Observations of Earth's Cryosphere Radiative Effect

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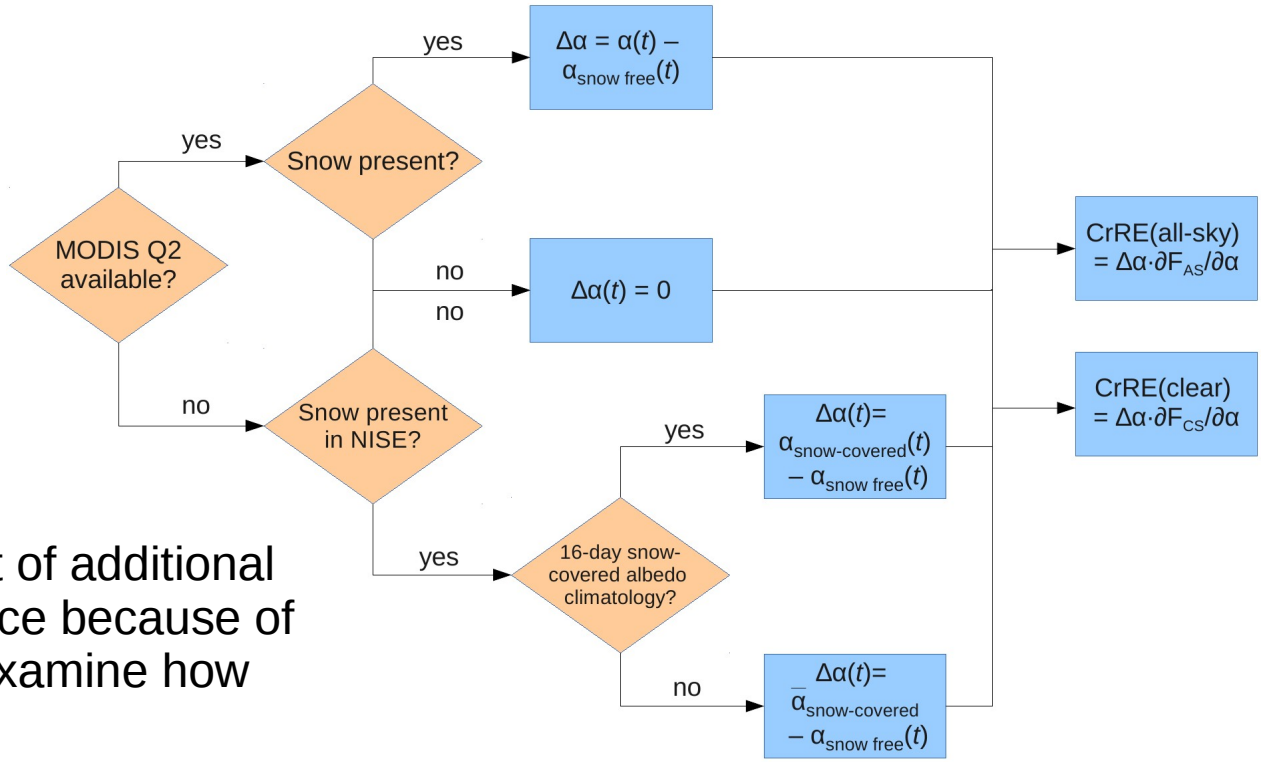
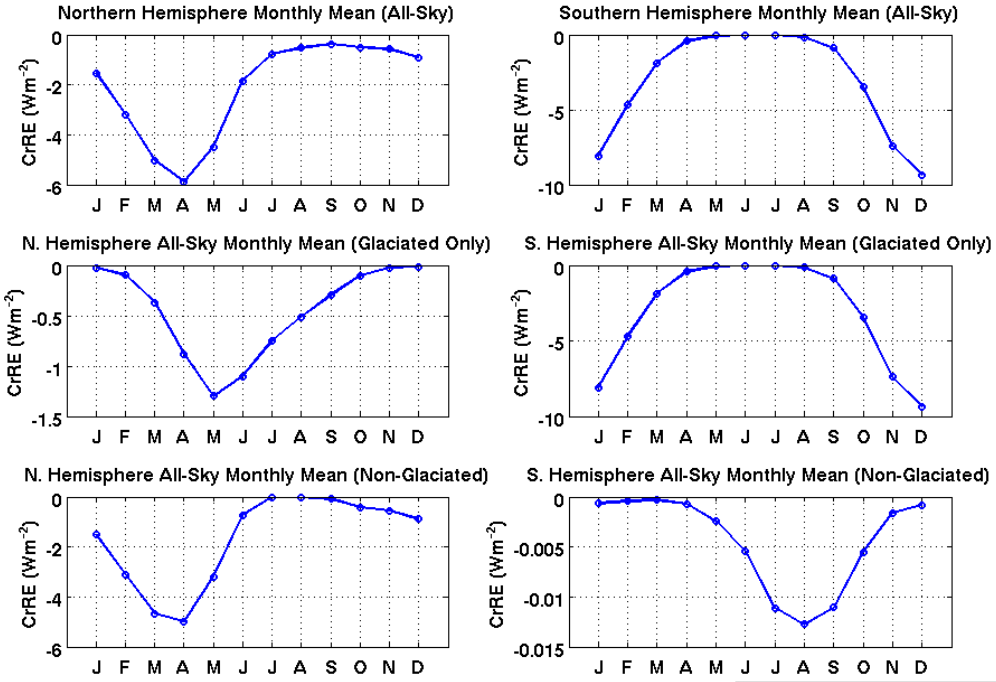
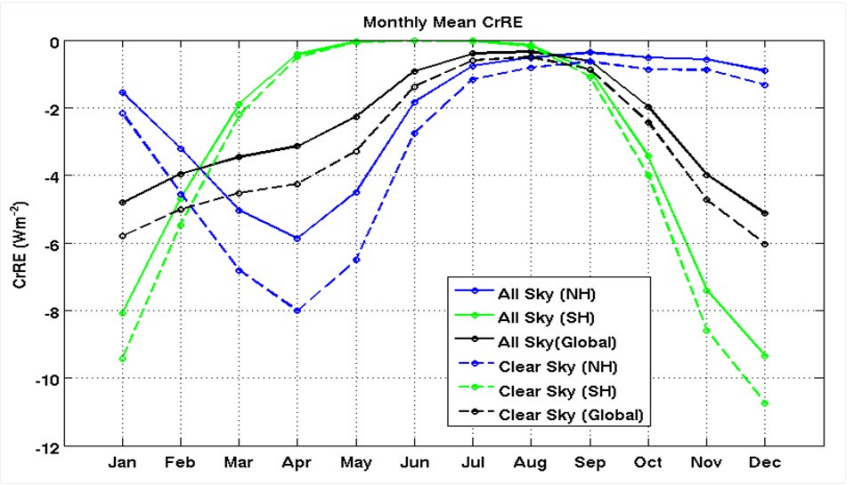
Methods:

1) Use MODIS albedo and snow detection, when/where available
2) Otherwise, use microwave-detected snow presence (NISE) combined with climatological snow-covered albedo from MODIS
3) Difference snow albedo with monthly-varying snow-free albedo derived from MODIS (Moody et al, 2008)
4) Pass albedo difference, caused by snow, through radiative kernels to provide TOA radiative effect



Goal: Determine the amount of additional solar energy reflected to space because of cryospheric presence, and examine how this quantity is changing

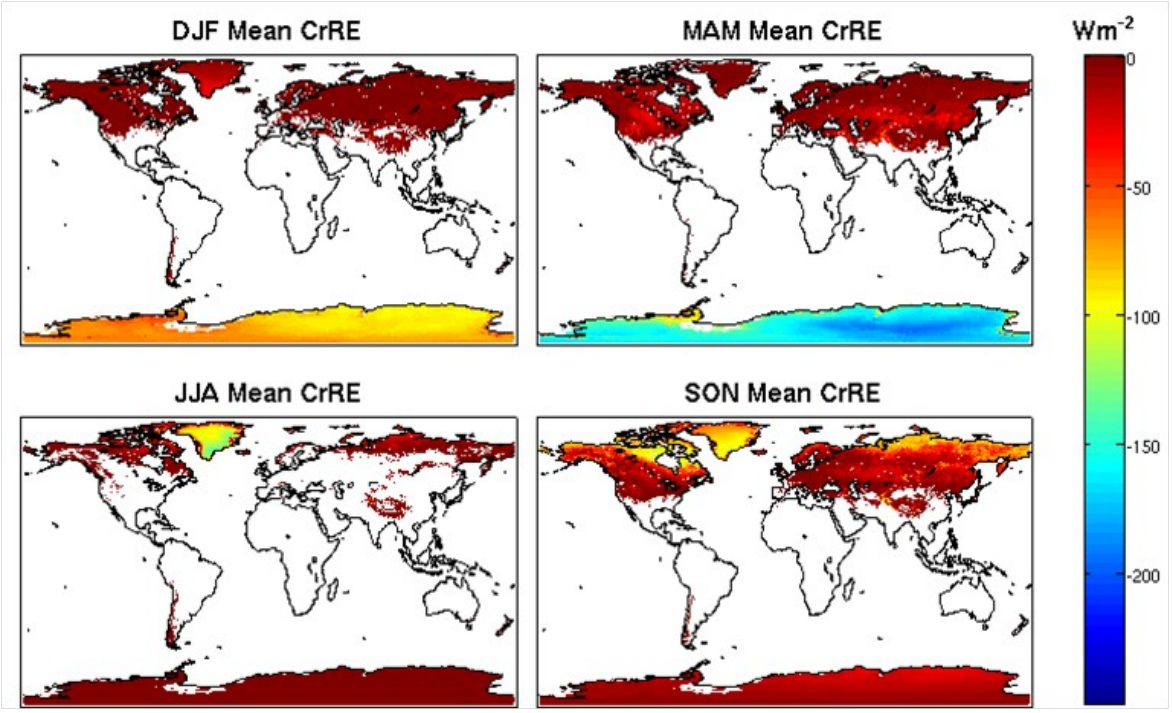




Figures: Seasonal distributions of land-based cryosphere radiative effect (CrRE), over glaciated and non-glaciated surfaces, averaged over 2001–2013.

Upper-right: Differences between all-sky and clear-sky CrRE

Global annual mean land-averaged top-of-atmosphere CrRE: ~2.6 W/m^2



Trends in CrRE

Significant trends in CrRE are not apparent during 2001 – 2013 (below)

Substantial changes between 1979 and 2008 are, however, apparent in AVHRR data (Flanner et al, 2011, right).

Current work: Evaluating consistency between MODIS and AVHRR CrRE derivations to determine utility of longer-term record