

**Abstract:** In 2018, Ecometrica Ltd. was tasked with identifying potential deforestation over 7000 sites spread across South America over a one year period. This required the analysis of more than 15 Terabytes of satellite imagery, and was equivalent to processing a total area of approximately 25 million km<sup>2</sup> for the entire time sequence. Given the vast area and dense time series data required, we developed an approach that uses freely available data from Sentinel 1 (radar) and the Hansen et. al. Forest/Non-Forest map<sup>1</sup>, and processed the imagery with using an open source stack including data preparation software (SNAP toolbox), Omnibus change detection algorithm<sup>2</sup> and Python 3.x GIS libraries (GDAL, Fiona and Rasterio etc). All of the data processing was run in the cloud on Amazon Web Services, but the toolchain and data can readily be executed and processed locally at a smaller scale. Our proprietary asynchronous processing chain executes all the file operations required to generate the expected outputs and deduce the deforestation from change and Fnf maps.

The resulting output was a 30m<sup>2</sup> resolution (potentially 14m<sup>2</sup>) classified change map, with each pixel value representing the frequency of change (from within the stack). The results successfully identified forest loss events within the bounds of the areas of interest, but also included challenging error of omission if there were gaps in the time-series, and commission error over steep terrain or rapidly changing landscapes (e.g. flooding) but with the majority of error carried forward from the Hansen Map. In order to validate our automation processes and the change detection algorithm, the results were all manually verified to exclude omission and commission as part of due process.

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<sup>1</sup> Hansen, M. C., P. V. Potapov, R. Moore, M. Hancher, S. A. Turubanova, A. Tyukavina, D. Thau, S. V. Stehman, S. J. Goetz, T. R. Loveland, A. Kommareddy, A. Egorov, L. Chini, C. O. Justice, and J. R. G. Townshend. 2013. "High-Resolution Global Maps of 21st-Century Forest Cover Change." *Science* 342 (15 November): 850–53.

<sup>2</sup> Nielsen, A. A., Conradsen, K., & Skriver, H. (2016). An omnibus likelihood test statistic and its factorization for change detection in time series of polarimetric SAR data. In *Proceedings of the 2016 Conference on Big Data From Space (BiDS '16)* (pp. 316-319). Publications Office of the European Union. DOI: 10.2788/854791