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Automating a near real-time satellite rainfall pipeline for digital pastoralist decision support app

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Abstract

Timely and accessible climate information is critical for pastoralist communities operating in highly variable dryland environments. This study presents the design and implementation of an automated, near real-time rainfall data pipeline that integrates satellite-derived precipitation data into a decision support application tailored for pastoralists in Marsabit County, Kenya. The system leverages dekadal rainfall estimates from the TAMSAT dataset, distributed in NetCDF format. A Python-based backend pipeline was developed to automatically retrieve newly released datasets upon availability (published every ten days) and store them on a dedicated server hosted at the University of Kassel. To optimise data transfer and usability within web and mobile environments, a Python script is used as a secondary processing step to convert the NetCDF files into GeoJSON format, significantly reducing data size while preserving spatial structure. The processed rainfall data are then made available through an API endpoint, enabling seamless integration with the frontend of the Inforange application, a pastoralist decision support app. Within the user interface, rainfall patterns are visualised as blue-shaded rasterized polygons over a predefined bounding box encompassing Marsabit County and adjacent areas. This approach ensures complete spatial coverage despite irregular administrative boundaries. The rainfall module represents one component of a broader pastoralist decision support system that integrates multiple data streams; however, this work focuses specifically on the backend architecture, data transformation workflow, and frontend integration of satellite-derived rainfall information. The proposed pipeline demonstrates how automated geospatial data processing and lightweight data formats can enhance the timeliness and accessibility of climate information services in data-scarce regions. The system is scalable and adaptable to other geographic contexts and environmental variables, offering a practical framework for strengthening climate resilience among pastoralist communities.

Keywords: API, Geospatial data processing, Mobile app, Near real-time pipeline, Pastoralism, satellite-derived rainfall data

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