

Fire-induced changes in surface albedo as observed from MODIS observations

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An integrated assessment of the overall radiative forcing caused by fire is critical for fire and carbon management. The forcing due to greenhouse gas is well known, but there is a major gap in estimates of forcing due to fire-induced albedo change. Our objective is to examine the temporal evolution of post-fire albedo and analyze its relationship with the vegetation succession using MODIS satellite observations. We focus on two fire prone regions with very different fire regimes and vegetation succession patterns, Australia tropical savanna and Alaska boreal forest. We use MODIS albedo and vegetation index data from the years 2000 through 2004 from Northern Australia and interior Alaska. Burned area were derived from MODIS observations in Northern Australia and burn perimeters from 1950 through 2003 were identified by using the Alaska Fire History, 1950-2004, GIS Database. In northern Australia, the shortwave albedo decreased by an average of 0.024 within 16 to 32 days after fire. The albedo decreased by a greater amount in grasslands than woody savannas and as the dry season progressed. The albedo starts to increase within months after fire along with ash dissipation and fast vegetation regrowth in savannas. In post-fire boreal forest, both the vegetation succession and snow cover contributes to the temporal evolution of surface albedo. After boreal fire, albedo in spring (March and April) increases by 0.165 as compared with unburned areas, and reaches its maximum at nine years since fire. In summer (June and July), albedo shows an initial decrease of 0.023, which recovers in five years, followed by an increase of 0.025, and reaches its maximum at 20 years. Albedos in both spring and summer recover to pre-fire levels around 50 years. This pattern corresponds well with the post-fire boreal vegetation succession. Immediately after fire, loss of the canopy overstory leads to more gap and thus greater snow cover and higher albedo during spring while the charcoal leads to an albedo decrease in summer. In early and intermediate stages of succession, the establishment of grasses and deciduous trees leads to less snow cover in spring and have a more reflective canopy than mature black spruce ecosystems in summer.