CO₂ under surveillance

Switzerland is to gain a dense, globally unique CO₂ measuring network: 300 sensors permanently collect up-to-date readings, which form the basis for atmospheric dispersion models that are being developed at Empa.

TEXT: Martina Peter, Michael Lieberherr / PICTURES: Empa / Google Maps
The Empa spin-off Decentlab

300 measuring devices scattered across Switzerland form the backbone of a CO2 sensor network. Empa spin-off Decentlab integrated CO2, temperature and moisture sensors along with a communication module for LoRaWAN (Long Range Wide Area Network) in a device and caters for the wireless, low-energy mediation of the data to the next gateway. These gateways are connected via the internet to Decentlab’s cloud and visualization infrastructure. Empa scientists can access the data directly and are currently evaluating the data: depending on the time of day, the CO2 values measured can be distorted by temperature and moisture. Thanks to new mathematical sensor models, however, these deviations can be corrected and losses of individual data packets can be “bridged.”

The x-ray machine for CO2

For the City of Zurich, where the sensor network will be particularly close-knit, Empa developed a computer model that simulates the CO2 concentration from ten different sources (see diagram). These emission sources include various kinds of traffic, industry or heating systems in residential buildings, for instance. By combining these simulations with the sensor data, Empa will be able to display the city’s current CO2 emissions practically in real time. “This will give us readings with a sufficient density to follow Zurich’s CO2 emissions virtually live,” says Emmenegger. “What’s more, the measurements will provide valuable information on the spread of other air pollutants.”

The scientific and technical applications based on this sensor data recorded all over Switzerland, on the other hand, will give valuable hints for traffic planning, health care measures, developments linked to “smart cities”, and even for a better understanding of the exchange of CO2 between the atmosphere and the vegetation.

Swisscom is installing the CO2 sensors at antenna sites. The 300 battery-powered sensors transmit their readings to the computing centers at the ETH Domain’s Swiss Data Science Center (SDSC) via Swisscom’s Low Power Network, which offers a narrow bandwidth but has a long range, transmits in an energy-saving manner and reduces network costs. This makes it just the ticket for linking up environmental sensors, parking spaces, containers or any other communal infrastructure.

Not only does science stand to benefit from the sensor network, but also the Low Power Network itself: the sensors scattered across the country are a good way to continuously assess network quality. Carbosense, a collaboration between Empa, SDSC, the Empa spin-off Decentlab and Swisscom, was initiated by Empa and Swisscom and is co-funded by nano-tera.ch.