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A vicious circle of fire, deforestation and climate change: an integrative study for the Amazon region

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The Amazon rainforest is threatened by deforestation due to wood extraction and agricultural production leading to increasing forest fragmentation and forest degradation. These changes in land surface characteristics and water fluxes are expected to further reduce convective precipitation. Under future climate change the stability of the Amazon rainforest is likely to decrease thus leading to forest dieback (savannization) or forest degradation (secondarization). This puts the Amazon rainforest at risk to reduce the generation of precipitation, to act as a carbon sink and biodiversity hotspot. Fires increased in the past during drought years and in open vegetation thereby further accelerating forest degradation. Deforestation as a result of socioeconomic development in the Amazon basin is projected to further increase in the 21st century and brings climate-induced changes forward. Combined effects of deforestation vs. climate change on the stability of the Amazon rainforest and the role of fire in this system need to be quantified in an integrated study. We present simulation results from future climate (AR4) and deforestation (SimAmazon) experiments using the LPJmL-SPITFIRE vegetation model. Land use change is the main driving factor of forest degradation before 2050, whereas extreme climate change scenarios lead to forest degradation by the end of 2100. Forest fires increase with increasing drought conditions during the 21st century. The resulting effects on vegetation secondarization and savannization and their feedbacks on fire spread and emissions will be presented. The effect of wildfires and intentional burning on forest degradation under future climate and socioeconomic change will be discussed, and recommendations for an integrated land use and fire management are given.