

GEO VIRTUAL SYMPOSIUM 2020

Session: Earth Observations for COVID-19 Response and Recovery

Exploring Covid-19 seasonality in South Africa

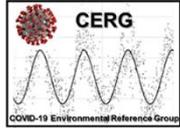
[Date] June, 2020

BIO Prof. Francois Engelbrecht

Francois Engelbrecht is Distinguished Professor of Climatology at the Global Change Institute (GCI) of the University of the Witwatersrand in South Africa. Engelbrecht specializes in numerical climate model development and the simulation of African climate variability and change, in particular, he currently leads the development of an African-based Earth System Model towards participation in the Coupled Model Intercomparison Project Phase Six (CMIP6) of the World Climate Research Programme (WCRP). Engelbrecht's research has led to new insights into the changing temperature, rainfall and circulation patterns over the continent under enhanced anthropogenic forcing. He served as an invited Lead Author of the IPCC's Special Report on Global Warming of 1.5 °C, which was published in 2018, and he is currently an invited Lead Author of Working Group I of Assessment Report Six of the IPCC. He is also an invited member of the Working Group on Numerical Experimentation of the World Climate Change Research Program (WCRP), and a Scientific Steering Group member of the Climate and Ocean: Variability, Predictability and Change (CLIVAR) project of the WCRP.



Francois A. Engelbrecht
Professor of Climatology
Global Change Institute
University of the Witwatersrand



CERG explores environmental impacts on Covid-19 infection rates



The COVID-19 Environmental Reference Group (CERG) is functioning under the auspices of the Department of Science and Innovation in South Africa:

Questions addressed (among many others):

1. How will the approaching winter impact on Covid-19 infection rates in South Africa?
2. What confidence can we ascribe to the potential role of environmental parameters such as ambient temperature, absolute humidity, UV radiation and AQ in affecting infection rate?
3. To what degree is infection rate influenced by seasonal climate variability and at what stage of local epidemics does it play a relatively important role?
4. Can we use experience from the climate change sphere (scenarios, multi-models, science-policy interface) to communicate the science and projections of Covid-19 infection rates?

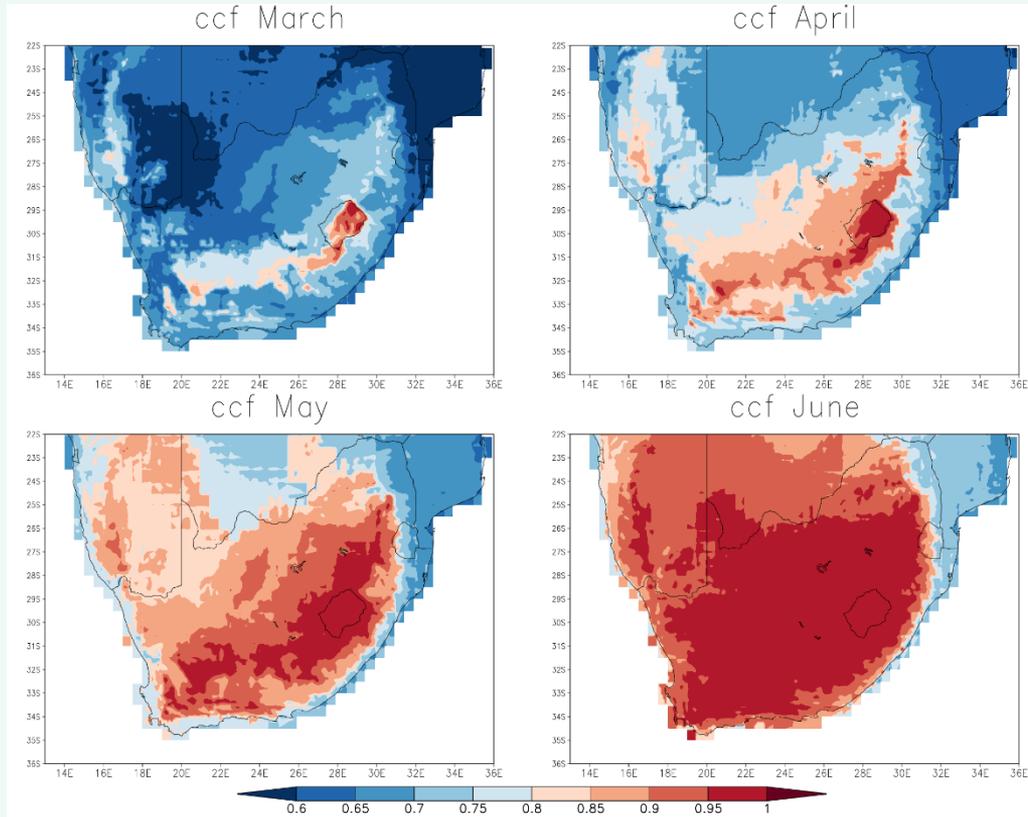
Algorithm (T_m = average daily temperature, H = absolute humidity)

If $T_m < 11$ then $CCF = 1.0$
 else $CCF = 1.0 - (T_m - 11) * 0.023$
 If $H > 9$ then $CCF = 0.9 * CCF$

CERG represented here by Prof Francois Engelbrecht
 (Francois.Engelbrecht@wits.ac.za)
 Global Change Institute, WITS University, South Africa

CERG coordinated by Dr Neville Sweijd
 (nsweijd@access.ac.za)
 ACCESS, South Africa

Preliminary results: projections of climate impacts on SARS-CoV-2 transmission probability from March to June 2020

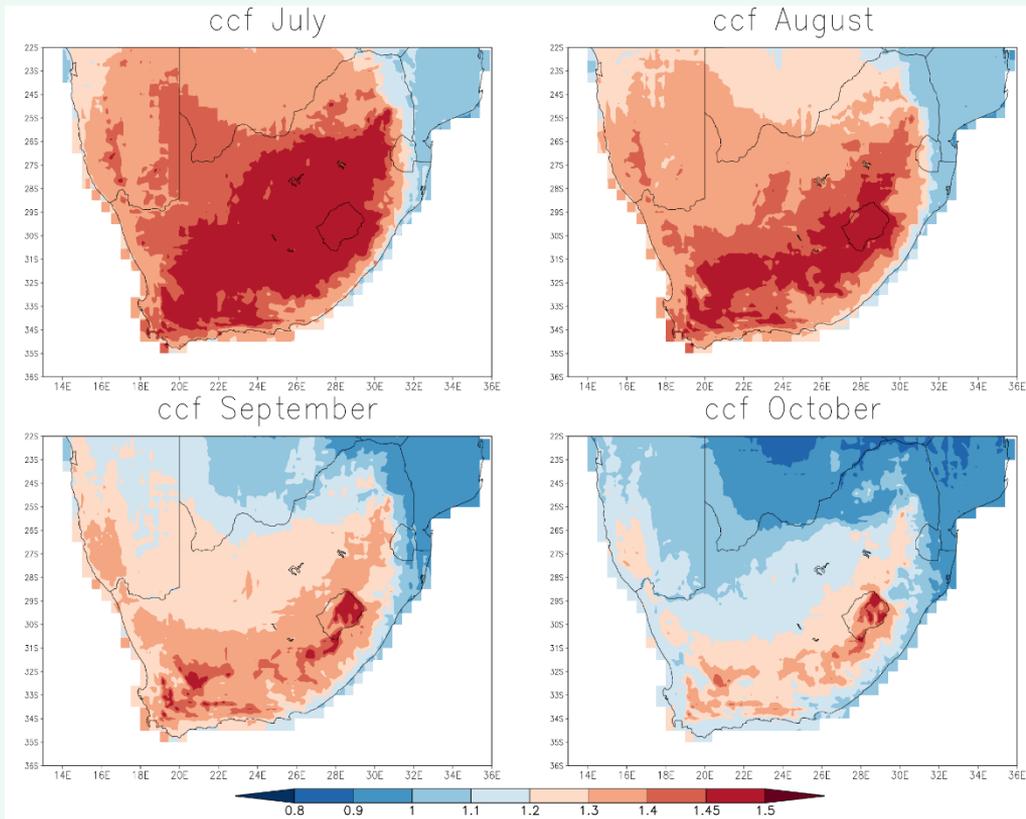


Current understanding of climate impacts on COVID-19 entails that cold and dry weather increases transmission probability.

All other factors held constant, transmission probability is predicted to be 30-40% higher by June compared to March over the central interior

Figure: Calculations of the climate-correction factor performed at the Wits-GCI as part of DSI-CERG research

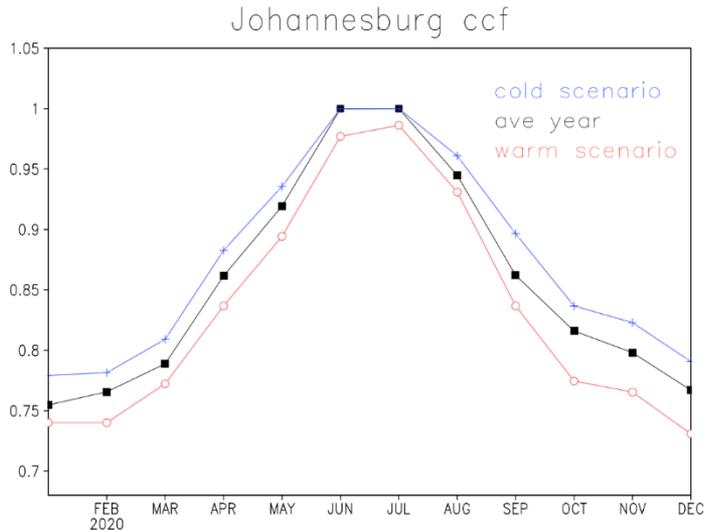
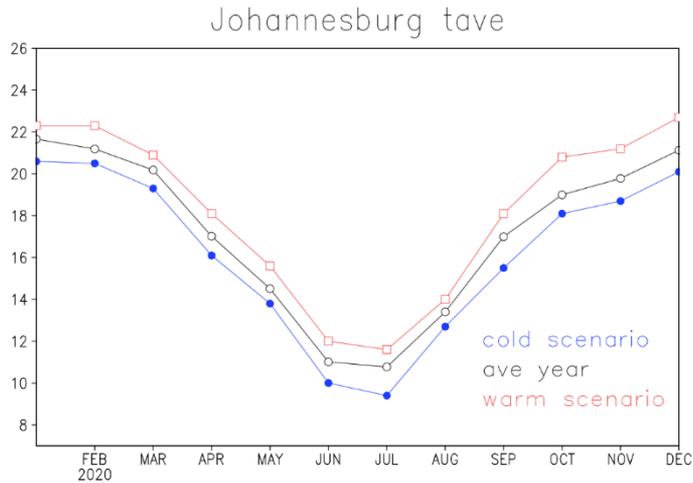
Preliminary results: projections of climate impacts on SARS-CoV-2 transmission probability from July to August 2020



Current understanding of climate impacts on COVID-19 entails that cold and dry weather increases transmission probability.

All other factors held constant, transmission probability is predicted to be 30-40% higher for Jun-Aug compared to Mar over the central interior

Figure: Calculations of the climate-correction factor performed at the Wits-GCI as part of DSI-CERG research



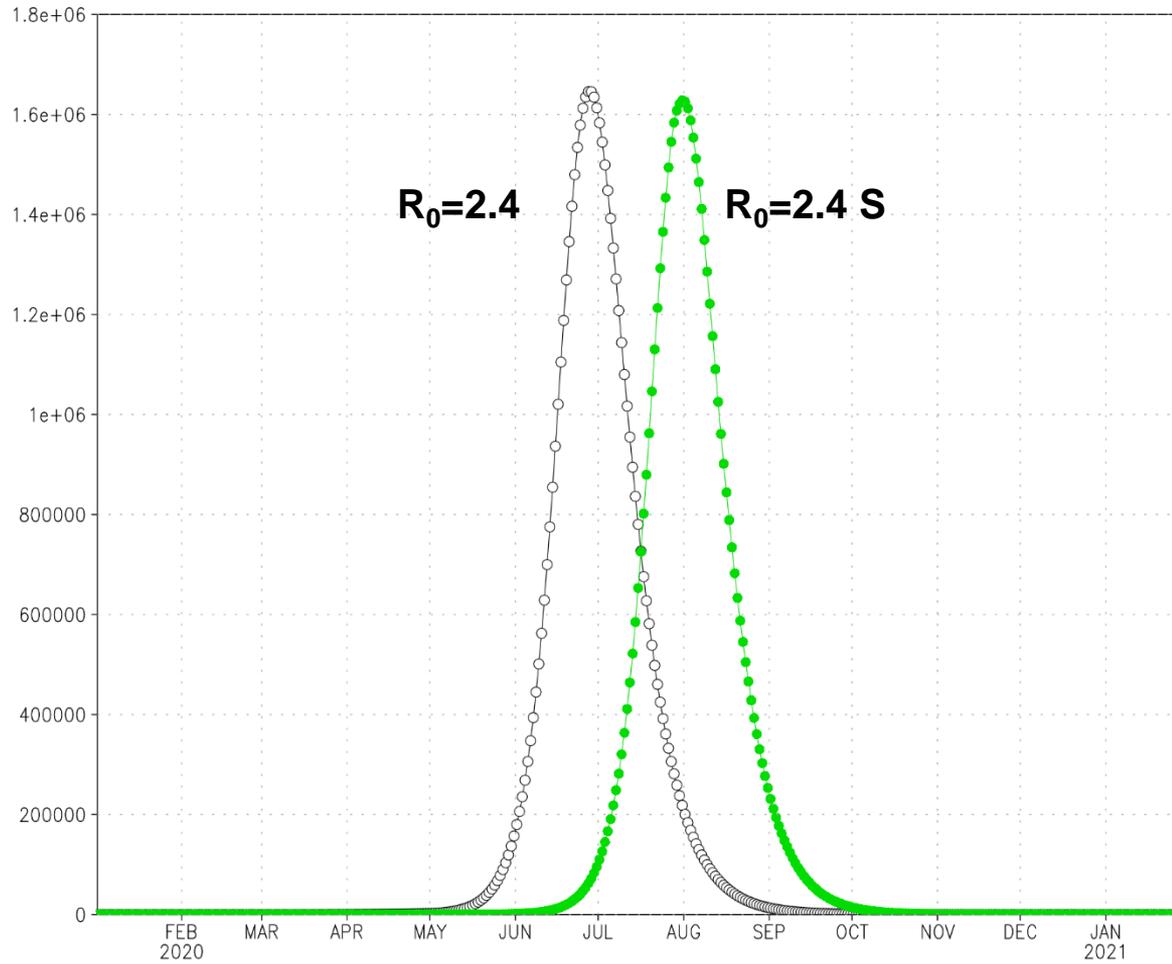
Seasonal cycle in temperature and CCF at Johannesburg

Figure: Observed average temperature (top) and modelled climate correction factor (CCF, bottom) indicating how the probability of transmission of the novel corona virus may be modified by temperature and humidity as in Johannesburg, for the months January to December. The black line represents average climatological conditions of the last 10 years, whilst the red and blue lines are representative of exceptionally warm and cold years, respectively.

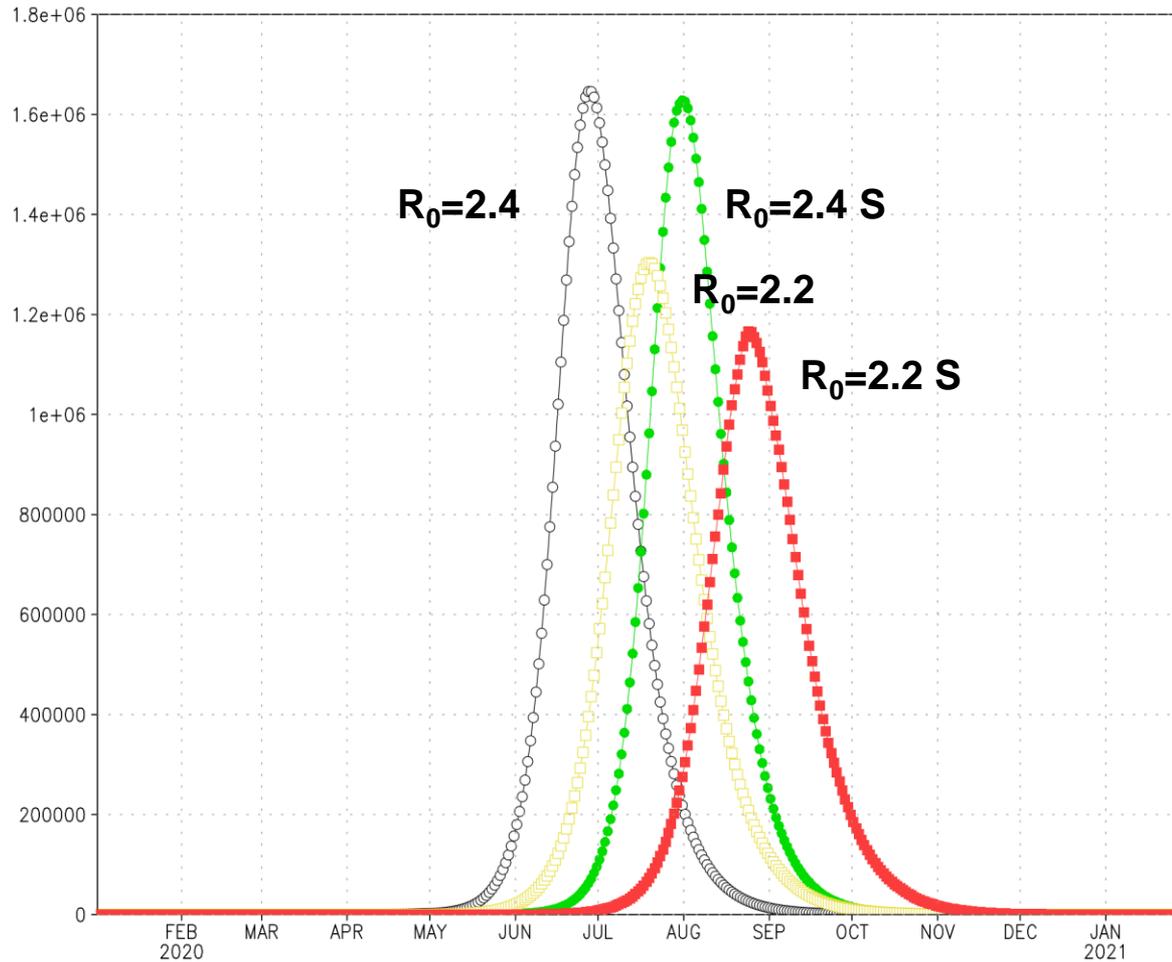
Application of the CCF in a SIRD model

- SIRD model following Anastassopoulou et al. (2020) PLOS ONE
- $\alpha = 0.319$; $\beta = 0.16$; $\lambda = 0.005$; $R_0 = 2$; $N = 1000\ 000$
- Initial state = 1 infected on 5 March; Population $N = 12\ 000\ 000$
- Level 5 lockdown of $0.63 \cdot R_0$ on 27 March and maintains it
- Reduced level of lockdown of $0.8 \cdot R_0$ from 4 May for the rest of 2020 and 2021
- This model is not updated in real-time! It is not set-up for operational prediction.
- The purpose of the experiments performed is to explore how seasonality may impact on Covid-19 infection rates in South Africa

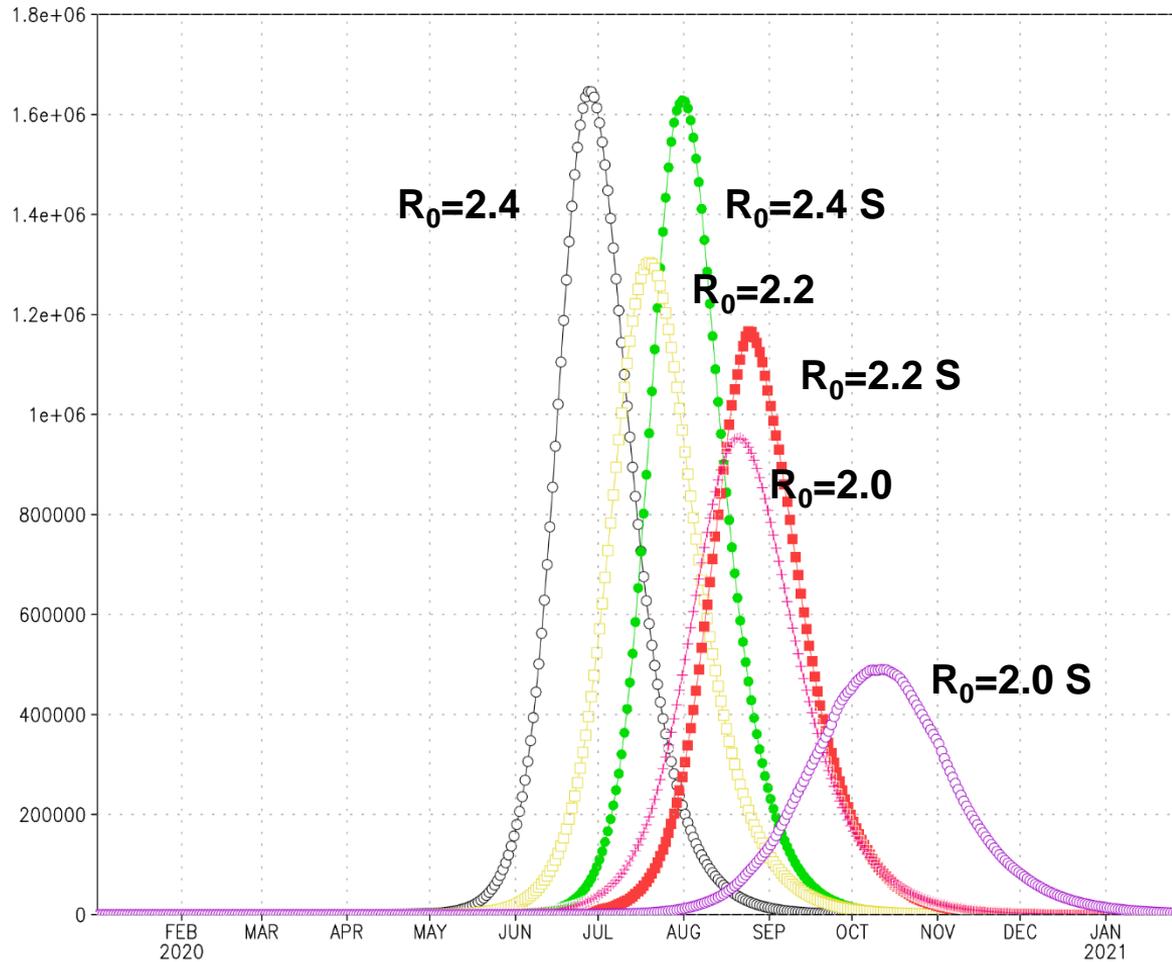
Number infected



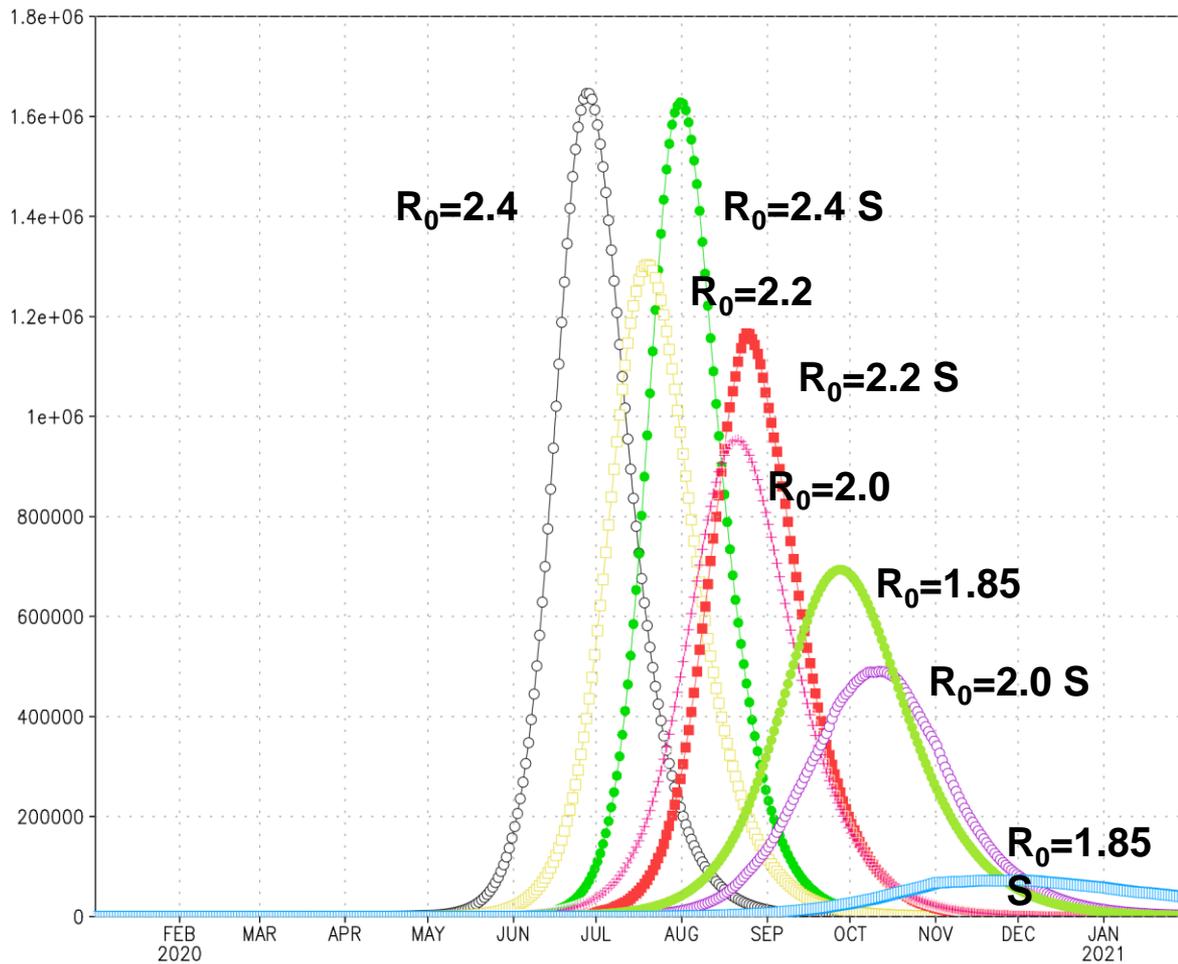
Number infected



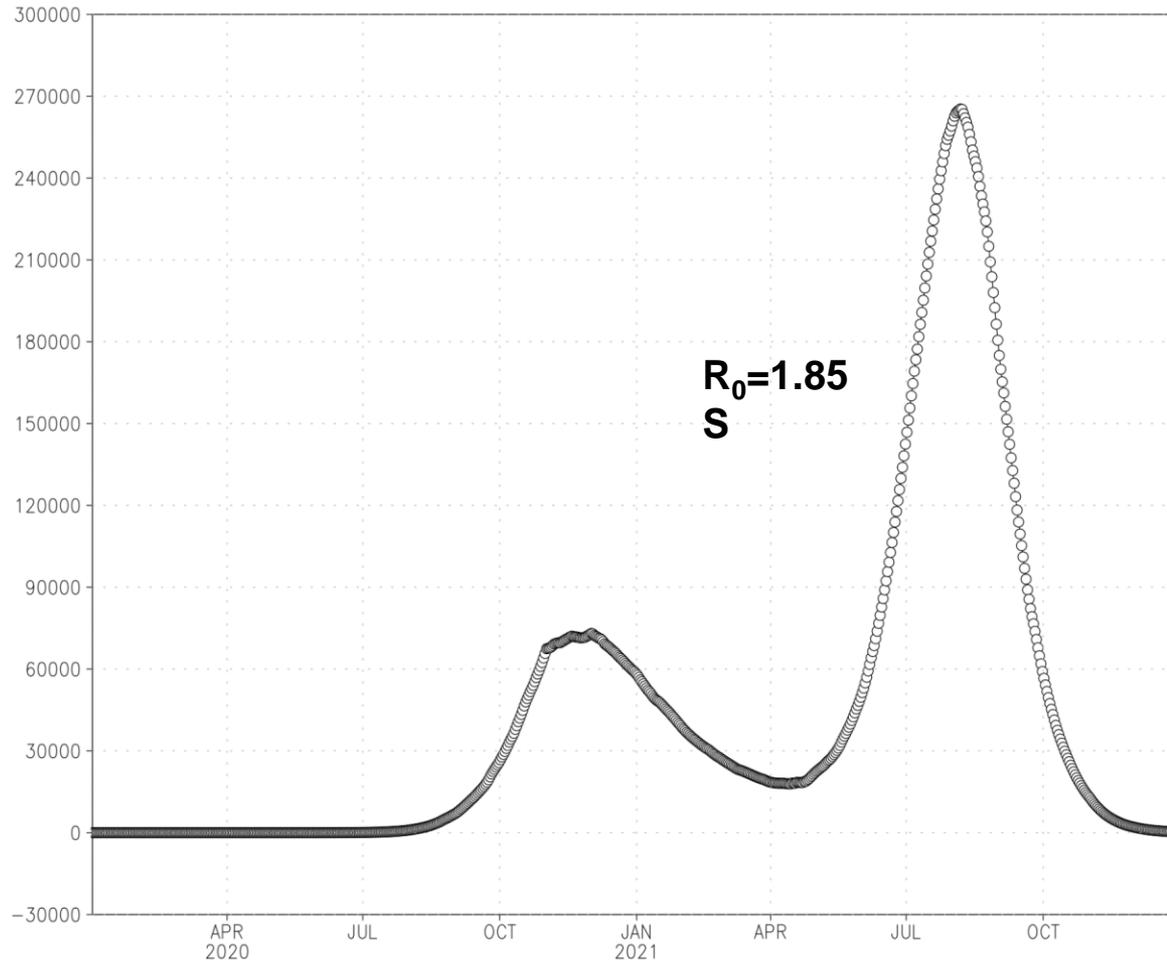
Number infected



Number infected



Number infected



Ongoing CERG research: input data sets & expected research outputs

- Review/assessment paper on Covid-19 and seasonality (Smith et al. submitted)
- Using South African data on local climate anomalies, air quality and local COVID-19 infection rates in regression-based studies to empirically estimate the impact of climate & AQ on COVID-19 infection rates.
- Inverse modelling using SEIR epidemiological models to explore impacts of seasonality on Covid-19 infection rates .
- Climate data flows to the national spatial epidemiological model (Kimmie et al., NICD): Daily data for January – December (climatological averages of the last 10 years), 8 km resolution in the horizontal, interpolated to ~ 4300 wards (Wits GCI). Observed data and forecasts can be provided in real time (SAWS).
- Advice to decision makers: CERG has extensive IPCC experience in terms of assessing multi-model output associated with different (climate change) scenarios (<https://theconversation.com/choices-in-a-fog-of-uncertainty-lessons-for-coronavirus-from-climate-change-137669>).

Ongoing CERG activities: International conference on Climatological, Meteorological and Environmental factors in the COVID-19 pandemic

- Climatological, Meteorological and Environmental factors in the COVID-19 pandemic
- 4-6 August 2020
- An international virtual symposium on drivers, predictability and actionable information
- WMO main hosts
- South African Gov (DSI/CERG) - partnering
- GEO Health the main sponsor
- AGU technological host
- Elsevier publisher
- Several other partners (JAMSTEC, Pacific Science Assoc, SENAEMI, Johns Hopkins, Future Earth, ISC (formerly ICSU).
- CERG Contact Dr Neville Sweijd (nsweijd@access.ac.za)

Thank You!

Francois Engelbrecht / 15 June 2020

@FAEngelbrecht / Francois.Engelbrecht@wits.ac.za

#EO4Impact

Collaborate and communicate with GEO:

