

# Bulletin GPoM-epidemiologic no 9

## Coronavirus Covid-19 epidemic

### (2019-2020)

29 April 2020



# Methodology

- **Models** of canonical form (GPoM tools) were **obtained for the outbreaks of Covid-19 at several locations in the world**: for several Chinese provinces (Hubei, etc.), for **South Korea, Japan and Italy**
- **These models are applied to other outbreaks in other countries**
- The objective is to identify which are the **closest scenarios** for the other countries

# Analysis

- For each country, **all the models** available **are run** (five initial conditions used with each model)
- Diverging models are directly rejected as inconsistent
- Other models are plotted. **Scenarios of inconsistent behavior are rejected** (e.g. a decreasing cumulative number of case proves that the scenario must be rejected)
- Among the remaining **consistent scenarios**, the ones showing the **best consistency with the recent observations** are considered as currently **more realistic**

Note: Correction factor are applied to the time series in order to ensure their consistency.

# $C_{\Sigma}(t)$ Cumulative Cases per 10M

(Observed and Simulated)

## Scenarios:

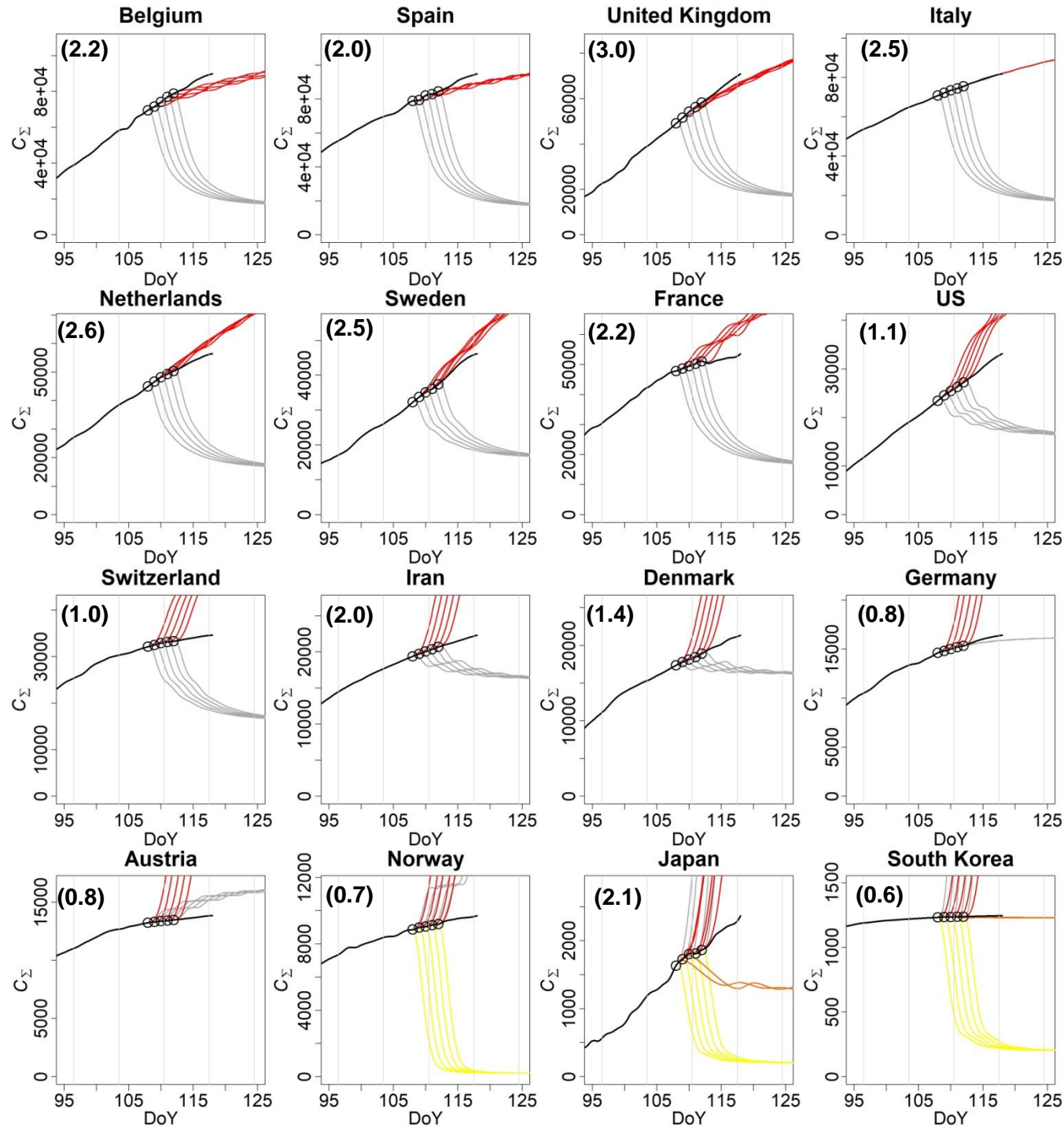


## Observations:



Note:

- A correction factor is applied to each time series to account for the under-estimations of infected cases in comparison to deaths
- This correction is provided in brackets (from 0.6 to 3.0)



# $C_1(t)$ Daily new Cases per 10M

(Observed and Simulated)

## Scenarios:

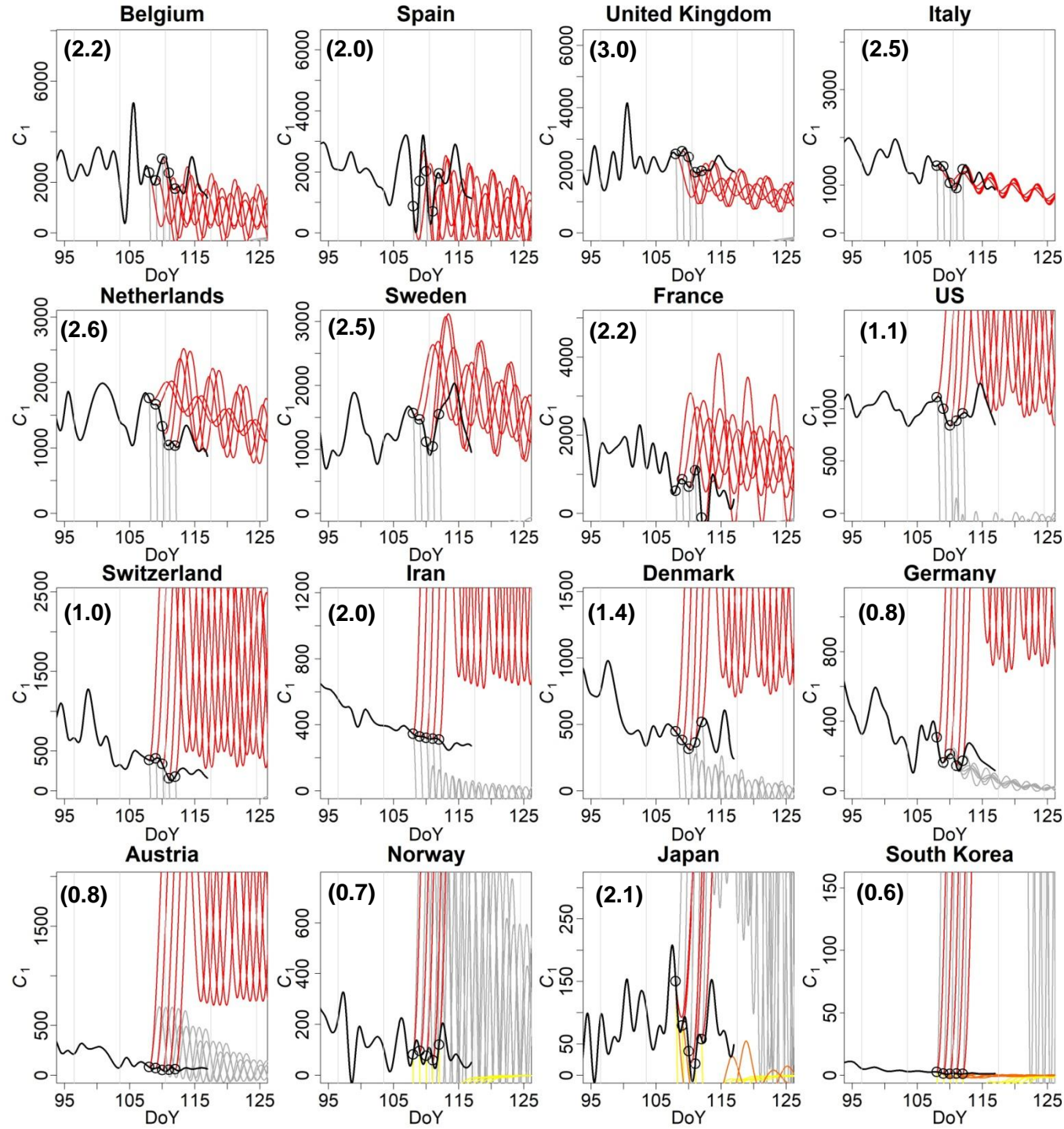


## Observations:



Note:

- A correction factor is applied to each time series to account for the under-estimations of infected cases in comparison to deaths
- This correction is provided in brackets (from 0.6 to 3.0)

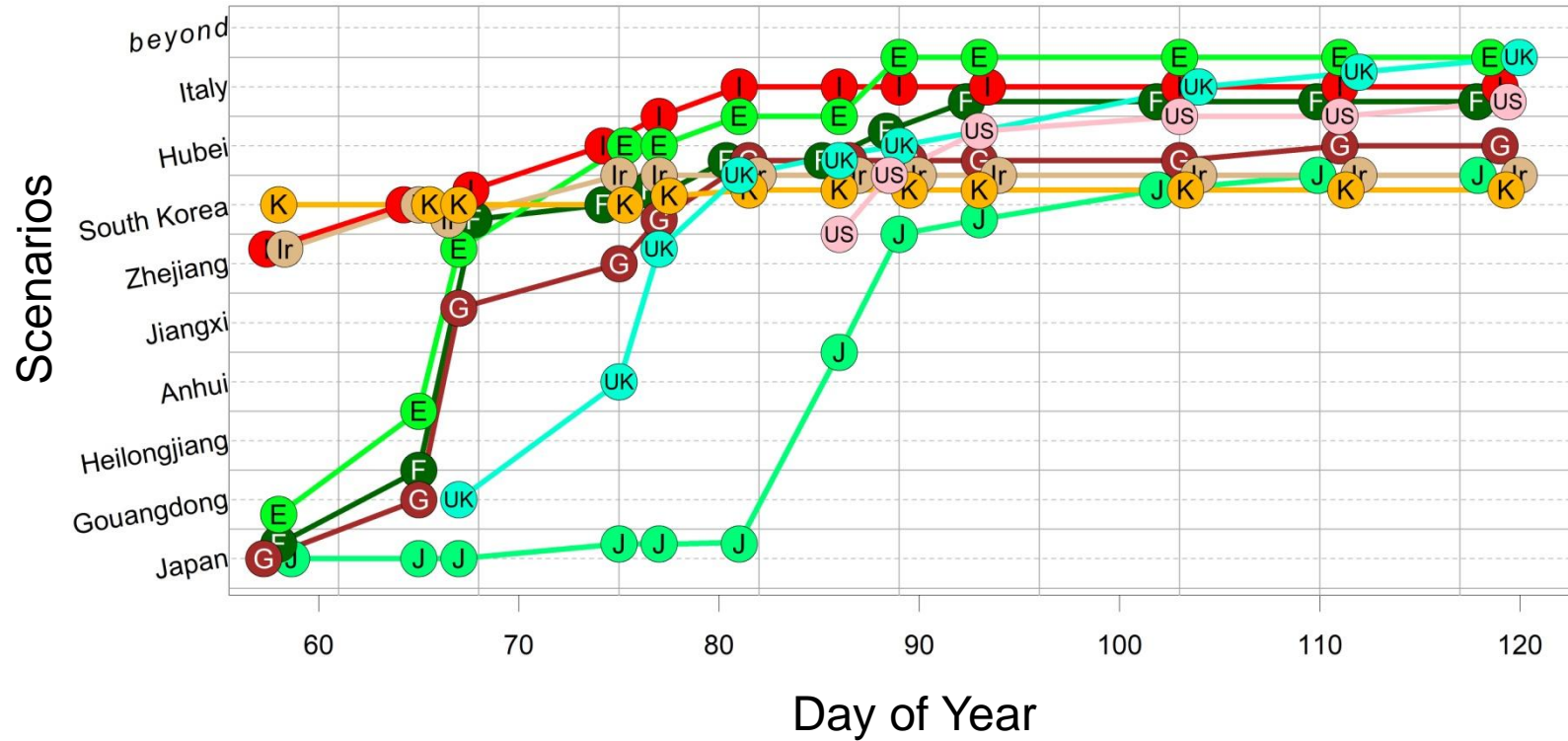


# Results

- **Belgium, Spain and United Kingdom** have now **overtaken** the **Italy scenario** in terms of cases and their evolution is not completely stabilized.
- **Sweden** and the **Netherlands** are progressively reaching the **Italy scenario** and their evolution is neither stabilized.
- **France** seems stabilizing close to the Italy scenario.
- The **USA** have now largely overtaken the Hubei situation and are closer and **closer to the Italy scenario**. Note that important heterogeneity takes place in the USA, this behaviour is thus the combined result of both lighter and much harder scenarios inside the country
- **Switzerland, Iran and Denmark** have now all largely exceeded the Hubei scenario. Their evolution is not completely stabilized yet
- **Germany, Austria, and Norway** are stabilizing under or close to the Hubei scenario
- **Japan** has experienced a restart and is not stabilized yet



# Scenarios evolution



# Scenarios evolution

- For a given country, the **scenario** can largely evolve in time.
- This evolution **highly depends on the control measures** taken to contain (or slow down) the outbreak
- In practice, the resulting scenario will **highly depend on the type, earlyness and strength** of the control measures and on the **acceptation of the control measures**



# Application to other countries

- **No correction was applied to account for the underestimation of the number of infectious case in comparison to death**

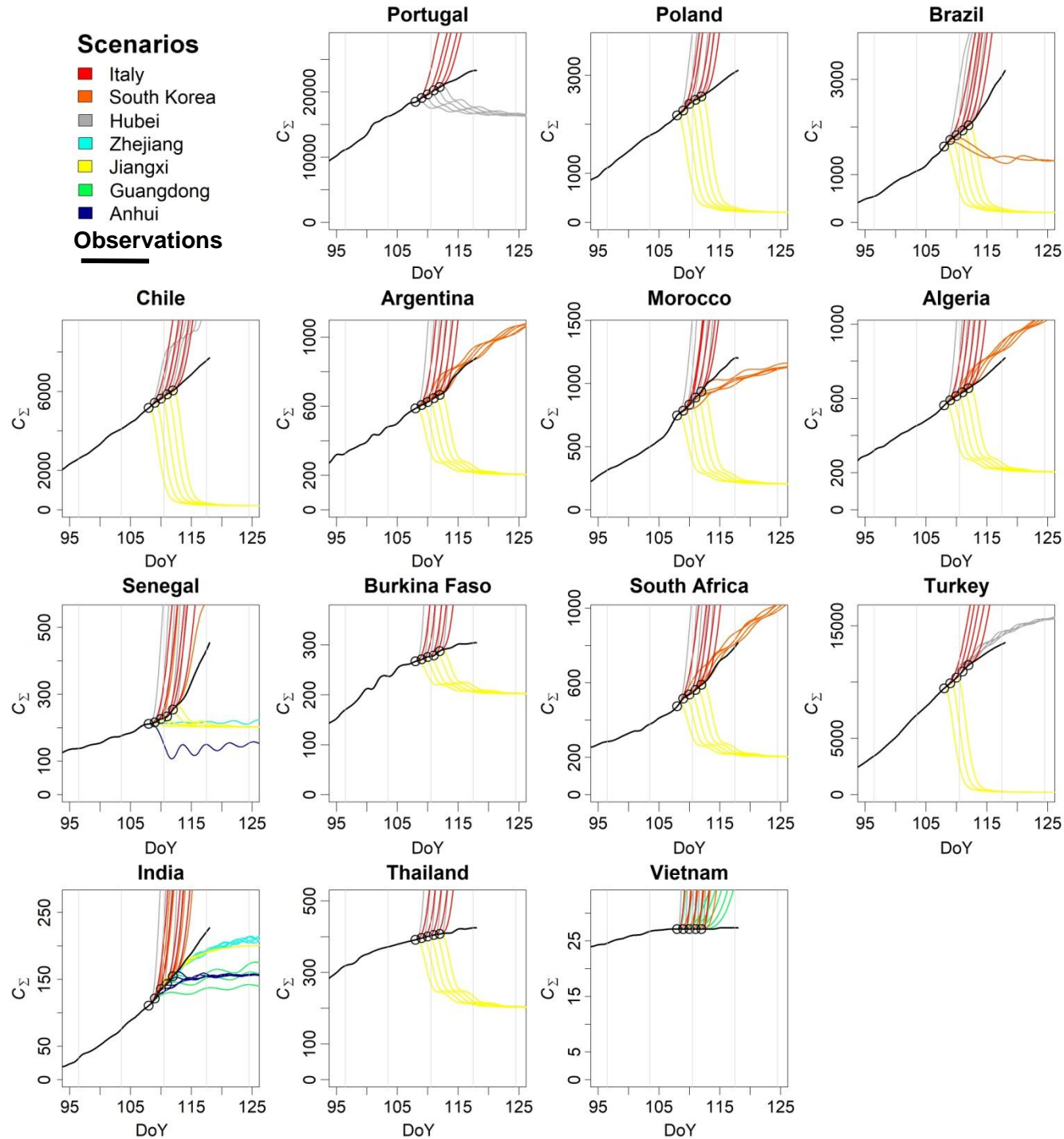
# $C_{\Sigma}(t)$ Cumulative Cases per 10M

(Observed and Simulated)

## Scenarios

- Italy
- South Korea
- Hubei
- Zhejiang
- Jiangxi
- Guangdong
- Anhui

## Observations



Note:

- No correction factor applied to to account for the under-estimations of infected cases in comparison to deaths

# Results

Without correction:

- **Portugal** has already largely overtaken the Hubei scenario
- **Brazil, Poland, Chile** and **South Africa** have already largely overtaken the South Korea scenario (which was rejected) but did not reach yet the Hubei scenario
- **Turkey** is very close to the Hubei scenario
- **Morocco, Argentina,** and **Algeria** are presently close to the South Korea Scenario.

Note that the current scenarios can still largely evolve



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