Cost-Effective River Level Monitoring for African Rivers (Oral Presentation)

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ABSTRACT

There are many reasons why Africa's rivers are not densely monitored. High capital and installation costs, as well as difficult terrain and operational settings are not helpful, especially with an eye on low resource availability. For these reasons, we have developed a cost-effective way to measure water levels in rivers, lakes, and reservoirs, based on Global Navigation Satellite System Interferometric Reflectometry (GNSS-IR).

GNSS-IR makes use of the interference between direct and water-reflected GNSS signals. In a way, this method only requires the signal-to-noise ratio to determine the height difference between the GNSS antenna and the water surface. This technology has been around for some time and has been well tested. So far, all signal processing was either done off-line or through full data communication through a direct internet connection.

In Africa, especially in lower valleys along large rivers, cellphone coverage is often lacking, which makes full data communication difficult. Within the framework of the TEMBO Africa project (www.temboafrica.eu), we have tried to install several discharge and level measurement devices in Chache on the Black Volta. Communication was always the bottleneck. Even installation of a Starlink modem was, due to its power requirements, not successful yet.

For these reasons, we developed a device that does all GNSS-IR processing internally. Only water heights need to be communicated. This can be done very cost effectively with a satellite modem. Computational power comes from a PICO 2 CPU, which only needs very little energy.

In all, the device is affordable with material costs of about EU 60, excluding the satellite modem. A small solar panel of 1.2W suffices to power the complete set-up. The satellite modem costs EU 400 to buy and EU 12 per month for communication costs. Perhaps best of all, because this is a non-contact method, the equipment can be installed away from the river with minimal civil engineering costs. The design is open source. This approach opens the way for rapid expansion of the river observation network in Africa..

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