Supplementary For Madagascar Channel

Supplementary 1: Study Timeframe

The time frame used for the study was set around the occurrence of TC Ana. As the cyclone occurred between the 20th and 25th January, data gathering was set before and after the occurrence of the cyclone to produce an effective comparative map of before/after the natural hazard. The flooding model mainly used Sentinel-1-SAR, which has the advantage of penetrating through clouds by leveraging a C-band at a center frequency of 5.405 GHz [71]. As Sentinel 1 has a repeat time of 6 days, time frame was set accordingly. In Mozambique, the span of the 'before' period was set to 18 days and composited with the average pixel of the collection. In Mozambique, for the 'after period', 12 days were taken and averaged out using a mean composite image. This resulted in a 'before' period between 02-01-2022 and 20-01-2022 and an 'after' period between 25-01-2022 and 10-02-2022. In Madagascar the mean composite was created with a 'before' period between 02-01-2022 and 20-01-2022 and an 'after' period between 25-01-2022 and 02-02-2022. In a similar way to Mozambique, the mean composite in the 'before period' was set to 18 days. However, as cyclone Ana was followed on February 4th by TC Batsirai which affected the southern Madagascar including the Melaky province, Sentinel-1 data was retrieved up to 2 days before the onset of the other cyclone to avoid affecting the flood model.

Supplementary 2: Pre-Processing

Pre-processing mainly aimed to reduce the granular noise due to the interference of waves reflected from elementary scatterers in SAR data. The speckle in SAR images typically complicates image interpretation by reducing the effectiveness of the segmentation of the image [72]. After' trial and error', a smoothing radius using a circle mean filter of a radius of 50 meters was applied to the 10 m resolution mosaic of both before and after images. The before and after images were then divided and the difference was calculated to obtain an image showing the differences in flooding between the two timeframes. A difference threshold was then also applied to reduce errors and make sure there are as few false positives as possible. These typically looked like small speckles on our model. Following trial-and-error approach and validation using the ACAPS data, the ideal threshold of 1.20 was found and applied to the model.

Supplementary 3: Post-Processing

Post-processing included masking of the areas with more than 5% slope using the SRTM-derived HydroSheds dataset (Table 1). Permanent surface water was also masked out whereby it was defined as areas where there is water for more than 10 months a year. The computation of an independent Normalized Difference Water Index (NDWI) to mask out permanent surface water was attempted but proved unsuccessful, as Sentinel-2 optical data was too cloudy to produce any accurate result [73]. To reduce some of the final noise on the flood extent images, the connectivity of pixels was calculated, and areas connected to eight or fewer neighbors were effectively masked out. Finally, the calculation of the flood extent was obtained by summing the areas of flooded pixel per region/province and converted to hectares. The images were then exported to Google Drive for version control, backed up on GitHub and physical hard drive and a high compression feature was applied to output rasters, which does not alter the output raster file and keeps the exact same pixel value.