



# SimCo-19: The digital twin of the Swiss population to support the battle against Covid-19

Researchers in Research Management and Operations Research at armasuisse Science and Technology (S+T) have developed SimCo-19, a web application based on a simulation of the Swiss population. The application supplies realistic predictions on the Covid-19 situation in Switzerland, supporting decision makers in the battle against Covid-19 and answering further questions.

**Text:** Dr Michael Rügsegger

*SimCo-19 is based on a synthetic population of Switzerland, also known as a digital twin.*

The abbreviation SimCo-19 stands for Simulation Covid-19. It is available in the form of a web application and digitally reproduces the spread of Covid-19 in Switzerland. It has been developed by the Operations Research and System Analysis team (ORSA) at armasuisse S+T, in cooperation with their research partner Scensei GmbH. SimCo-19 is based on what is known as a multi-agent simulation of human behaviour and the spread of Covid-19.

A synthetic population of Switzerland known as a digital twin forms the basis of SimCo-19 for calculating the spread of the virus and the resources needed. The Swiss population is replicated by composition, in other words, in terms of age, gender, place of residence, etc., without referring to specific people. Statistically speaking, no

differences can be identified between the real data and this synthetic data. It is not, however, possible to draw conclusions about real living persons. The advantage of this method lies in the fact that the human behaviour of a large group of people, in this case the entire Swiss population, can be simulated precisely and at low cost.

To emulate the spread of Covid-19 using the web application, the digitally simulated data on the Swiss population is additionally supplemented with data on countermeasures such as social distancing, mobility restrictions, wearing face masks and performing SARS-CoV-2 tests. The resources emergency doctors and paramedics required to help Covid-19 patients are also simulated. This includes personal protective equipment, mobile ventilators and beds in intensive care units.



*SimCo-19 helps crisis teams identify bottlenecks early on and assess the effectiveness of various countermeasures.*

The benefit of SimCo-19 lies in comparing the data on a realistic representation of the propagation dynamics of Covid-19 with the data on the resources required to combat the pandemic. Based on the actual values of the spread and the resource requirements, the application generates forecasts for the future and answers important questions, such as: how many more people may become infected with coronavirus and is enough protective equipment available for hospital staff? The application helps crisis teams identify medical bottlenecks early on and assess the effectiveness of various countermeasures at a particular point in time.

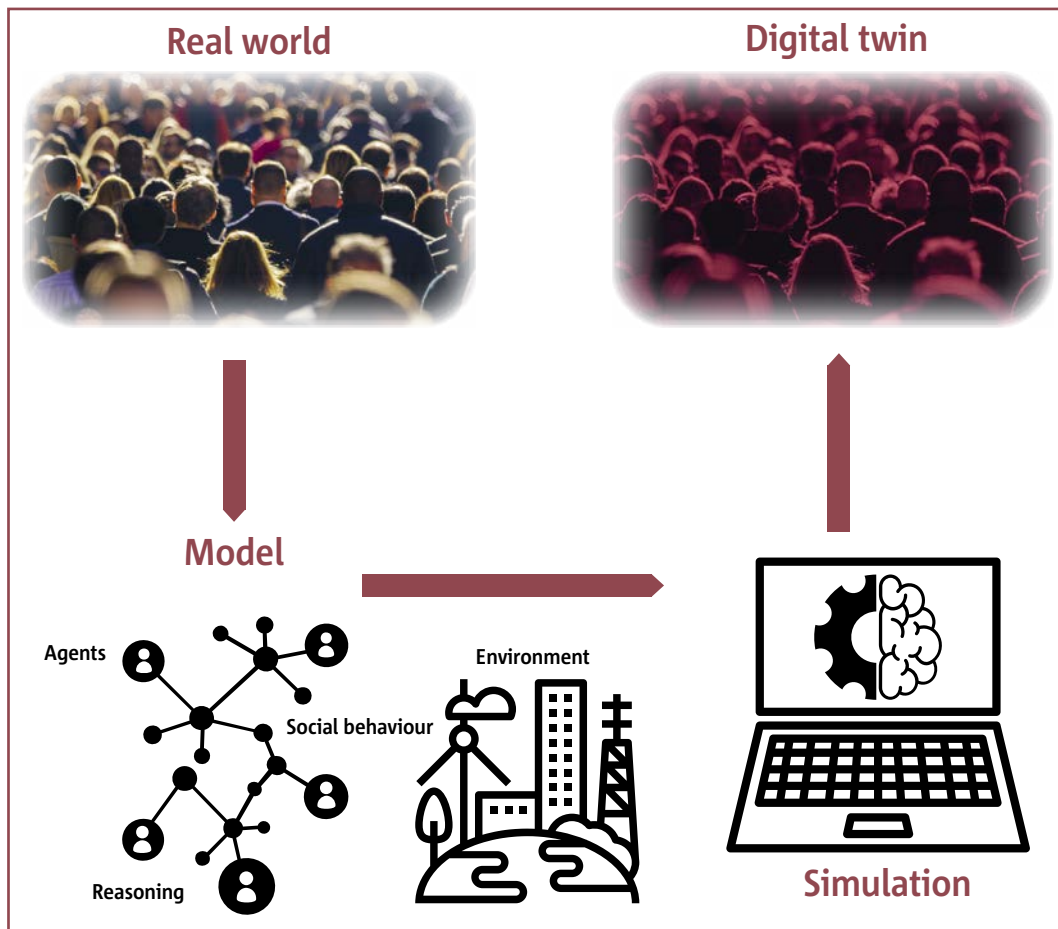
By means of data fusion, in other words, by merging various data records, synthetic population data can be continuously enhanced and supplemented, for example with data on pre-existing conditions and Covid-19 symptoms, the number of confirmed cases and the number of deaths. This static snapshot of the Swiss population can now be



**DR MICHAEL RÜGSEGGER**  
Deputy Head of Research Management and Operations Research

Michael Rügsegger has been Head of Operations Research and System Analysis (ORSA) at armasuisse Science and Technology since 2019.

Together with his team, he supports decision makers in the Swiss Armed Forces in making holistic and robust decisions in a complex and uncertain environment. He does this by simulating possible deployment scenarios in defence and disaster relief to examine the effectiveness of new technologies, systems and tactical approaches.



The principle of the digital twin of the Swiss population for simulating the spread of Covid-19 and checking countermeasures.



Projects | Views | Dashboards

### Dashboards

- Population
  - Demographics
- Interventions
  - Do nothing
  - Current
  - All-in

### Views

- Configuration
- Projections
- Map

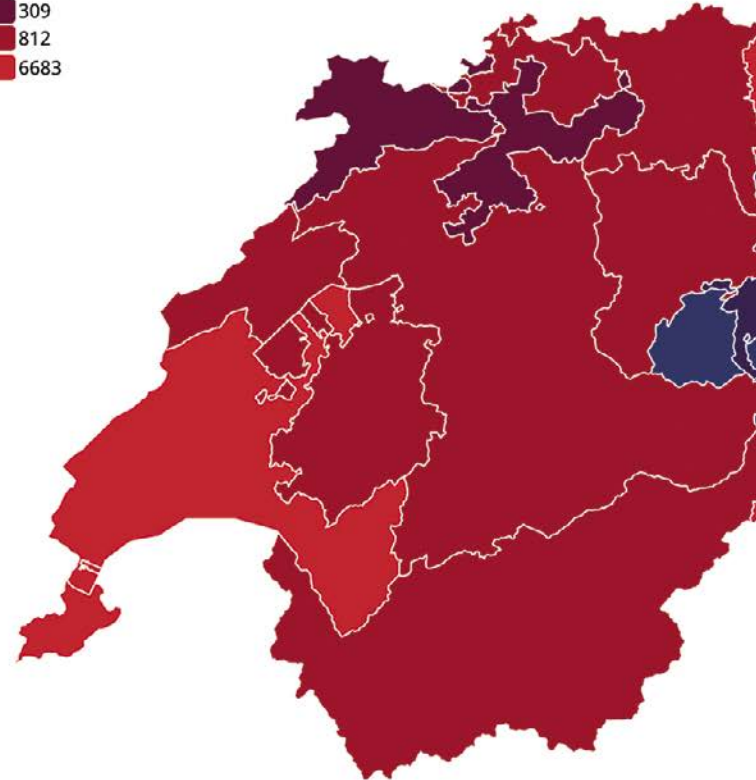
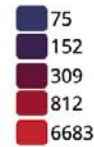
### Days into epidemic



### Map layers

- Canton
- District
- Resources
- Statuses
  - Asymptomatic
  - Symptomatic
  - Recovered
  - Dead
- Rates

### Symptomatic

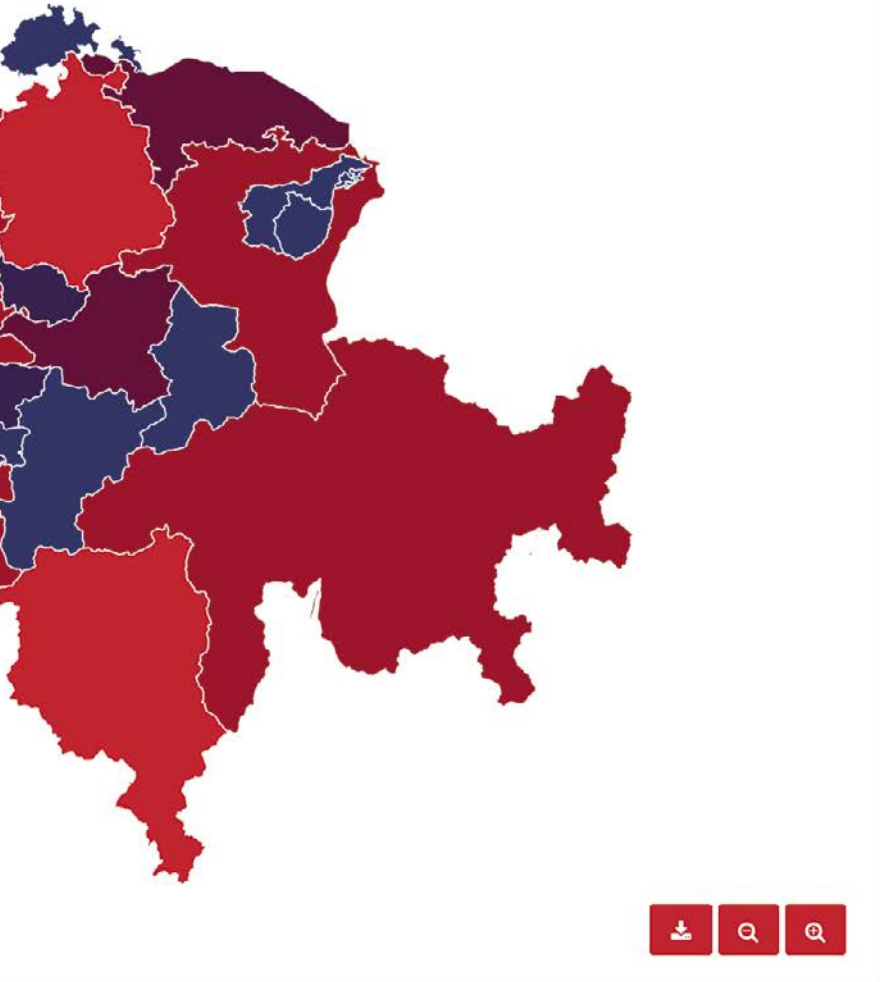


brought to life in times of Covid-19 by integrating the daily behaviour of persons depicted in the digital twin. People's relationships within their family, how they behave with other people where they live or work, and mobility can be taken into consideration. In reality, the SARS-CoV-2 virus spreads through social interactions with a measurable probability. SimCo-19 can explicitly model this.

Questions such as the impact possible multiple infections may have on the burden on the healthcare system or optimum distribution of a vaccine can now be analysed using the digital twin of the Swiss population. The open architecture enables real data about mobility and contact tracing to be integrated. SimCo-19 can also simulate various scenarios, such as exits from lockdown, based on the economic costs



Logout



Screenshot of the SimCo-19 web application. Forecast of the number of symptomatic and asymptomatic people infected, deaths and people who have recovered by district and canton.

*SimCo-19 also makes it possible to predict the need for medical supplies.*

incurred and intervention costs required, and compare them with each other.

SimCo-19 not only makes it possible to show how SARS-CoV-2 infections and Covid-19 illnesses in the population develop, it also facilitates reliable predictions of the need for medical supplies and allows various scenarios to be compared with each other.

ORSA has made the methods and algorithms of SimCo-19 available to other nations through the NATO Science and Technology Network to support decision makers and emergency staff in other countries at this difficult time.

#### **How will things continue after Covid-19?**

During the development of the application SimCo-19, care was taken to ensure that the architecture could be transferred to a platform which can support future decision-making better and more quickly. Regardless of whether simulations are used to combat a virus, for disaster relief or in the case of a hybrid conflict, a digital twin of the Swiss population provides many advantages: The web application simulates human behaviour cost-effectively and can predict and test a variety of different measures before they are implemented.