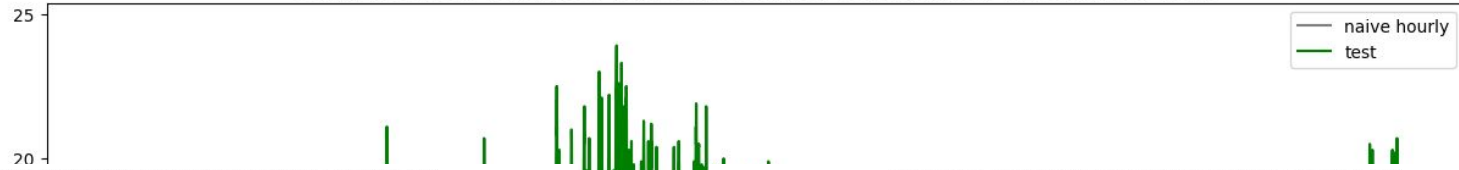


Comparison of Actual Test Values and Naive Model (Shifted 1 hour) from 2019

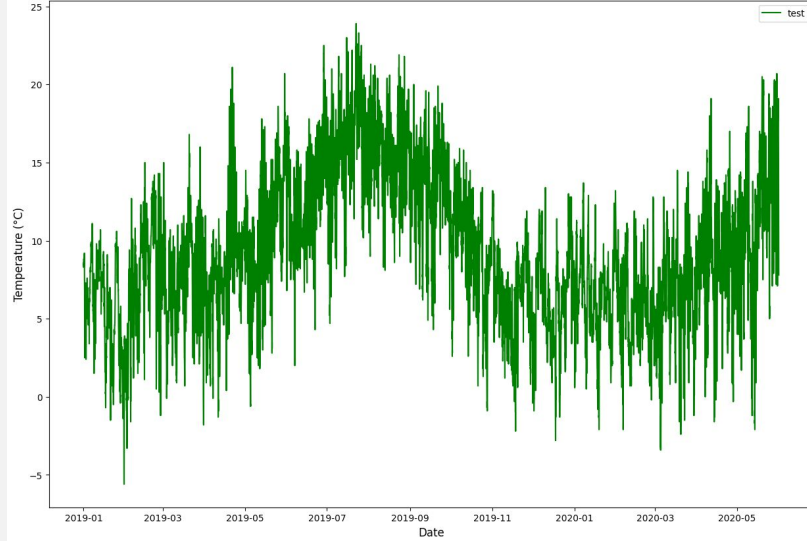


Daily = .6 mm

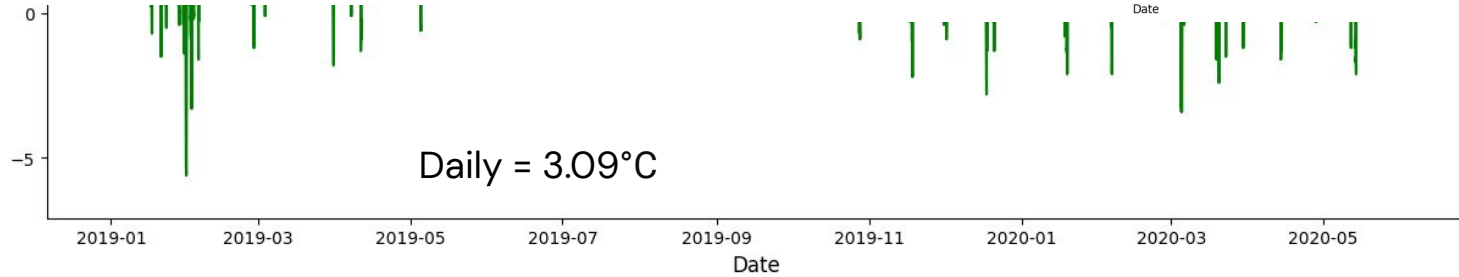
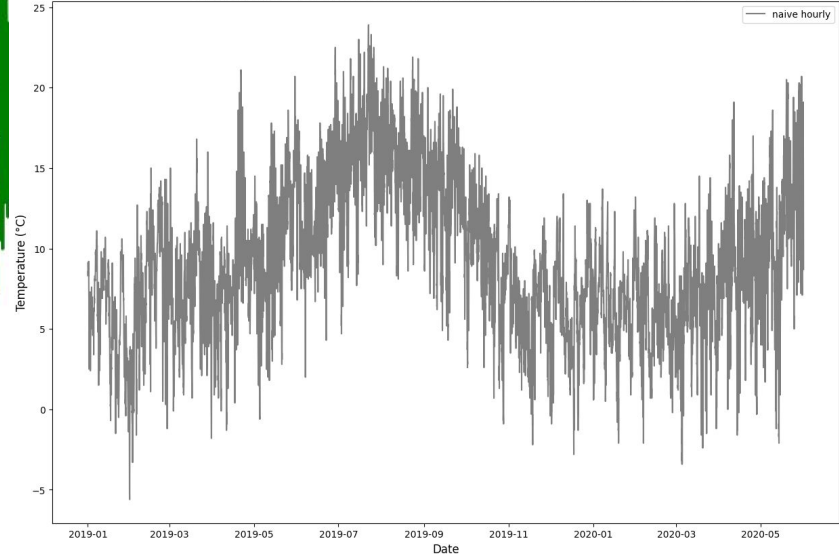
Comparison of Actual Test Values and Naive Model (Shifted 1 hour) from 2019



Comparison of Actual Test Values and Naive Model (Shifted 1 hour) from 2019



Comparison of Actual Test Values and Naive Model (Shifted 1 hour) from 2019





# 04

# FOURTH SECTION

Recommendations and  
Next Steps

# RECOMMENDATIONS

Light snow – you can have 2–3 hour holdover time

**Freezing rain** – you will have maybe up to 15 minutes holdtime

- Expect shorter holdover times between October and April as the temperatures are in the high risk zone for structural ice to be formed.
- Accurately predicting the rain hourly during the colder months is crucial
- Passengers should expect delays in May, October and December

# ABOUT NEXT STEPS

**01**

**TEST**


Test the forecast in the next year to see if the model is accurate enough to be helpful moving forward

**02**

**ADD**

Add in other columns that could help forecast weather



A large, vertical rectangular area on the left side of the page is filled with a complex, black and white marbled paper pattern. The pattern consists of swirling, wavy lines of varying thicknesses, creating a sense of movement and depth. The colors range from deep black to light gray, with some areas appearing almost white where the lines are thin and closely spaced. The pattern is reminiscent of traditional marbling techniques used in bookbinding.

“Aer Lingus warrants passengers if winter weather is expected to cause delays offering passengers a chance to rebook their flight before coming to the airport. Of course knowing if it’s worth the potential added cost is a tough call.”

## **KIND OF LIKE PREDICTING THE WEATHER**

A vertical strip on the right side of the page contains an abstract black and white pattern. It features bold, thick black shapes that resemble stylized, flowing forms or perhaps a close-up of a textured surface. The background is white, and the overall effect is graphic and modern.



# **THANKS**

**Do you have any questions?**  
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