Geophysical Research Abstracts, Vol. 9, 09193, 2007
SRef-ID: 1607-7962/gra/EGU2007-A-09193

Climatic controls on the area burned by wildfire in the western U.S.

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Studies of the modern relationship between climate and the area burned by wildfire in the western United States (U.S.) have focused primarily on persistent ocean-atmosphere interactions which influence climate or on drought. The climatic mechanisms linking fire and vegetation can be more directly analyzed by using combinations of temperature and precipitation, such as water balance deficit, that relate climate directly to its impacts on vegetation, especially fuel and foliar moisture. We present relationships between the area burned by fire and climate for the period 1916-2003 in the western U.S.A. Persistent, ecosystem-specific correlations between climate variables and area burned are grouped by vegetation type for 16 ecoprovinces across the West. For the period 1977-2003, between 33 and 87 percent (mean 64 percent) of the variability in ecoprovince area burned could be explained by a few significant climate variables. For the period 1916-2003, between 25 percent and 57 percent (mean 39 percent) of the total variability could be accounted for with climate. In both cases, precipitation variables were more important than temperature, but the relationships point to the importance of water balance deficit and surplus as the proximate climatic mechanisms driving the area burned by fire. Finally, we relate water balance variables (potential evapotranspiration, actual evapotranspiration, deficit, and surplus) calculated for each of the ecoprovinces to the area burned by wildfire. These variables are better area burned predictors in most northern and forested ecoprovinces, but precipitation in the years leading up to the fire season is the best predictor in southern/shrub-dominated ecoprovinces. Clear patterns of climate-fire relationships that parallel coarse vegetation structure emerge.