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The August 2010 Zhouqu debris flow: Likely causes and trends

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On August 8, 2010 in the northwestern Chinese province of Gansu, a rainstorm-triggered debris flow devastated the small county of Zhouqu. A modeling study, using a new multiple-phase scalable and extensible geo-fluid model, suggests that the cause is an intersection of several events. These were: a heavy rainstorm, not necessarily the result of global warming, which triggered the landslide and followed a drought that created surface cracks and crevasses; the geology of the region, notably the loess covering heavily weathered surface rock; and the bedrock damage, that deepened the surface crevasses inflicted by the 7.9 magnitude Wenchuan earthquake of May 12, 2008. Deforestation and topsoil erosion were critical contributors to the massive size of the debris flow. The modeling results underscore the urgency for a high priority program of re-vegetation of Zhouqu County, without which the region will remain exposed to future disastrous, 'progressive bulking' type landslides. Debris flows are more predictable types of landslides; consequently, a series of 'pseudo-climate change' model experiments of future extreme precipitation events is carried out using the WRF model, forced by temperature perturbations from an ensemble of climate models. In a likely future warmer climate, extreme precipitation events are anticipated to be more severe, and this study has identified an atmospheric blocking pattern that might produce future extreme precipitation events in the peri-Tibetan Plateau (TP) area (located to the north east of the TP).