Learning to see in the thermal infrared: Separating the temperatures of snow and trees

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Thermal infrared sensing of land-surface temperature from space is a well-developed field, but mixed pixels pose a problem for many applications. I show how multiple thermal bands on MODIS can be used to separate snow and forest temperatures and determine the fractional snow-covered area (fSCA). During the day, visible, near-infrared, and shortwave-infrared bands provide a first guess of fSCA and help to constrain the solution. Comparisons with measurements from the field and from aircraft show estimated errors of only about 1 degree; such measurements from space would help constrain models of the snowpack energy balance and identify atmospheric inversions and cold air pools.