

A High-Resolution Global Convective Precipitation Probability Product from Geostationary Infrared Observations

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Classifying precipitation types as convective (non-uniform, intense and localized) or stratiform (homogeneous, weaker and typically widespread) supports extreme event identification, diabatic heating characterization, and understanding of precipitation microphysics. Whilst the Global Precipitation Measurement (GPM) Core Observatory provides instantaneous precipitation type observations from space with the Dual-frequency Precipitation Radar (DPR), sampling limits these observations to localized domains which prevents the DPR's suitability for global monitoring purposes. To address this gap, we have produced a global convective precipitation probability product at high spatiotemporal resolution (0.05°, 30-minute) underpinned by geostationary infrared (GEO-IR) brightness temperature observations from 1998 onward. The rationale of this Generic Retrievals for MEaSURES Infrared-based precipitation Typology (GROMIT) algorithm is to extend the DPR precipitation type retrievals across the globe for monitoring purposes by fusing its capabilities with the extensive high-resolution global GEO-IR record. GEO-IR observations, whilst sensitive only to cloud tops, can provide global high-resolution coverage within 60°N-S, thus extending DPR precipitation types beyond its 245-km swath on its non-sun-synchronous orbit. The innovation of GROMIT is to retrieve convective precipitation probabilities across the globe with an AI/ML model trained on DPR precipitation type classifications with coincident GEO-IR brightness temperatures as predictors. In our analysis, we highlight AI/ML advances beyond a classical lookup table, showcase GROMIT's accuracy relative to input DPR retrievals and compare the scheme to an independent ground reference over the Contiguous U.S. (CONUS), the Ground Validation Multi-Radar Multi-Sensor (GV-MRMS) product, which is principally underpinned by ground-based radars for determining precipitation types. We also demonstrate the potential for the GROMIT IR-based typology product to contribute to our wider NASA MEaSURES initiative to produce a global high-resolution precipitation type product which leverages and complements the Integrated Multi-satellite Retrieval for GPM (IMERG) legacy in merging precipitation retrievals from IR and passive microwave sources.