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Stream channel morphology, sediment and large wood transport evolution patterns following the 2008 Chaitén volcano eruption, Chile

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The study about hydrologic and geomorphic impacts of explosive eruptions on river systems and associated patterns of stream channel morphology, sediment and large wood transport evolution is extremely important in a country like Chile which, according to the Global Volcanism Program, is ranked 5th in terms of active volcanoes among nations. To date, such effects have been little studied in the densely vegetated and steep forested watersheds of southern Chile, and the likely hydrologic and geomorphic responses to these disturbance processes are not well understood. In addition to the overall need for greater understanding, the 2008 Chaitén volcano eruption provides a rare opportunity to study post-eruption landscape adjustments

Explosive eruptions have the potential to inflict large impacts in terms of scale and severity. They can damage, destroy, or bury extensive areas of forest vegetation and cover the landscape with volcanic ash, filling river valleys, obliterating watershed divides, disturbing drainage patterns and changing channel size, shape, pattern and structure, and dead trees can contribute to large log jams on valley floors. Hydrologic, sedimentologic, and geomorphic responses to major explosive eruptions can be dramatic, widespread and persistent, and present enormous challenges to those entrusted with managing disturbance response.

Specific channel segments in river systems affected by the 2008 Chaiten volcano eruption are investigated since January 2010. Data acquisition methods include the use of a sequence of remote images, GIS, continuous hydrologic measurements, periodic field surveying and sampling campaigns, and radio tagging.

From the first two field campaigns in January 2010 and 2011, huge amounts of large wood (LW) were observed in the severely impacted river systems. In the Chaiten river (total catchment area of $\sim$120 km2), LW deposited parallel to stream indicates high mobilization rates and some typical wood structures (log steps, valley jams) are developing in the main channel. Noticeable is the stream avulsion caused by a large 3 meters high and 30 meters wide LW dam which diverted the flow through the forest. Channel geometry, sediment transport and bed grain size are evolving in the Chaiten river system. Comparing the data from the 2010 and 2011 summer campaigns, a reduction in instantaneous sediment transport rates measured in the same cross section and with relatively comparable discharges (5.3 m3/s in 2010 and 6.7 m3/s in 2011) from 1.25 to 0.9 kg/s for suspended and from 5.7 to 2.3 kg/s for bed load were detected. Between February 2009 when a pyroclastic flow buried the Chaiten river valley and January 2010, a 4.3 m deep channel was excavated and the bed further deepened in $\sim$ 2 additional meters one year after. Longitudinal bed-slope in the study segment was 0.547% in 2010 and 0.503% in 2011. D50 of the bed material changed from 2 mm in 2010 to 5.8 mm in 2011, indicating that the finer volcanic material is been washed away and the channel of the Chaiten River is reaching pre- eruption levels.

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