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Mapping present-day mountain treeline pattern based on high-resolution remote sensing images

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Mountain forests, widely distributed around the world, are hotspots of biodiversity and provide important environmental services by conserving water and soil, regulating river flow and storing carbon. The upper altitudinal limits of trees is defined as the treeline. Some field investigations indicate that treelines around the world are moving upward as a response to global climate change. However, to date, a high-resolution spatial map of global mountain treeline position is still lacking. In this study, we develop an algorithm to detect the present-day tree line positions in mountain regions globally, via integrating a high-resolution tree distribution dataset with a high-resolution digital elevation model. The results are validated with even finer resolution remote sensing images in Google Earth. We analyse a range of climate datasets to understand important climate drivers of the present-day tree line position. Further, we explore the change in Normalized Difference Vegetation Index (NDVI) within the buffer zone of the treeline to determine how the treeline position has shifted in the last three decades. By providing the first global mountain treeline distribution, our analysis will help to reveal how mountain forests are responding to climate change globally, and to detect how the responses vary regionally.