The S-curve is calculated by using loops in order to find values closest to the optimal values making the predictions correct. There are two main functions involved:

1. The MSE function (Used to calculate error)

$$MSE = \frac{\Sigma_{d\ in\ \Lambda}(s(d)-r(d))^2}{|\Lambda|},$$

2. The S-curve model (Used to calculate S-curve for a specific day value)

$$s(d) = S + \frac{M}{1 + e^{-L(d-D)}}$$

To explain in detail, the S-curve is a function involving a sigmoid that must be optimized to find parameters that make its result fit the best to the COVID-19 data. In order to do so, all the parameters must be varied and the error must be calculated to find the set of parameters with the least number of errors, calculated using MSE. After finding the values of the parameters, the proper function of the S-curve can be derived (i.e. closest to the values as possible for the predictions) and the values can be predicted up to a certain accuracy, as determined by the minimum error produced by the MSE function.

For each of the parameters of the S-curve, there are 4 parameters. These include S, D, L, and M. Each of these values are controlling the different parts of the S-curve. For example, L determines the steepness of the curve. Other parameters can be varied to change the shape of the curve.

All of these can be concluded that an in order to predict an S-curve, we have to use parameters optimized by an error function, which could also be called a loss function, and that the value could be very useful in predicting the COVID-19 time series.