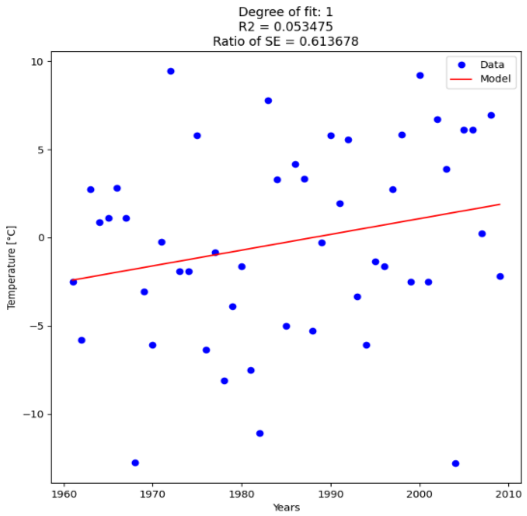

Figure 1. A4.I

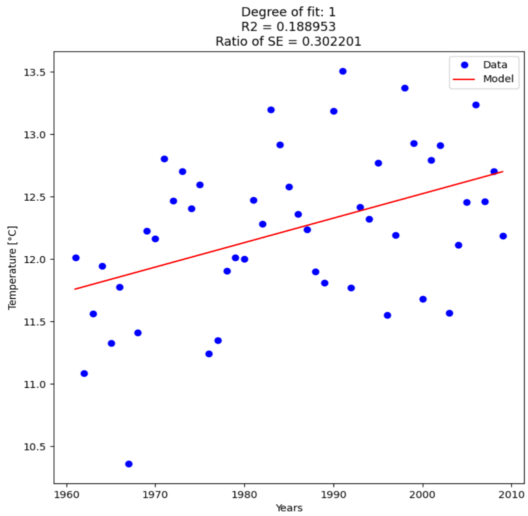

Figure 2. A4.II

Figure 1. A4.I	**10th January**	**R^2 = 0.053**	**Ratio of SE = 0.616**	**M-1**
Figure 2. A4.II	**Yearly Averages**	**R^2 = 0.188**	**Ratio of SE = 0.302**	**M-2**

1. The **R^2** value is a measure of how well the model fits the data. When **R^2** values are compared, it is seen that **M-1** value is lower than **M-2** value. This suggest that **M-1** is less consistent than **M-2**.

A smaller SE means that the prediction is less likely to be affected by random fluctuations in the data and is therefor a more accurate reflection of true population value. **M-2** is therefor more reliable than **M-1**.

Choosing a specific day may provide a less accurate representation than using annual averages.

2. Although both graphs appear noisy, when we examine the y-axis values, the range in **M-1** is between -10 and 10, whereas in **M-2** it ranges from 10 and 13.5. Therefore, we can conclude, **M-1** is noisier.

Averaging the measurements helps minimize the impact of measurement errors.

3. In both graphs, models show an increasing trend for temperatures. However, the best our best model R^2 value is 0.18 and this makes it difficult to make firm judgements for the future based on these models.

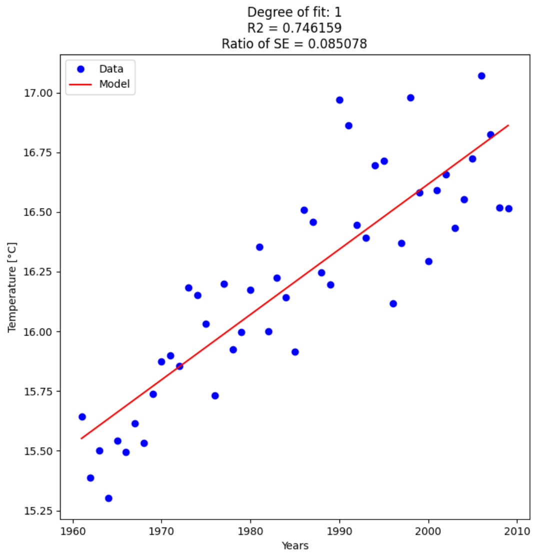

Figure 3. B

Figure 3. B | R^2 = 0.746 | Ratio of SE = 0.085

1. The **R^2** value increased and the **SE** decreased. The model is now more reliable for forecasting. And based on the model we can say that global warming is happening.

2. By including data from multiple cities, B's analysis has access to a larger information. More data leading to a more accurate representation of the trend.

Each city experiences unique local fluctuations in temperature due to factors like geography and other factors. By averaging temperature data across multiple cities, B's analysis reduces the influence of these local factors.

3. Adding two more cities may be more reliable. However, having 100 cities would be more reliable and would minimize the geographical effects of the selected cities. Nevertheless, the choice of cities should be truly random or deliberately complex, rather than a selection of cities that will give the desired results. However, too much data may lead to overfit.

4. Since cities in the same region will have similar climate patterns, the data points will be closer together. This could have resulted in a higher R2 value. However, a more homogenous dataset of cities in the same region could make it harder to access whether the global warming trend is statistically significant. Data from different regions helps to increase the overall validity and robustness of the trend.

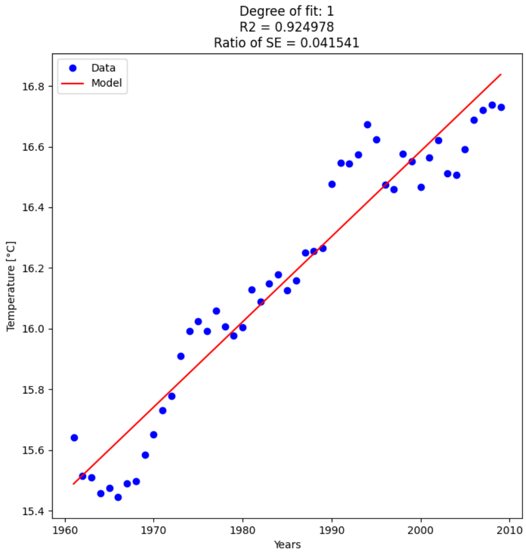

Figure 4. C

Figure 4. C | R^2 = 0.924 | Ratio of SE = 0.041

1. The model has improved. **R^2** is increased more and **SE** is decreased. Model is more reliable and data points behave together. There's a stronger coherence between data points, with fever deviations from the model.

2. When considering 5-year rolling averages of the original data, outliers become less extreme and they slightly influencing the values of nearby data points. Overall, the data exhibits greater coherence and fever extreme values.

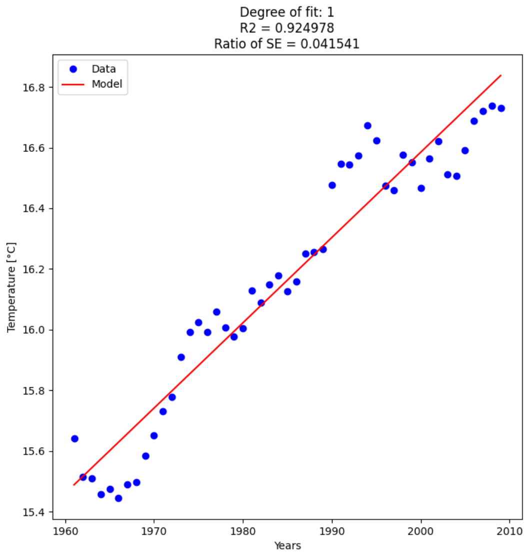

Figure 5. D2.1.1

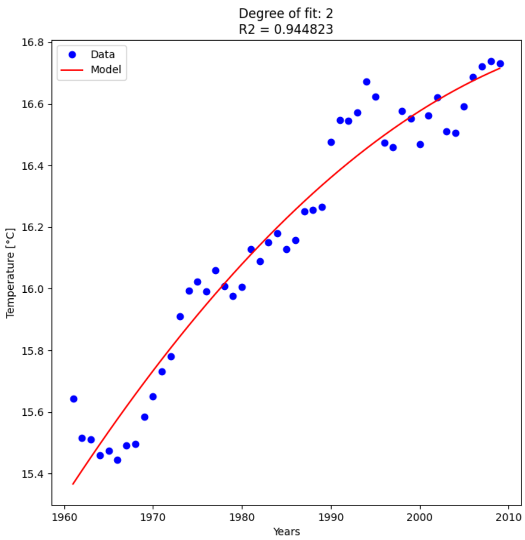

Figure 6. D2.1.2

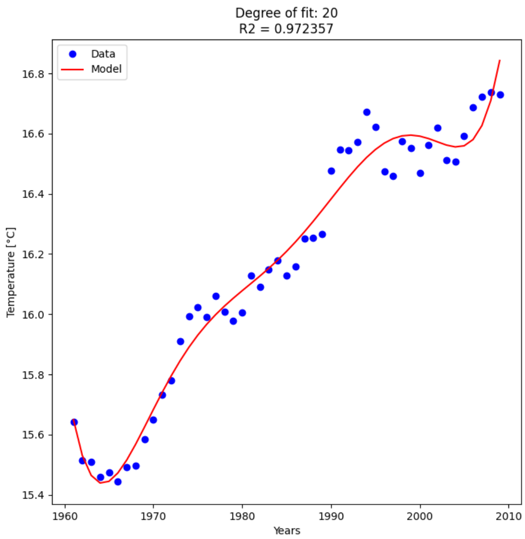

Figure 7. D2.1.3

Figure 5. D2.1.1 | R^2 = 0.924 | Ratio of SE = 0.041
Figure 6. D2.1.2 | R^2 = 0.944
Figure 7. D2.1.3 | R^2 = 0.972

1. All three models shows a good fit to the data, with $\mathbf{R^2}$ values above 0.9. Degree 1 (linear) model is the simplest model, capturing the overall trend in data but may not capture subtle non-linear relationships. Degree 2 (quadratic) better fitting data with slight non-linearities. Degree 20 (high non-linear) model is very flexible and can capture complex patterns in the data, but it effects from noise and prone to overfitting.

2. The degree 20 model has the highest $\mathbf{R^2}$ value. Higher $\mathbf{R^2}$ can indicate overfitting, especially for complex models like degree 20. This means the model might be memorizing specific data points instead of capturing the underlying relationship.

3. Degree 20 model is the best fits the data, highly probability with overfitting.

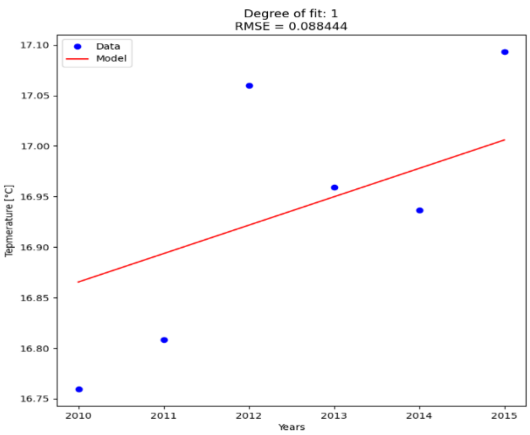

Figure 8. D2.2.1

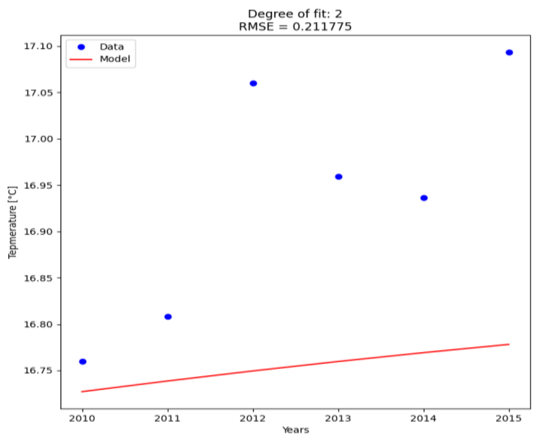

Figure 9. D2.2.2

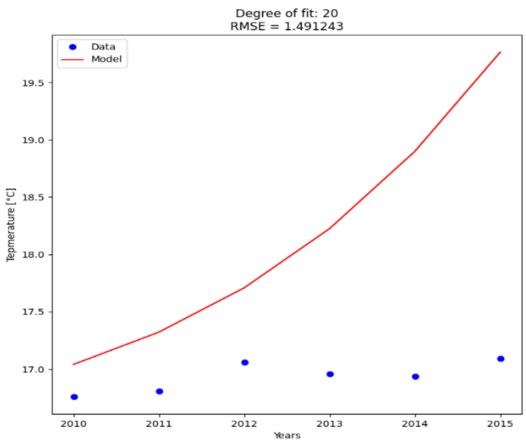

Figure 10. D2.2.3

Figure 8. D2.1.1 | RMSE = 0.088
Figure 9. D2.1.2 | RMSE = 0.211
Figure 10. D2.1.3 | RMSE = 1.491

1. RMSE measures the average size of the error of a predictive model. The smaller the RMSE value, the higher the accuracy of the predictive model. Even if the degree 20 is fit the data its RMSE is too high and cannot accurately predict future values. The predictions of degree 2 are much more accurate, but still degree 1 is the best in this case.

2. Comparing RMSE values, degree 1 is the best and degree 20 is the worst model. The opposite was the case with the training data. Degree 20 explained data so well that it missed the general behavior of the data. But, degree 1 captured the general behavior of the data without being overly affected by noise, resulting in better predictions for future values.

3. Model accuracies would be reduced (RMSE would increase) in any case, but the degree 1 model would still predict better than the degree 20 model.

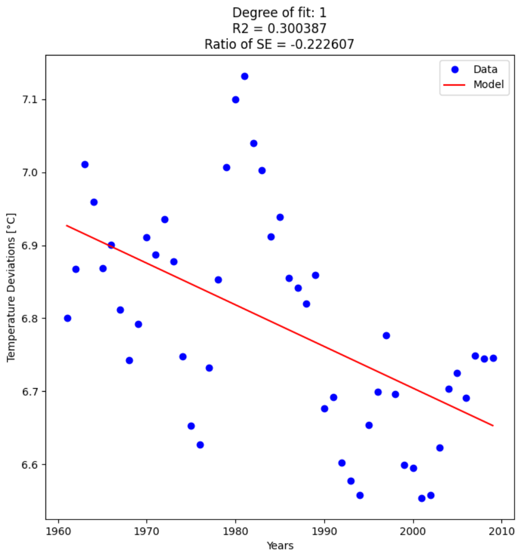

Figure 11. E

Figure 11. E | R^2 = 0.300 | Ratio of SE = -0.222

1. No, there are no indication that the temperature change is increasing, on the contrary, it's getting slightly decreasing.

2. In addition to annual changes, we should also consider seasonal changes. Winters may be getting colder and summers getting hotter over the years. Another consideration is the location (latitude, longitude) can give us more insight.