Bulletin GPoM-epidemiologic no 7 Coronavirus Covid-19 epidemic (2019-2020)

29 Mars 2020

Methodology

- **Models** of canonical form (GPoM tools) were **obtained for the outbreaks of Covid-19** at **ten locations**: eight Chinese provinces (**Hubei**, **Zhejiang**, **Henan**, **Hunan**, **Gouangdong**, **Anhui**, **Jiangxi** and **Heilongjiang**), **South Korea** and **Japan**

- **These models** are **applied to other outbreaks in 28 countries** in Europe, South America, Africa and Asia

- The objective is to identify **what scenarios are the closest** when **considering the recent evolutions** of these outbreaks

Analysis

- For each country, the **ten models are run** (several initial conditions are used to test the simulations robustness)

- Diverging models are directly rejected as inconsistent

- Other models are plotted. **Scenarios of inconsistent behavior** are **rejected** (example: a decreasing cumulative number of case proves that the scenario must be rejected)

- Among the remaining **consistent scenarios**, the ones showing the **best fit with the recent observations** are considered as curently **more realistic**

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

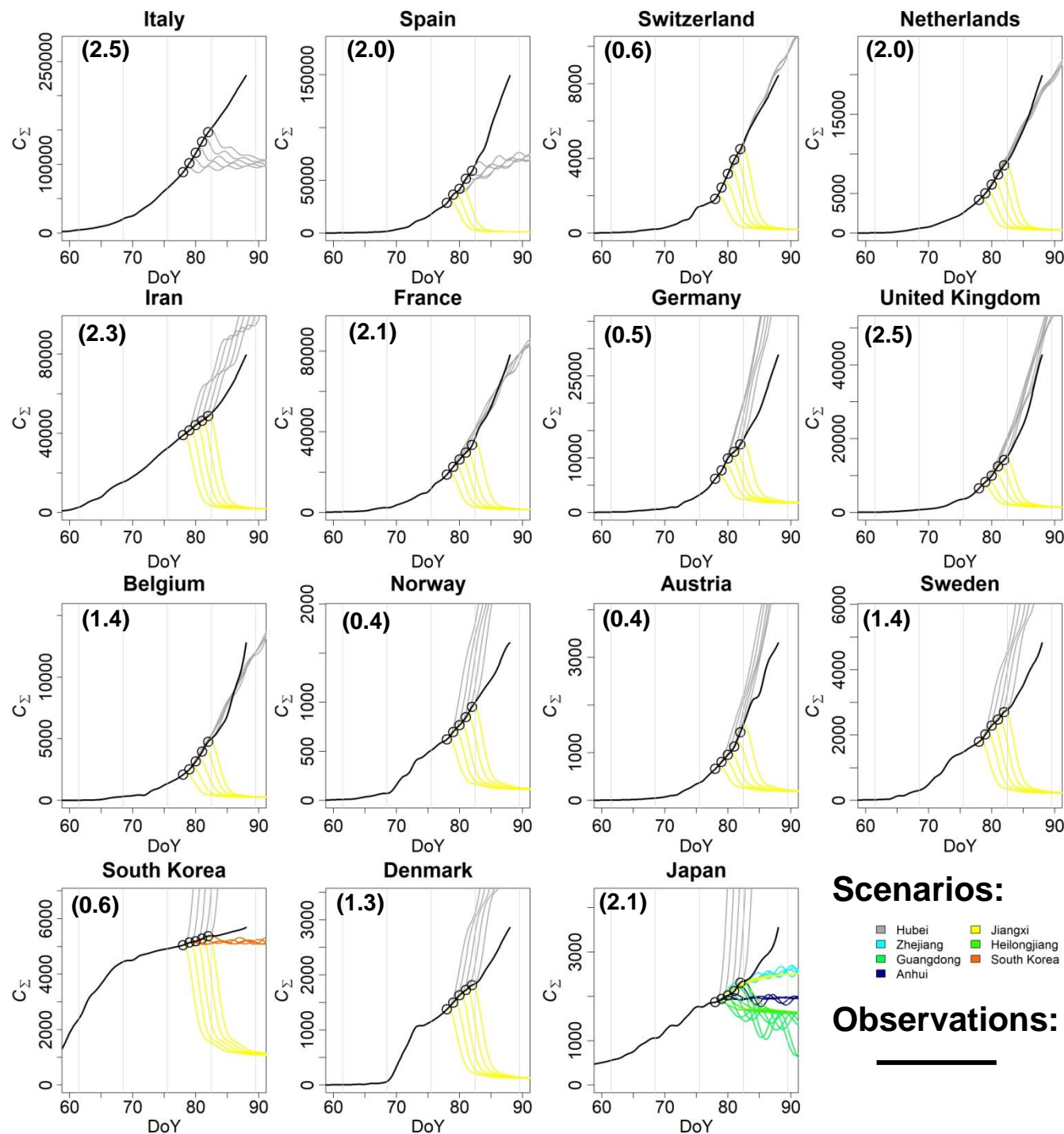# Cumulative cases $C_\Sigma(t)$ scenarios

(Observed and Simulated)

Note:

• A correction factor is applied to each time series to account for the under-estimations of infected cases

• To do so, the Chinese data set is abritrarily taken as a reference

• This correction is provided in brackets (from 0.4 to 2.5)

Scenarios:

Hubei	Jiangxi
Zhejiang	Heilongjiang
Guangdong	South Korea
Anhui	

Observations:

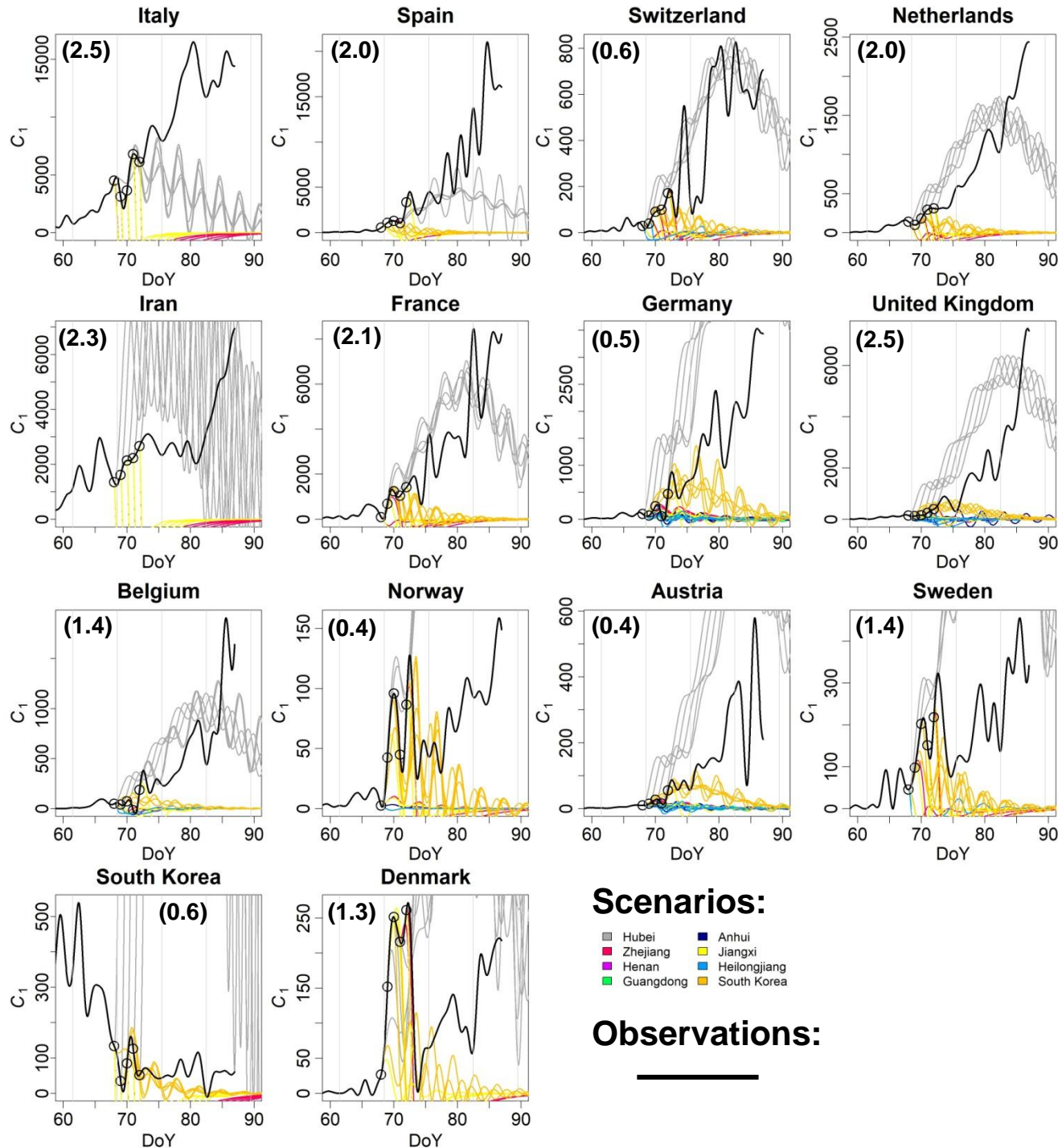# Daily new cases $C_1(t)$ scenarios

(Observed and Simulated)

Note:
- A correction factor is applied to each time series to account for the under-estimations of infected cases

- To do so, the Chinese data set is arbitrarily taken as a reference

- This correction is provided in brackets (from 0.4 to 2.5)

Scenarios:

■ Hubei	■ Anhui
■ Zhejiang	■ Jiangxi
■ Henan	■ Heilongjiang
■ Guangdong	■ South Korea

Observations:

Results

- **Italy** and **Spain** have now **largely overtaken** the **hardest Chinese scenario** (Hubei provinces).

- **Netherlands**, **France**, **Belgium** and **United Kingdom** have also **overtaken** this scenario.

- **Switzerland** is presently on the Hubei scenario

- The other countries (**Germany**, **Austria**, **Sweden**, **Norway** and **Denmark**) still remain under this scenario

- Control in **South Korea** is not complete but it still able to maintain the propagation of the epidemic at a relatively slow rate (<100 daily new ceases per day)

- **Japan** is experiencing a clear restart

Italy

•On last Thursday (26th of March), using the global modelling technique, a first model could be obtained for the outbreak in Italy

•This model suggests that the peak of the epidemic is close, or has already been reached, this, at least for the presently most active regions of the outbreak (however, new clusters cannot be excluded)

•This models enables us to performing forecasts of ending stages to come (threshold taken equal to 130 cases/day)
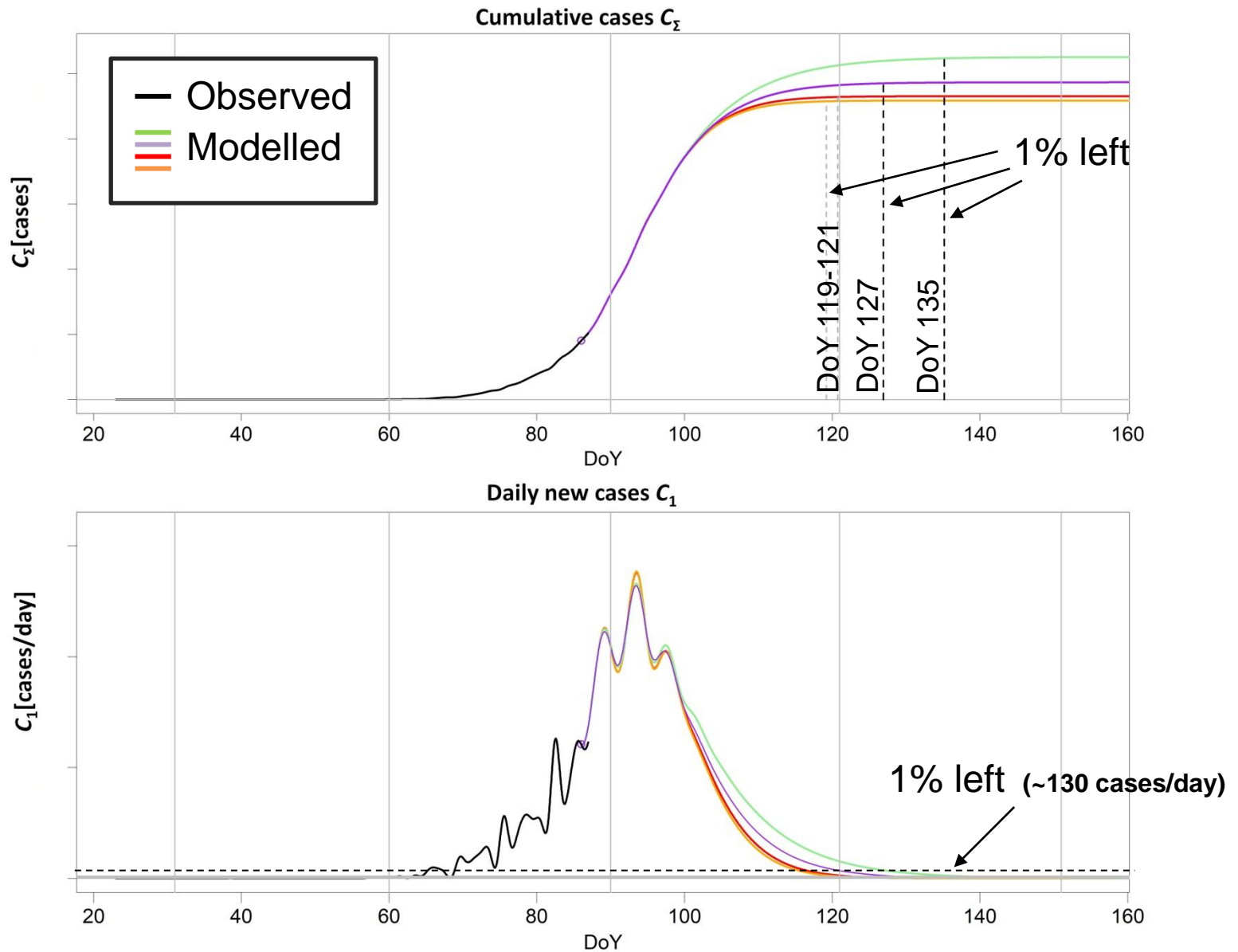
Italy
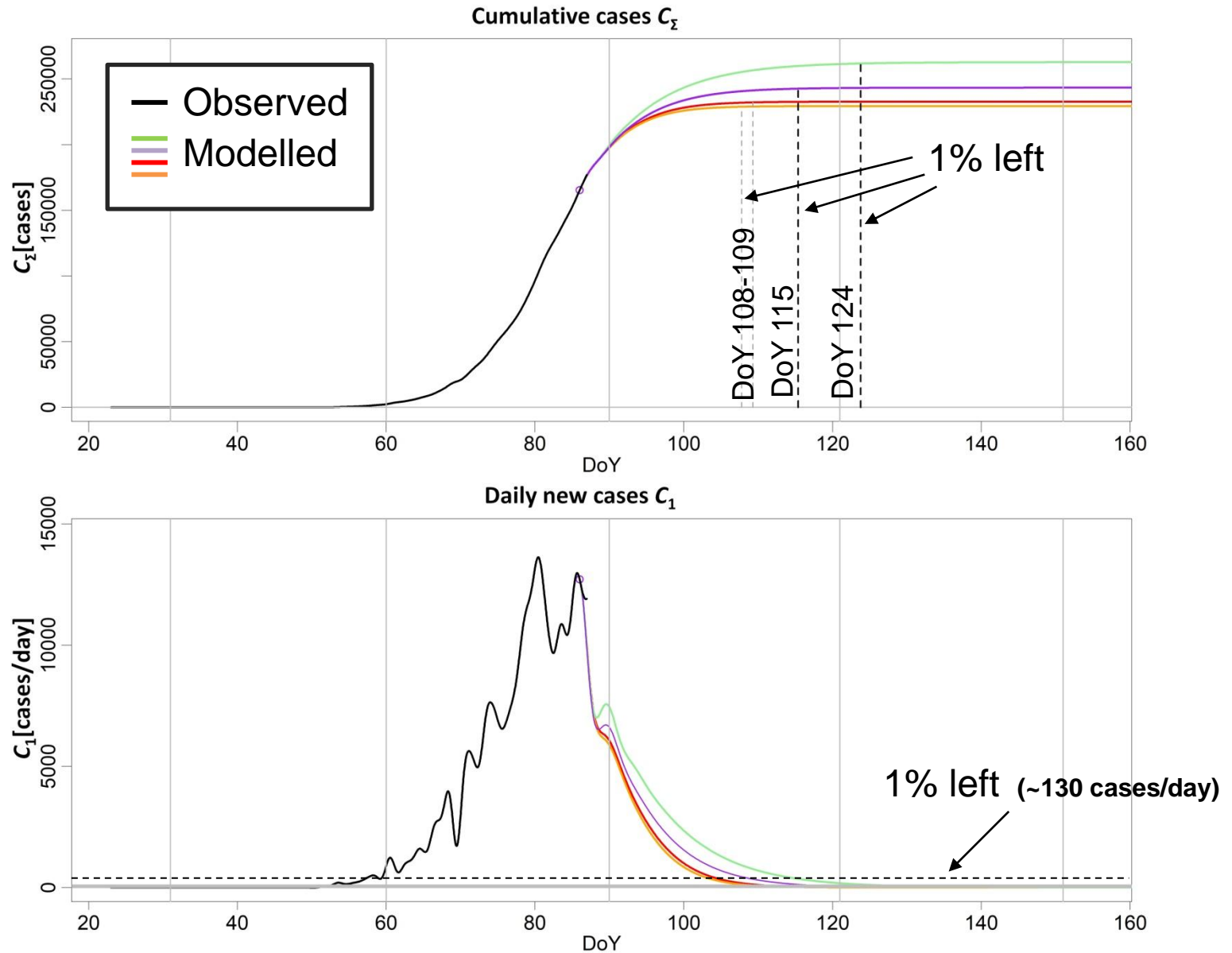
Other countries

- Assuming that the model obtained for Italy can be applied to other countries, preliminary runs were also performed for **France**, **Spain** and **United Kingdom**

France

Cumulative cases C_Σ

C_Σ[cases]

DoY

1% left

DoY 119-121

DoY 127

DoY 135

Observed
Modelled

Daily new cases C_1

C_1[cases/day]

DoY

1% left **(~130 cases/day)**

Slow stage propagation **(<130 cases/day)***
When can this stage be reached?
<u>Preliminary</u> forecastings

	Day of Year	
Italy	108-124	17 avril – 3 mai
Spain	111-126	19 avril – 5 mai
France	119-135	28 avril – 14 mai
United Kingdom	123-139	2 – 18 mai

• Note that South Korea could stop the propagation of the disease, it is why a threshold close to zero appears poorly realistic at this stage

Commentary

- Althouh **Italy**, **France**, **Spain** and **United Kingdom** are of similar population sizes (by a factor 0.8 to 1.1), their strategies and their behaviors have been different.
- The application of this model can thus be only indicative

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