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Volcanic disturbance triggers high organic carbon fluxes into the Chilean Patagonian fjords

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Both fjords and old-growth forests are important sinks of organic carbon. Yet the role of episodic disturbances, particularly volcanic eruptions, in mobilizing organic carbon in fjord landscapes covered by dense temperate rainforests remains hardly quantified. To this end, we estimate how much forest vegetation and soils were lost to nearby fjords following the 2008 eruption sequence of Chaitén volcano in south-central Chile. Pyroclastic sediments obliterated >12 km2 of near-pristine temperate rainforest; the subsequent reworking of these sediments also delivered >80,000 tC of large woody debris into two gravel-bed rivers draining into the Patagonian fjords in less than a decade. A similar volume of wood remains in dead tree stands partly submerged by pyroclastic deposits, and stored in active channels prone to future erosion. We also estimate that >215,000 tC of highly organic floodplain forest soil was lost to bank erosion, thus adding to the carbon loads contained in large woody debris. Surface samples of the river deltas store some of the reworked forest-soil sediments at vertical accretion rates of >5 mm/yr. While some of the large woody debris is incorporated into the long-shore drift, the finer particulate organic carbon from eroded forest soils is likely to be buried rapidly in the fjords. We conclude that organic carbon fluxes will remain elevated for the coming years and that Patagonian temperate rainforests may episodically switch from carbon sinks to carbon sources following destructive impacts by explosive volcanic eruptions.