CHAPTER

6

FORECASTING WIND SPEED WITH AUTOREGRESSIVE-SINGLE EXPONENTIAL SMOOTHING MODEL

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6.1 INTRODUCTION

Wind speed, or wind flow velocity, is a simple atmospheric quantity that is caused by air passing from high to low pressure, typically due to temperature variations. A multitude of causes and conditions impact wind direction, working on different scales. These comprise the gradient of pressure, Rossby waves and jet streams, and local weather patterns. Wind velocity depends on the pressure differential; the larger the pressure differential, the faster the wind moves to offset the variance.

Gradient of pressure is a concept used to characterise the atmospheric pressure variation between two points in the atmosphere or on the Earth's surface. The Rossby waves are strong winds in the upper troposphere. The wind works and travels from West to East on a global scale. In the lower troposphere, the Rossby waves have different wind levels than what they encounter at the lower level. In affecting wind speed, local weather conditions play a key role, as the formation of

hurricanes, monsoons and cyclones as freak weather conditions will dramatically influence the wind speed.

For certain diseases like foot-and-mouth disease, Malaria and even COVID-19, wind has been recognised as one of the factors that contribute to the spreading of the virus (Endo & Eltahir, 2018; Mikkelsen et al., 2003). Wind, other than the role as carrier for the airborne virus, is said to also contribute as a crucial factor in transmitting various diseases because it could modify the active pathogens since wind can also carry other molecules (Coocia, 2021). Hand-foot-and-mouth (HFMD) disease for example, spread through droplets of an infected animal and in certain conditions it could dispersed for several hundred kilometers via the wind (Mikkelsen et al., 2003).

Under 50% humidity, these droplets could survive 50 times longer compared to normal conditions and 90% humidity can increase the survival of these smallest droplets up to 150 times (Chong et al., 2020). Thus, to a country that has high humidity and windier location, the possibility for the virus to spread will be higher and chances for the population in that area to get infected also will be larger. Some even suggested that the social distancing of 2 meters apart is now inadequate to practice because of this reason (Sommerstein et al., 2020). Hence, by studying the wind pattern, recommendation of how to locate the patient can be made to decrease the infection of the disease.

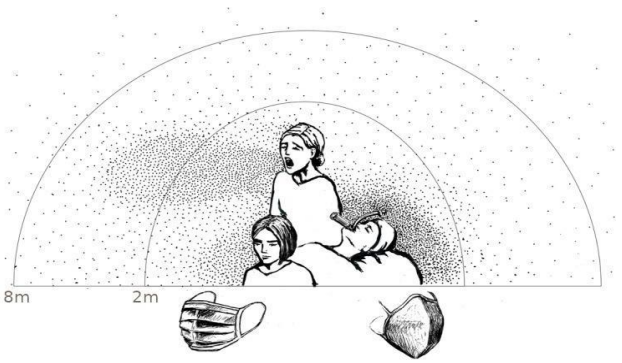

Figure 6.1 Droplet transmission range for speaking, coughing, or sneezing and intubation generated by a patient (Sources: Sommerstein et al., 2020)

In the above Figure 6.1, we could see the droplet transmission range of the saliva when a person speaks, cough and being intubated. Speaking and being intubated have the smallest transmission range compared to coughing. Due to this reason, it is important for a person to make sure the mask is used when a person is not healthy, especially when they are infected with a virus that can be transmitted through airborne.

6.2 WIND AS VIRUS TRANSMITTER

The wind is very related to the airborne viruses. Few research on virus spreading involving wind have been done in few countries such as Brazil, Turkey, China, Italy, United Kingdom and many more (Chenar & Deng, 2018; Khan et al., 2020; Liu et al., 2016; Ma et al., 2020; Mikkelsen et al., 2003; Şahin, 2020; Sedda & Rogers, 2013; Sun et al., 2016). The studies want to know whether viruses such as HFMD disease, Malaria and Schmallenberg can be spread through the wind and whether the wind can modify the viruses to be more aggressive.

Mikkelsen et al., (2003) has found in their study that low wind speed is one of the reasons to why the virus HFMD spread from Heddon to Ponteland with other factors such as air pollution, downwind distance, and wind stratification in HFMD virus spreading. Sedda and Rogers (2013), study the deployment of virus Schmallenberg in Europe in 2011. According to their findings, 70% of the virus spread through the downwind movement. Endo and Eltahir (2018), in their study on effects of the wind direction with Malaria dispersion have found that population in area with low wind speed are more likely to get infected with Malaria. The low wind speed in this study is outlined between 0.5 km/h to 1.0 km/h. This information has been applied in Brazil to reduce the infection of Malaria among the patients by locating the patients at downwind of lake.

As for the COVID-19, it has struck many countries in the world within few months. Starting from China, the virus has infected millions of people all around the world. Few studies have shown that wind is one of the features that help transmit the virus from one infected person to