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River bed dynamic monitoring on ephemeral/intermittent rivers – sand-bed response on topical drylands

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Intermittent and ephemeral rivers, prevalent in dryland areas, have less monitoring data than perennial rivers worldwide. It hinders studies about hydro-geomorphology dynamics on these streams, which is especially complex in rain-fed flow regime on tropical rivers. Irregular rain patterns characterise the tropical drylands, which reverberate in the hydro-geomorphological dynamic. Unmanned Aerial Vehicles (UAV) survey is an efficient and cheap technic to monitor these streams since the dry periods expose the riverbed surface. This research aimed to analyse the hydro-geomorphology dynamic on sandy bed reaches of an intermittent tropical river. Five UAV surveys were realised on eight sandy reaches, from headwater to the outlet, between 2020 January 7 and December 9 in the Tigre River – Brazilian Drylands –, a 30Km ephemeral/intermittent. The UAV photos from all the surveys were co-aligned to create matching DEMs. We compared the DEMs to identify channel morphology changes, calculating differences in the riverbed and riverbank. The DEMs comparison enabled to calculate the erosion and sedimentation volume to each reach. Simultaneously, we installed crest stages gauges to monitor the peak water level between the surveys. Lastly, we used five rain gauges to identify the necessary rain volume that generates flow events. The 2020 annual rain volume was close to the historical average, between 530mm and 700mm, on the pediments, up to 1000mm on highland headwaters. The average potential evapotranspiration is around 1400-1800mm/year, due to the tropical climate. There was an average of 3.4 extreme rainfall daily events (over 50mm/day) during the year and the rainest period was between March 15 to 26th when rained from 134mm to 376mm around the watershed. The surveys between January 18 and March 8 identified insignificant morphology changes on eight reaches. The peak water levels were between no flow to 0.49m; only the outlet reach showed slight erosion and water level reaching 1.1m. The rain events between March 15/26th generate the water level annual peaks at all the reaches, from 1.9m to 5.4m (outlet reach). Seven reaches increased the vertical incision around 20/30cm to 80cm, and localised pools were eroded to up 1.7m deep. The outlet part exhibit around 30 to 40cm of sedimentation even with a water level peak of 5.4m. This unusual response could be caused by backwater effect from the Espinho River flood, which Tigre River is a tributary, that trapped sediment in the Tigre River. These results highlight how dynamic intermittent/ephemeral tropical rivers and showed how low-cost UAV High-Resolution DEMs and stage crests are workable and efficient techniques to monitor ungauged intermittent/ephemeral rivers. Simultaneously, narrow

the surveys timespan (Covid-19 pandemic hindered most of the monthly planned surveys) is essential to identify which flow events caused erosion and sedimentation and which rain events trigger flow events.

Keywords: Sand-bed rivers; UAV HR-DEMs; Brazilian Drylands; Water Level Stage Crest, riverbed erosion