RShiny App user guide

Overview

The RShiny app is designed to make three features accessible to the user: 1) **Forecasts**: Current and previous four-week ahead forecasts of the daily number of cases and weekly number of deaths in each region (and age group when available), 2) **Predictors**: The risks of secondary transmission and importations estimated by the model, and 3) **Scenarios**: The impact of changes in transmission, be it due to more infectious variants, changes in behaviour, or NPIs. These changes in transmission represent the potential impact of control measures on transmission, and should be interpreted with caution in a constantly changing epidemiological situation (impacted for example by behaviour, adherence..). Similarly, this model only considers the epidemiological impact of NPIs, the social or economic costs of different control measures is not considered in this analysis.

Forecasts:

The *Forecasts* tab displays current and previous forecasts of the model, at different geographical scales. It shows four-week-ahead forecasts generated for each country, using two plots:
- A map showing the 14-day incidence forecasted in each region (by default at the NUTS-3 level).
- A time-series plot representing the number of daily cases or weekly deaths predicted over the next four weeks (i.e. latest data points, median, 50% and 95% prediction intervals).

By default, the map shows the median predicted incidence, while the time-series plot shows the overall number of cases or deaths predicted in the country over all age groups at the latest date. Clicking on a region of the map changes the time-series plot to show the predictions in the selected region, which then becomes highlighted in red on the map, as shown in Figure 1.

A number of options to customise these plots and explore the predictions generated by the model are available:
- **Country**: This can currently be set to France, Czechia or Italy.
- **Plot age-stratified forecasts**: If ticked, the time-series plot will display the age-stratified predictions (in four groups: 0-20; 20-60; 60-80; 80+ years). This option is disabled for Italy, where age-stratified subnational data was not available.
- **Use logarithmic y-axis in the time-series plot**: If ticked, the y-axis of the time-series plot will be logarithmic.
- **Type of forecasts:** Select whether the map and time series show case or death forecasts.
- **Geographical area**: Select whether the map should display the incidence at a NUTS-2 or NUTS-3 level.
- **Prediction quantile shown on the map**: This changes the prediction quantile displayed on the map. By default, the map shows the median forecasts. The prediction interval should be used to explore the dispersion of the forecasts generated by the model.
- **Number of observed weeks in the time-series plot**: This changes the number of observed data points (in black) shown on the time-series plots.
- **Change in prediction date (i.e. number of weeks before the latest data point)**: This sets the map and time-series to a prior prediction date. Comparing previous forecasts of the model with recent data points gives insight into the performance of

the model at different geographical scales and time horizons (i.e. forecasts are expected to become less accurate as the number of forecasted days increases).
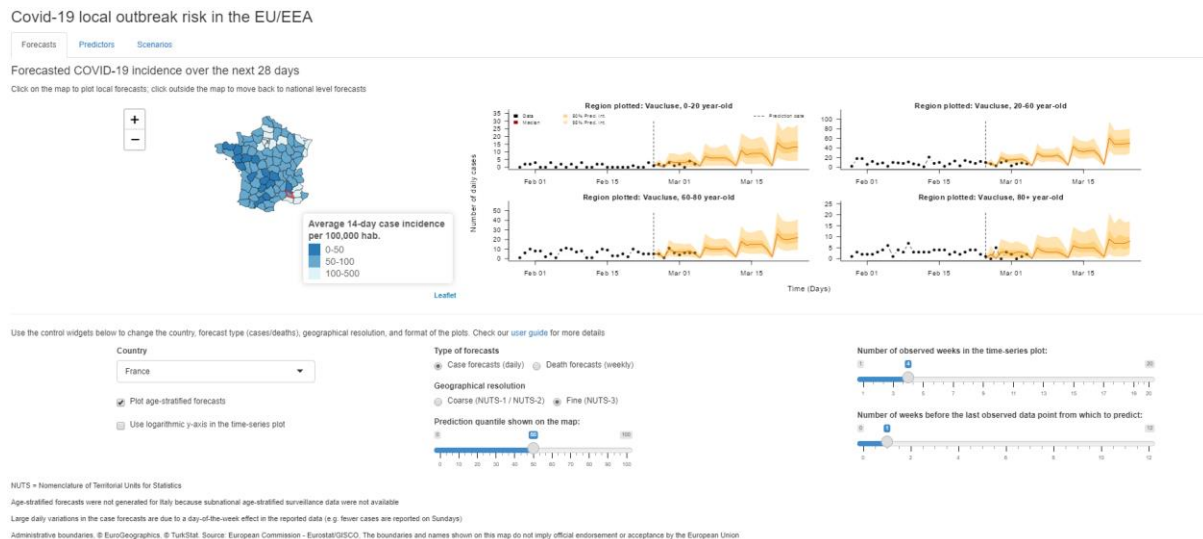

Figure 1. Screenshot showing the *Forecasts* tab of the RShiny App. In this example, the map represents the median prediction of the 14-day incidence in France, one week before the last data point, at NUTS-3 regional level. The time series plot shows the number of daily cases forecasted in Vaucluse (84). This region was selected by clicking on the map (red outlined region).

Predictors:

The *Predictors* tab describes the spatial heterogeneity in incidence, risk of transmission and risk of importation at the latest date of the forecasts. It contains three maps:
- The spatial distribution of cases or deaths in the country (by default set to 14-day incidence).
- The local risk of transmission, computed from the neighbourhood component of the model in each region (averaged across all age groups according to the local population structure). The map shows the percentage compared to the highest value of the neighbourhood predictor in the country, giving insight into the differences in transmission risks between regions.
- The local risk of importation, computed from the endemic component of the model in each region (summed across all age groups). Similar to the previous plot, in each region the map shows the percentage compared to the highest value in the country.

The maps can be changed by the user via a number of options:
- **Country**: This can currently be set to France, Czechia or Italy.
- **Geographical area**: Select whether the regions on the maps should be grouped at a NUTS-2 or NUTS-3 level.
- **Prediction quantile shown on the incidence map**: This changes the prediction quantile displayed on the map. By default, the map shows the median forecasts. The prediction interval should be used to explore the dispersion of the forecasts generated by the model.
- **Type of incidence map (changes the left-side map)**: The left-side map can be set to display the 14-day incidence in each region (similar to the *Forecasts* tab), the total number of cases forecasted in each region in the next 14 days, or the percentage change in cases between the last week of data and first week of forecasts (a positive value indicates an increase in the number of cases).
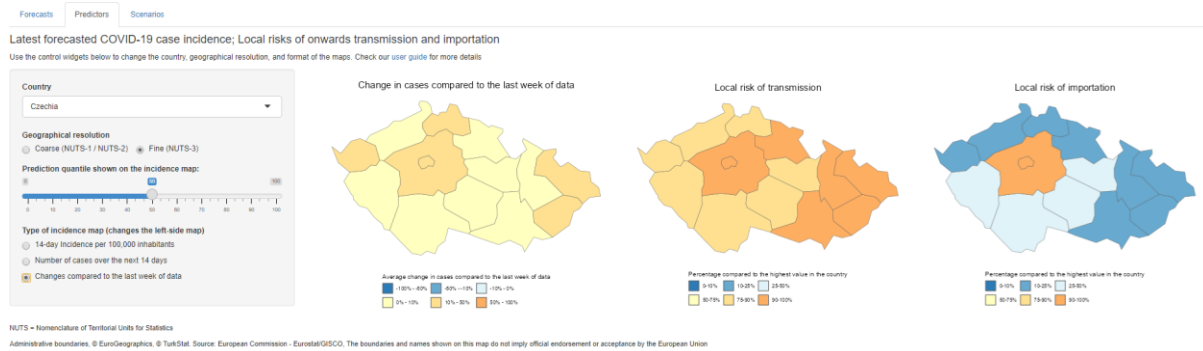
Figure 2. Screenshot showing the *Predictors* tab of the RShiny App. In this example, the first map shows the median percentage change in the number of cases compared to the last week of data in Czechia. The other maps illustrate the local heterogeneity in the risk of transmission and importation. All maps were generated at a NUTS-2 level

Scenarios:

Finally, the *Scenarios* tab follows the same layout as the *Forecasts* tab, and describes the impact of changes in transmission (either increases due to new variants, or decreases caused by targeted or global NPIs). The figures displayed are similar to the *Forecasts* tab:

- The 14-day incidence forecasted in each region (by default at NUTS-3 level).
- The number of daily cases or weekly deaths predicted over the next four weeks (i.e. latest data points, median, 50% and 95% prediction intervals).

In addition to options presented in the *Forecasts* tab, there are settings to explore the impact of changes in transmissibility, timing of NPIs, or border closures on the number of cases and deaths:

- **Country**: This can currently be set to France, Czechia or Italy.
- **Plot age-stratified forecasts**: If ticked, the time-series plot will display the age-stratified predictions (in four groups: 0-20; 20-60; 60-80; 80+ years). This option is disabled for Italy, where local age-stratified data was not available.
- **Use logarithmic y-axis in the time-series plot**: If ticked, the y-axis of the time-series plot will be logarithmic.
- **Type of forecasts:** Select whether the map and time series show case or death forecasts.
- **Geographical area**: Select whether the map should display the incidence at a NUTS-2 or NUTS-3 level.
- **Number of observed weeks in the time-series plot**: This changes the number of observed data points (in black) shown on the time-series plots.
- **Prediction quantile shown on the map**: This changes the prediction quantile displayed on the map. By default, the map shows the median forecasts. The prediction interval should be used to explore the dispersion of the forecasts generated by the model.
- **Increase in transmission due to changes in behaviour or new variant (%)**: Can be set to 0, 20, or 40%, and represent different properties of an emerging variant, or changes in behaviour that lead to increased risks of spread. The map and time-series plot then display the incidence and number of cases or deaths expected if the neighbourhood predictor was increased in every region and age group from the prediction date onwards.
- **Drop in transmission due to Non-Pharmaceutical Interventions (%)**: Can be set to 0, 20, or 40%, and represents the impact of decreasing the transmission using control measures. The map and time-series plot then display the incidence and number of cases or deaths expected if the neighbourhood predictor was decreased

in every region, the age group affected and the date of implementation can be impacted by other settings.

- **Population targeted by the Non-Pharmaceutical Interventions**: Select which age groups should be targeted by the NPIs. By default, all age groups will be impacted.
- **Remove importations from outside the selected country**: This sets the number of cases stemming from the endemic component to 0 from the date of prediction onwards. This illustrates the impact of stringent border closures on the number of transmissions. First results show that this impact is minimal when the level of local transmission remains high in most regions.
- **Date of Non-Pharmaceutical Interventions becoming effective**: Can be set to one week or two weeks after the prediction date, which illustrates the impact of delaying control measures on the forecasted number of cases or deaths forecasted.
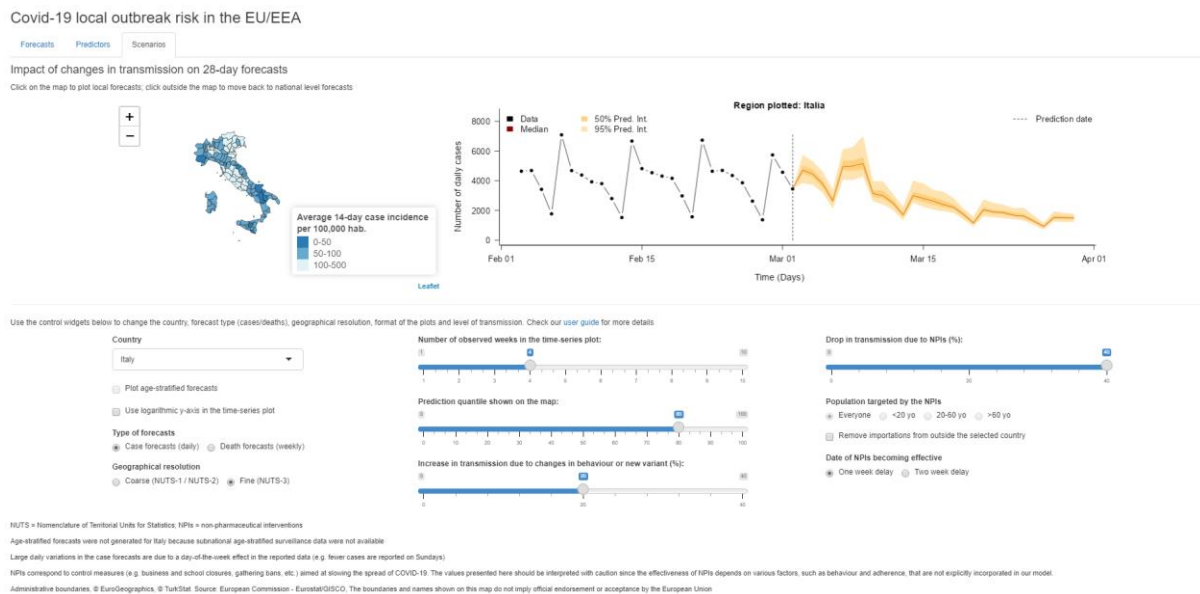

Figure 3. Screenshot showing the *Scenarios* tab of the RShiny App. In this example, the map represents the 8th decile of the 14-day incidence in Italy, at NUTS-3 level, if the level of transmission was increased by 20% (e.g. a more transmissible variant), but stringent NPIs were implemented one week after the prediction date. The time series plot shows the number of daily cases forecasted in the country.