

# Calculating Risk Index of Third Wave

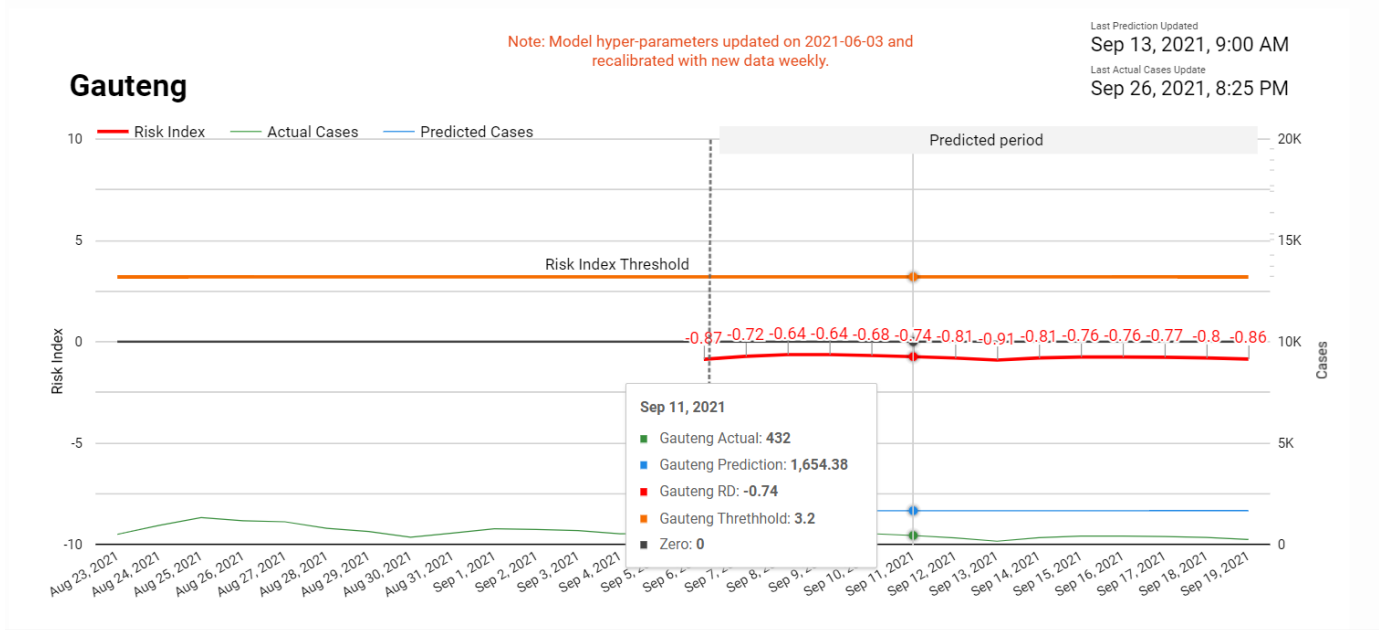
## Artificial Intelligence Algorithm: LSTM RNN

Alert system for a third wave of Covid-19 cases in South Africa recognises an additional wave when the actual value of daily cases deviates from the predicted value for each province. The risk metric used for the alert system is the relative difference. The **Risk Index (the relative difference)** is calculated using the following equation:

$$\text{Risk Index} = \frac{\text{Actual } dTCt - \text{Predicted } dTCt}{\text{Predicted } dTCt}$$

$dTCt = \text{Daily Change of Cases}$

Based on the relative differences between the predicted and measured values at steady-states between the first and the second waves, the **threshold** for the possible onset of the third waves were determined



**Risk Index** = Relative Difference = (Actual cases - Predicted cases) / Predicted cases

**Threshold** = [RI (Second Wave) - RI (First Wave)] / RI (First Wave) .....divided by max value

**Values Required** = 1) Overall actual cases and predicted cases , 2) actual cases and predicted cases in the first wave as well as 3) in the second wave

## Epidemiological model : SI model

**Risk index** gives a measure of the risk for the 3rd wave.

$$x = 100 \frac{\text{actual cases} - \text{present day prediction}}{\text{present day prediction}}$$

$$y = 10 \frac{1}{1 + \frac{\text{actual cases}}{\text{Total prediction}}}$$

$$\text{If } y > 8 \text{ risk index} = y + x \text{ else risk index} = x$$

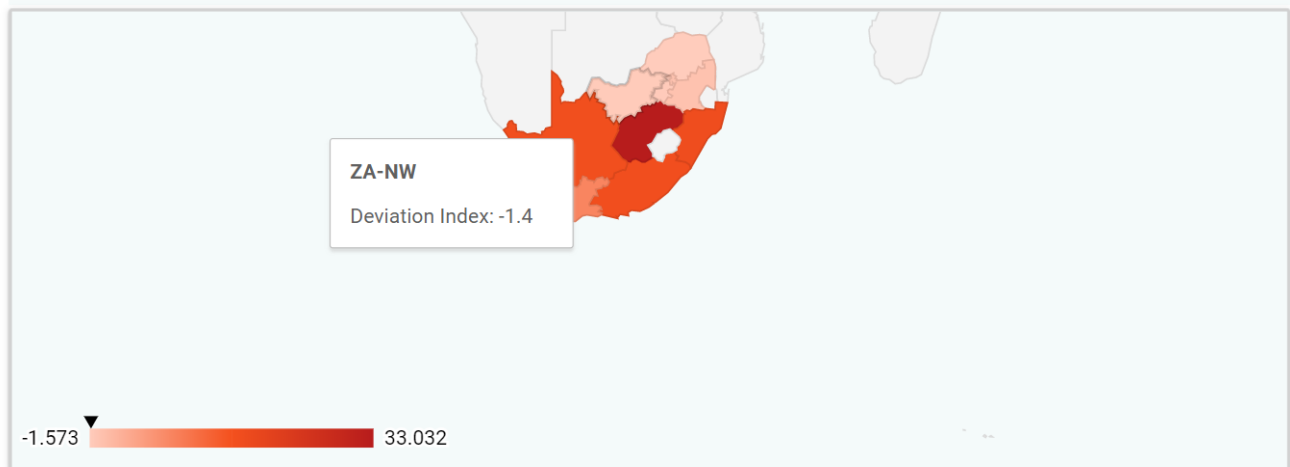
If Risk Index is ,

<0 = Very Low Risk  
 0 = Low Risk  
 7.5 = Medium Risk  
 10 = High Risk  
 >10 = Very High Risk

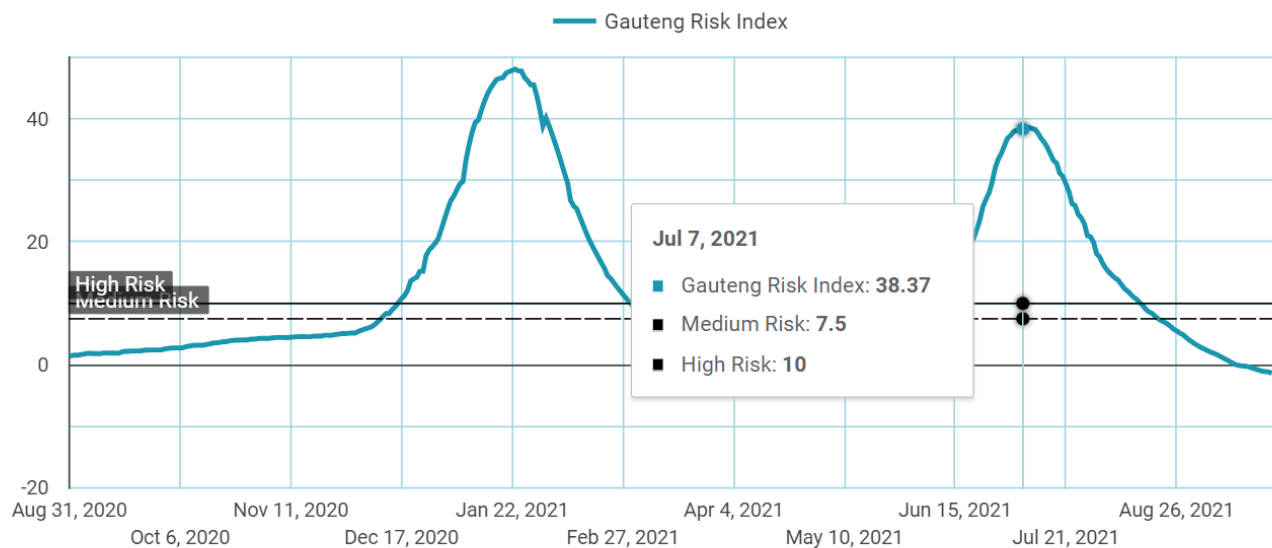
## South Africa Risk Index for the 3rd Wave

Last Updated:  
 Sep 26, 2021, 10:51 PM

South African Map with Risk Index



Time Series Graphs of South African Risk Index



Values Required = 1) Actual Cases

2) Present Day Prediction

3) Total Prediction

## Stringency Index and Alert Level South Africa


The South African Stringency index is a measure of the level of stringency of the accumulation of the Non-Pharmaceutical Interventions (NPIs) implemented by the government. The seven NPIs that are taken into account in the calculation are:

- S1: School Closure
- S2: Work Place Closure
- S3: Cancel Public Events
- S4: Close Public Transport
- S5: Public Information Campaign
- S6: Domestic Travel Ban
- S7: International Travel Ban

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### Summary of alert levels

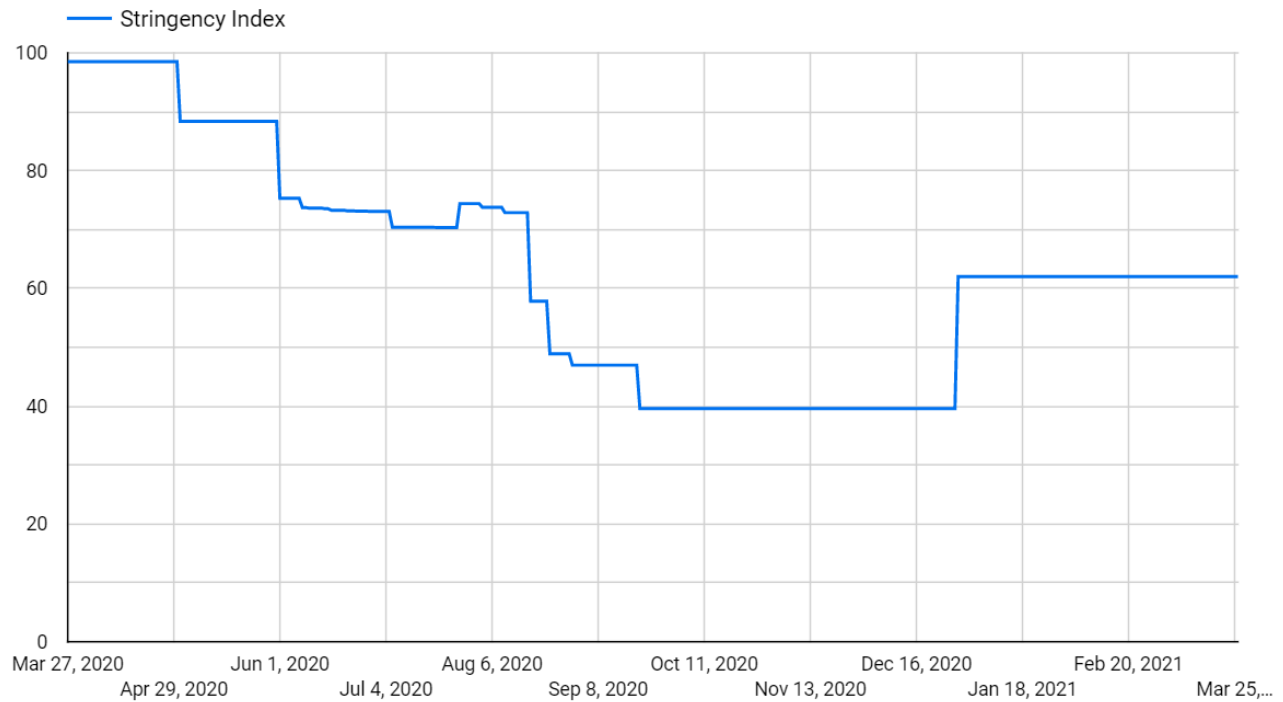
ALERT LEVEL 5	ALERT LEVEL 4	ALERT LEVEL 3	ALERT LEVEL 2	ALERT LEVEL 1
 <b>OBJECTIVE</b>				
Drastic measures to contain the spread of the virus and save lives.	Extreme precautions to limit community transmission and outbreaks, while allowing some activity to resume.	Restrictions on many activities, including at workplaces and socially, to address a high risk of transmission.	Physical distancing and restrictions on leisure and social activities to prevent a resurgence of the virus.	Most normal activity can resume, with precautions and health guidelines followed at all times.  Population prepared for an increase in alert levels if necessary.

WHATSAPP SUPPORT  
**0600 123 456**  
EMERGENCY NUMBER  
**0800 029 999**  
[sacoronavirus.co.za](http://sacoronavirus.co.za)

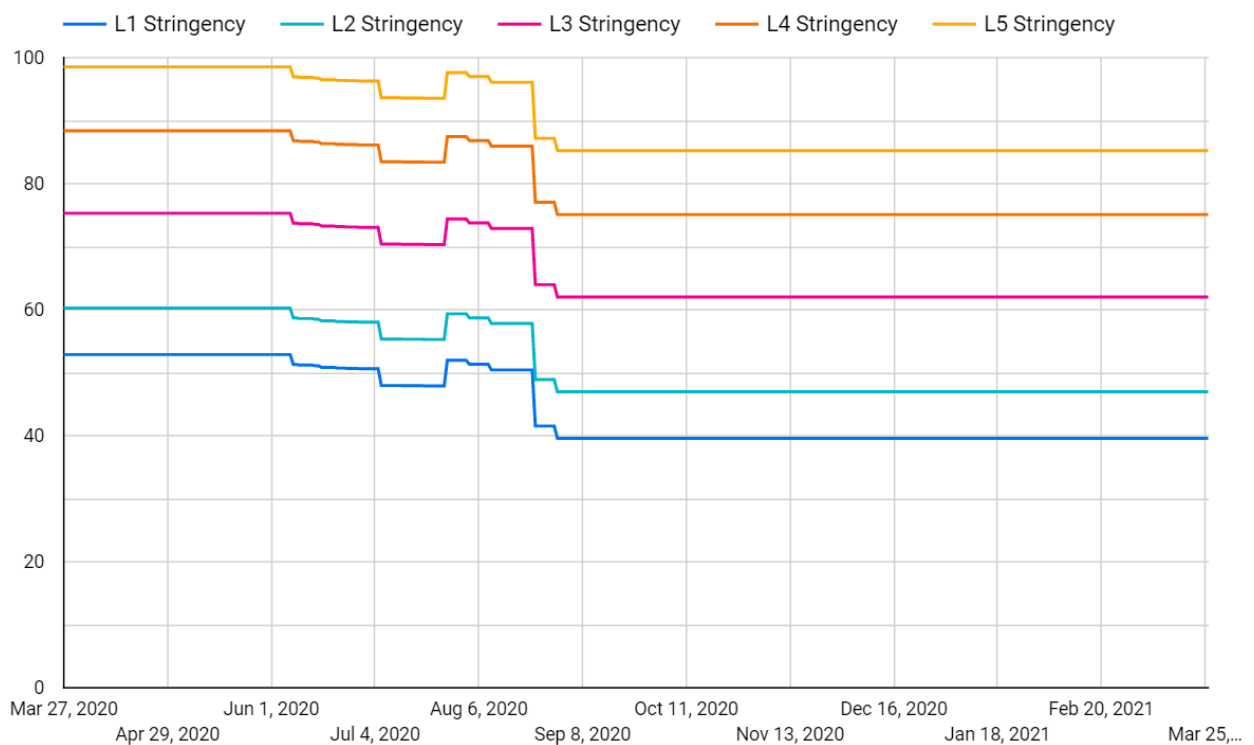


In order to quantify the effects of the alert system, a **Stringency Index** was carefully created for each South African Alert Level. The calculation of this Stringency index takes into account the status of various indicators that represent a number of Non-Pharmaceutical Interventions (NPIs).

## Time Series Graph of South African Stringency Index



## Comparison of Alert Level Stringencies



[Risk Adjusted Non-Pharmaceutical Interventions for the Management of COVID-19 in South Africa](#)

How to calculate stringency index : <https://covidtracker.bsg.ox.ac.uk/>