Measurement site with an RQ-30 at an alpine river in Austria

AI meets flow

Challenging river conditions in an Austrian city required **Sommer** to create a modularized monitoring station with AI-enabled flow sensors

Located near the German border, the 5,200-strong municipality of Schärding in upper Austria is famous for its baroque city center on the shores of the Inn river. Its history dates back to the eighth century and many of its buildings border the river with only a small amount of elevation. Swelling from the Inn still leads to frequent floods, such as happened again in the summer of 2021 following heavy rains in the northern Alps.

Given its vulnerability, Schärding is dependent on a reliable flood management system to minimize loss and damage.

River monitoring

For proper flood management, the Inn needs to be closely monitored with reliable techniques, but this presents a challenge. The river, with its source in the high Alps, is 250m wide when it passes Schärding.

Generally speaking, single-sensor stationary flow measurements require steady flow conditions. These are met if the water course is straight for at least five times the river width in the upstream and downstream direction. The river Inn does not offer a straight stretch, but rather flows in a large bend through Schärding.

If there is an additional water inflow, it takes up to 10 times the river width until the river flow reaches steady conditions again. At Schärding, the river Roth flows into the Inn, providing little opportunity for it to reach steadiness. This river bend and confluence create challenging conditions that require an innovative solution.

Multiple flow sections enhance accuracy

Sommer, a specialist in non-contact flow monitoring, met the challenge with a sensor from its RQ family. A standard flow sensor, such as the RQ-30, can be used as a stationary mobile instrument to monitor the water flow of small and large rivers alike. Sometimes, however, a single sensor is not suitable for capturing the water flow correctly. This is the case at Schärding, where the river has a very inhomogeneous flow pattern.

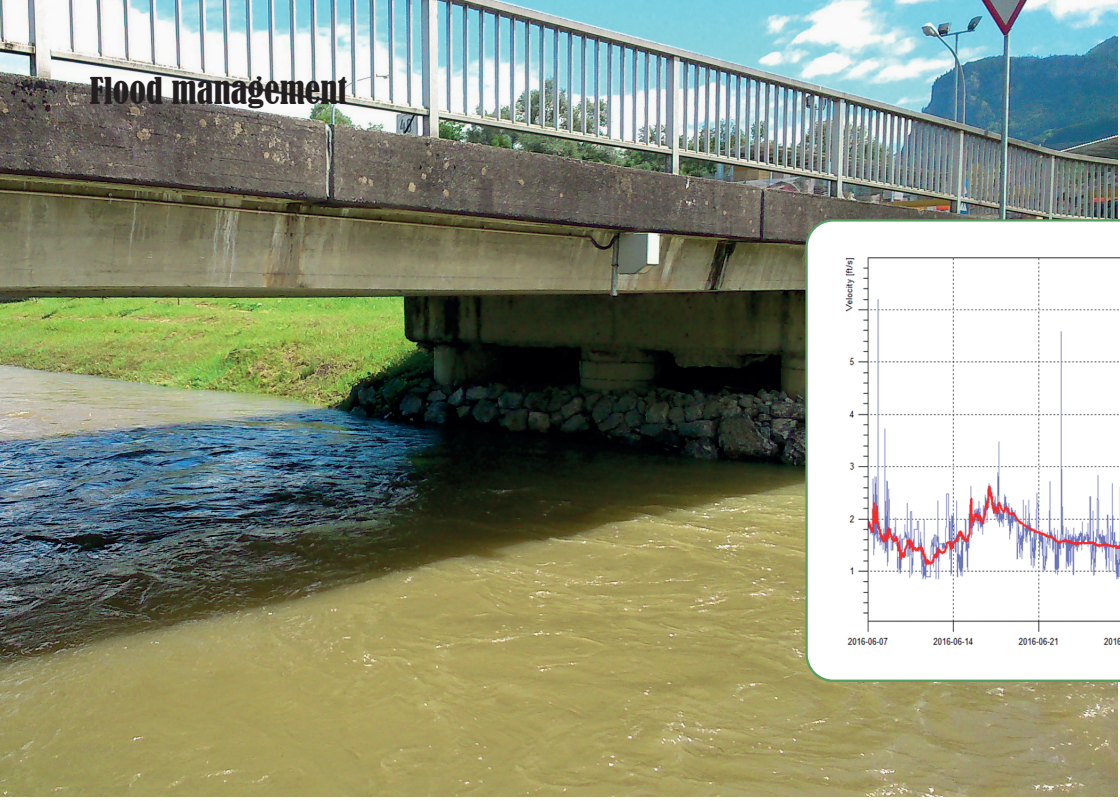
For such applications, Sommer has developed an enhanced flow sensor, the RQ-30d, a multisensor device with the features of the popular RQ-30. It combines a section-by-section approach with artificial intelligence (AI) to meet the most challenging flow conditions.

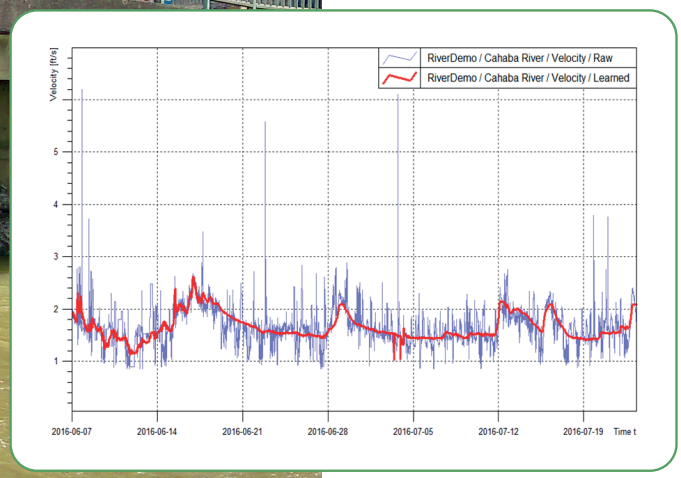
The basic principle is a primary-secondary concept by which multiple secondary devices communicate with a primary device that controls the required measurement tasks. Each of the secondary devices monitors the water flow of a subsection of the river cross-section and the primary device computes the total flow. In this way an irregular flow pattern is divided into multiple parts with less inhomogeneity.

In Schärding, Sommer installed a multisensor RQ-30d with one primary and one secondary unit to cover the total river width. This setup was a compromise between accuracy and cost, given that a setup with three or four units would be optimal.

AI tames difficult flow conditions

To alleviate the effects of difficult flow conditions, the sensors of the RQ family are equipped with





> "The power consumption of the entire monitoring station could be reduced to less than 1mA in idle mode, thus prolonging battery life and enhancing reliability"

various AI features. They are able to handle flows at both very low and high water levels and eliminate the interference of wind-generated ripples not related to the actual water flow. This is especially crucial as in low water levels or super-slow flow conditions the wind may have a greater impact on the water surface. During high flow conditions, the AI becomes redundant thanks to the quality of the Sommer hydraulic model inside the RQ-family. The monitoring architecture within the AI-enabled RQ-30d devices also offers a single point of access to all sensors and allows interfacing with any data acquisition system.

Tuned data flow for top reliability

Once the challenges of the monitoring situation had been resolved, an adequate data acquisition and management scheme, as well as a reliable alert system, had to be implemented.

As no mains power was available on the bridge that carried all monitoring devices, an autonomous solar power supply with rechargeable batteries was selected. The Sommer RQ flow sensors feature an advanced power saving mode that is activated between measurements. Combined with a Sommer MRL datalogger, the power consumption of the entire monitoring station could be reduced to less than 1mA in idle mode, thus prolonging battery life and enhancing reliability.

The Sommer MRL datalogger triggers the measurements; acquires level, velocity and flow data; and triggers notifications by SMS and email if predefined limits are exceeded. Additionally, the datalogger regularly transmits the acquired data to the Sommer data cloud, which pushes alert messages to social media platforms such as Twitter or Telegram. The MRL datalogger also collects and transmits images shot by a connected camera, visualizing the situation at the measurement site. Thus, the local authorities are continuously updated and have the tools at hand to inform the public in the event of an approaching flood. ▮

TOP LEFT: A monitoring station with an RQ flow sensor at a canal with high water

TOP RIGHT: Graph illustrates the performance of the implemented AI algorithms of the RQ sensor family. The blue line shows the raw velocity values at a measurement site. The red line shows the AI-enhanced, filtered velocity

ABOVE: A three-unit RQ-30d site in Nepal with one primary and two secondary devices