Geophysical Research Abstracts
Vol. 15, EGU2013-12525, 2013
EGU General Assembly 2013

Summertime Climate Response to Mountain Pine Beetle Disturbance

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The current mountain pine beetle infestation in British Columbian forests ranks among the largest ecological disturbances recorded to date and may foreshadow similar scale outbreaks in North American forests over the coming decades. The associated dieback may result in substantial shifts in evapotranspiration and albedo, which alter the local surface energy balance, thereby affecting regional temperature and climate. Here we quantify the surface energy budget impact for summertime, by reporting changes to evapotranspiration, albedo, and surface temperature measured primarily via remotely-sensed observations. Over the 170,000 square-kilometers of affected forest, the typical decrease in summertime evapotranspiration is 19%; changes to the absorbed shortwave flux are comparatively negligible. The resulting increases in the outgoing sensible and radiative heat fluxes of 8% and 1%, respectively, correspond to a typical increase in surface temperature of 1 degree Celsius. These changes are comparable to those observed for other types of disturbance, such as wildfire, and may have secondary consequences for climate, including modifications to circulation, cloud cover, and precipitation.