Model comparison and evaluation

Comparison

In general, the models demonstrate two trends in CO2 concentration. After sharing a common accelerated rise from 2000 to ???, while Model 1 presents a tragically continual increase throughout the century until hitting as high as 650 ppm, Model 3 projects an optimistic turning point around ??? when the inclination is supposed to be replaced by a static state maintained around the concentration of ??? ppm. As for Model 2, predicted CO2 level will increase in a sluggish speed and hit the peak concentration of ??? in 2080. Then, it will drop until 2100 to an end at ???. The curves appear generally smooth without violent surges or declinations.

Assuming the most factors exerting influence, we can see that Model 1 basically extents the current trend and little variation in the factors are evidently visualized. In contrast, as the only model that is optimistic enough to speculate declination in CO2 levels, Model 2 boldly points out the transition from unconstrained growth in history to a comprehensive restraint on CO2 emission and even a consequent drop in projected future. Compared to previous algorithms, Model 3 holds a mediate position of staying the

Evaluation

We see in the figure that Model 2 & 3 give similar predictions, while projection values of Model 1 are much higher. Yet, all of the three models’ predictions conclude that CO2 concentration will not reach as high as 680 ppm in 2050, not even in 2100. In fact, Model 1 predicted that CO2 concentration will go above 680 ppm in 2115, but the model will probably be no longer accurate after going through such long time.

To strengthen certain outstanding characteristics in each model, other aspects are sacrificed to reach inter-model balance. Among the models presented, we reckon Model 2 as the most accurate projection and Model 1 as the least realistic before year 2100. Model 1 has utilized all factors to give the prediction, but the predicting methods it adapts is not optimized for specific problem. Model 3 has considered the retroaction effect that CO2 exerts on humans, yet the feedback functions are artificially designed, which cannot be supported by the data. Model 2, adapting stepwise regression and borrowing STIRPAT equation from environmental science study, reasonably estimated the relation between major factors and CO2 concentration. The model gave a convincing prediction that CO2 concentration will hit a climax of 456 PPM in around 2085 and later fall back.

---above is evaluation---

---below is s & w---

Model 1 is developed as all ten factors contribute to the eventual projection in different weights. This highly resembles the often situation in reality, where multiple factors decide the final result in minor proportions, instead of a few major ones determining every aspect. While mimicking reality, the large number of factors also brings setbacks: the more factors are, the bigger the possibility that intense changes occur after sudden disruptions. Thus, it becomes harder to avoid unreasonable bothers and to maintain the result within a reasonable interval, making the algorithm more fragile to sudden changes or long-term projections. In this case, it goes the opposite way from the other two projections and failed to foresee the positive changes in basic factors supporting the projection.

Model 2 is evaluated as generally accurate. It is crucial that the generalized algorithm be flexible to changes in factors. To achieve this, Model 2 embodied the original trends in determining factors when predicting by simplifying trends in selected factors directly form a compound algorithm. While it provides more flexible insights by simplifying the attribution of weight between factors, the form of exponential function also decides that the changing rate of factors and the independent factor $c$ beer a linear relationship, which is a more realistic way for variables to change.

By designing feedback functions, Model 3 clearly shows the influence of efforts to reduce carbon emissions taken into account. By focusing on the amount of CO2 emission – the derivative of CO2 concentration with respect to time, instead of CO2 concentration itself, Model 3 is intuitively more reliable that other 2 models. However, as the effectiveness of feedback function relies on our designs, it becomes hard to set an ideal function. Also, the model predicts that CO2 concentration will maintain as high as 460 ppm, which seems not reasonable.