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Spatial patterns of rainfall anomalies and fire response in the Western Ghats hotspot of biodiversity

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Despite the recurrent nature of fire in the tropics and its effects on carbon, energy, and water balance of forests, little is known about the general contribution of extreme climatic events to fire-related activity. Here, a 10-year observational analysis of data shows important contributions of extreme climatic events to fire over large regions of the Western Ghats hotspot of biodiversity, including a pronounced signal during the year 2004. Seasonally dry forests in the Western Ghats experience annual forest fires which coincide with these climatic conditions. The spatial extent of droughts and fire response to drought was analyzed with TRMM and from MODIS thermal anomalies data (C5 MOD14A1, and MYD14A1), respectively. The original thermal anomalies data was aggregated into monthly-accumulated hot pixels at 0.25∞ spatial resolution. Simultaneously daily ecosystem water balance metrics were estimated from an automatic meteorological station in a focal landscape in the Western Ghats between 2004 and 2009. The 2004 drought was characterized by its intensification throughout the dry season in South and central parts of the Western Ghats. Also, in 2004, > 50% of the hot pixels during the dry season experienced enhanced fire anomalies (> 1σ). The mean daily potential evapotranspiration was highest in 2004, 3.78 ± 0.86 mm, the mean daily fire grids was also highest in 2004. The daily variability in wildfire incidence in 2004 is strongly associated with potential evapotranspiration (Spearman's correlation of 0.66, $p < 0.001$, $n=90$). Intense and prolonged droughts as characterized in the year 2004 could be critical for the occurrence of fire anomalies in all forests, and especially in moist forests. Droughts and the ensuing fires could result in fire-climate feedbacks with consequences for regional and global biogeochemical cycles and vegetation patterns.