Hydro-JULES Education

Project 2- Understanding Precipitation Estimates from Commercial Microwave Links

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Commercial Microwave Links (CMLs) between base stations form the basic infrastructure of mobile phone networks used ubiquitously across the world. Signal attenuation due to precipitation is routinely compensated for by mobile phone operators – providing the opportunity for these links to be used as precipitation sensors. The high resolution of the link data can provide useful precipitation estimates as a complement to more conventional sensors such as raingauges and weather radar, especially where these may be sparse or subject to error. Urban areas and remote mountainous environments often have potential to benefit from use of CML data. Arguably, the greatest challenge is gaining access to CML data from the commercial companies running the mobile phone networks.

In summer 2024, the mobile phone operator Vodafone began a pilot study to collect and make available CML precipitation estimates from across its UK network. These include blended estimates incorporating weather radar and raingauge data. The Hydrological Forecasting Group at UKCEH has developed several hydrological models used in operational flood risk forecasting and are interested in exploring the potential uses of these CML-derived data in this context; and as part of an ongoing collaboration with the National Centre for Atmospheric Science (NCAS) Radar Group on improved space-time precipitation estimation.

An initial step is to systematically assess the accuracy of the CML precipitation estimates by calculating various measures of the error compared to a raingauge "Truth". How does the accuracy compare to estimates from weather radar or raingauge interpolation? Are there situations where the CML-based estimates are more or less accurate? How dense is the network of links and how does this impact on accuracy at grid- and catchment-scales? What quality control has or could be performed? How does the path-integrated nature of the precipitation estimate (between base stations separated by several km) affect the accuracy? How can such data be best interpolated in space and time? Is there anything of value in the raw data?

Depending on research outcomes, this initiative could inform future use of CML data in operational flood risk forecasting, in the Flood and Drought Research Infrastructure (FDRI) project, and lead to peer review R&D publications.

Potential intern tasks and outcomes

- Retrieve CML data from Vodafone's API/dashboard.
- Retrieve raingauge data to support assessment.
- Create scripts to process, evaluate, explore, and plot data.
- Provide feedback to contact at Vodafone.
- Summarise findings and Next Steps.

Required skills and background

- Interest in hydrology and novel technologies.
- A programming language (e.g. python or R).
- Data analysis and plotting skills.