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Analysis of atmosphere-biosphere interactions and feedbacks in the arctic

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Interactions and feedbacks between the land surface, vegetation and boundary layer may have an important role to play in the progression of Arctic warming. A regional Arctic climate model ARCSyM, coupled to a land surface model LSM, were used to investigate the radiation budget and energy balance of the three main vegetation types found in north west Alaska; tundra, shrub tundra and boreal forest. A multivariate statistical analysis was done to statistically pinpoint where the feedbacks were occurring in the modeled land-biosphere-atmosphere system, and these tests were duplicated, where possible, with location-specific field data, to determine whether the feedbacks were model artifacts or reflected in the observational record. This methodology resulted in many feedbacks being identified not only in the model results but the observational data also. Whilst the strength of the feedbacks is not able to be determined using this statistical methodology, results indicate it is a useful first order measure for identifying not only a models ability to capture feedbacks, but can also provide insight into the dynamics of the interaction of the land surface-atmosphere system in the Alaskan arctic. This study indicates that vegetation type can affect the surface fluxes and the development of the boundary layer, and thus potentially the regional climate, and that these climate changes can act as a feedback to the land surface.