The GRR Product: A Regionally Adjusted Rainfall Retrieval for the Galápagos Archipelago

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Due to its geographic location and unique climatic conditions, the Galápagos archipelago is renowned for its exceptional and highly endemic biodiversity. However, because of the limited availability of permanent freshwater bodies, the freshwater budget of the archipelago depends almost exclusively on precipitation. Owing to the lack of spatially and temporally resolved rainfall information, the short- and long-term dynamics of precipitation in the Galápagos remain poorly understood.

This poster presents a new satellite-based rainfall retrieval algorithm, the **Galápagos Rainfall Retrieval (GRR)**, which provides the potential for a high spatio-temporal resolution rainfall product (2 km, 10 min) in near real time for the Galápagos archipelago.

The algorithm combines physical approaches with machine learning techniques, using sequences of geostationary Earth orbit (GEO) images from the **Geostationary Operational Environmental Satellite (GOES)-16** and its successor **GOES-19** to retrieve both convective and stratiform rainfall.

In the first step, a threshold technique and spectral differences are used to identify cloudy regions. Next, band combinations and the liquid water content product are applied to detect rainy areas. These regions then undergo an entity-based classification procedure (e.g., slope tests or visible-band thresholds) to identify potentially convective core areas for each cloud type. A subsequent test evaluates the temporal and spatial evolution of these cores to determine whether they are likely to be decaying. If a convective core is classified as decaying, it is labeled as stratiform rain; otherwise, it is identified as an active convective core. Finally, rainfall rates are assigned using a one-dimensional model for convective cells and an XGBoost regression model for stratiform precipitation. The stratiform component is trained using data from 11 stations across the region. All processing steps are then integrated into the final GRR product.

Validation is conducted using: (i) independent station rainfall data not used in the model training, with a high temporal resolution of 10 minutes and covering west–east and windward–leeward transects across three islands (Isabela, Santa Cruz, and San Cristóbal); and (ii) comparisons with the Galápagos Archipelago Refined (GAR) analysis, dynamically downscaled using the WRF model for the region.

Keywords: rainfall retrieval, GOES-16, Galápagos, XGBoost