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Supplemental Material

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Evaluating TMPA Rainfall over the Sparsely Gauged East African Rift

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Supplementary Material 1. Rain gauge network installation, maintenance, and data control

Collecting rainfall data within the western branch of the East African Rift is challenging due to limitations related to accessibility, security, among other reasons, which is described by Monsieurs et al. (2017). Data from 24 gauges were obtained through a variety of different sources, including: (1) research institutions: Appalachian State University (USA), University of Burundi (Burundi), Centre de Recherche en Hydrobiologie (DR Congo); Observatoire Volcanologique de Goma (DR Congo); (2) EAGLES research project (<http://www.eagles-kivu.be/project.htm>); (3) religious institution: Père Blancs Bukavu (DR Congo); and (4) governmental institutions: Meteo Rwanda (Rwanda), NOAA (USA), United States Geological Survey (USA). From these gauges, 16 have a daily temporal resolution with rainfall accumulated over 24h when reading the gauge at 8 AM. The latter is important for comparison with other data sources of which the accumulation period might be different, or can be adapted accordingly when sub-daily data is available. The remaining eight gauges have a sub-daily temporal resolution.

In order to perform rainfall analyses on a sub-daily scale, a total of 22 additional gauges were installed and maintained through the RESIST and AfReSlide projects (<http://resist.africamuseum.be/>; <http://afreslide.africamuseum.be/>). These include 10 gauges in the Rwenzori Mountains with 1-hourly data recording (UG1-10 in Fig. 3 and Fig. 4), and 12 gauges in DR Congo with 30 min data recording (DRC1-4,6-10,14,16,17 in Fig. 3 and Fig. 4). These gauges are self-contained automatic logging tipping buckets with 0.2 mm per tip. Details on these gauges' technical specificities and constraints on their location and maintenance are given by Monsieurs et al. (2017).

Original data from the, in total, 46 gauges vary in temporal resolution, units, time period, and data quality. These data were firstly harmonized for: location (latitude and longitude indication), date and time of the measurements, and units (all data were converted to mm/day). Data were kept in the local time, i.e., UTC+2 for DR Congo, Rwanda, Burundi, and UTC+3 for Uganda.

Through experience gained during installation and maintenance of our network comprising 22 gauges, we learned that a range of possible sources inducing uncertainties in gauge data exists in this particular area (Monsieurs et al. 2017). Gaps in the time series originated from gauge blockage through leaves or dust, stolen data loggers, tilting of gauges, or drained batteries of the data loggers. In total 13% of the time series in our gauge network was marked as a gap (Fig. 4). Data was found for 6.5% suspicious because of uncertain time parametrization, unspecified units (mm or inch) for observations or presence of many data gaps (Fig. 4). These data are however still valuable at the applied resolution and kept for analyses. Metadata for the 24 gauges outside our own network was non-existing. Data could hence not been marked as gaps based on information on the gauges' operationality but were detected solely as jumps in time (Fig. 4). When taking all gauges into account, a marginal portion (1%) was found suspicious for reasons of doubtful units or the presence of many data gaps. We checked if TMPA validation results differ between the 22 gauges in our own network and the 24 gauges of which we have no metadata to exclude possible data related to a gauge malfunctioning, but found no significant difference according to the Pearson correlation coefficient, Normalized Mean Error, Normalized Mean Absolute Error,

Normalized Root Mean Square Error, Heidke Skill Score, Probability of Detection, and Probability of False Alarm.

A more in-depth quality control of the gauge data is constrained by a number of reasons. First, only one gauge out of the 46 was a weather station including other climate factors such as humidity or temperature, hence cross-validation with other climate factors in the region was not possible. Second, the temporal heterogeneity of the datasets, the lack of a dense gauge network, and the high spatiotemporal variability of rainfall, impede to study the consistency between nearby gauges. Lastly, based on the limited time series, no sound method could be adopted to identify outliers.