Lecture 8.

Clouds-aerosol –climate interactions in northern latitudes and the Arctic: Wildfires

General reviews:

Impacts of a Warming Arctic: Synthesis Report (2004)

The 140-page synthesis report of the Arctic Climate Impact Assessment.
You can download the full report for free from
http://www.acia.uaf.edu/pages/overview.html

The Arctic Report Card, 2012

http://www.arctic.noaa.gov/reportcard/

Major Findings:

- *During 2012, a number of record or near-record events occurred in relation to the Arctic terrestrial snow cover. Snow cover duration was the second shortest on record and new minima were set for snow cover extent in May over Eurasia and in June (when snow still covers most of the Arctic region) over the Northern Hemisphere. The rate of loss of June snow cover extent between 1979 and 2012 (the period of satellite observation) set a new record of -17.6%/decade, relative to the 1979-2000 mean.*
- *Record minimum Arctic sea ice extent occurred in September 2012; The lowest observed during the satellite record (1979-present) and 49% below the 1979-2000 average minimum. 2012 had the largest loss of ice between the March maximum and September minimum extents during the satellite record. The extent of multi-year ice continued to decrease.*

Screen, J. A., and I. Simmonds (2010), The central role of diminishing sea ice in recent Arctic temperature amplification, Nature, 464, 1334–1337, doi:10.1038/nature09051.

Arctic Amplification - enhanced Arctic warming relative to that in mid-latitudes. The widespread warming resulted from a combination of increased greenhouse gases and positive feedbacks involving sea ice, snow, water vapor, and clouds

Trends in clouds:

Liu, Y., J. R. Key, Z. Liu, X. Wang and S. J. Vavrus. 2012. A cloudier Arctic expected with diminishing sea ice. Geophys. Res. Lett., 39, L05705, doi:10.1029/2012GL051251.

This study quantified the relationship between changes in sea ice and clouds, using satellite-derived sea ice concentration and cloud cover over the period 2000–2010. Results show that a 1% decrease in sea ice concentration leads to a 0.36–0.47% increase in cloud cover, suggesting that a further decline in sea ice cover will result in an even cloudier Arctic.

Arctic haze

Law., K., and A. Stohl, Arctic Air Pollution: Origins and Impacts. Science 315, 1537, DOI: 10.1126/science.1137695 (2007)

Quinn, P. K. et al. Short-lived pollutants in the Arctic: Their climate impact and possible mitigation strategies. Atmos. Chem. Phys. 8, 1723 1735 (2008)

Shindell, D.T., et al. A multi-model assessment of pollution transport to the Arctic. Atmos. Chem. Phys., 8, 5353-5372, doi:10.5194/acp-8-5353-2008 (2008)

Wildfires in northern altitudes

Randerson, J. T., et al. The impact of boreal forest fire on climate warming, Science, 314, 1130–1132, doi:10.1126/science.1132075, 2006.

Rogers, B.M., J. T. Randerson, and G. B. Bonan. High-latitude cooling associated with landscape changes from North American boreal forest fires. Biogeosciences,10, 699–718, 2013. http://www.biogeosciences.net/10/699/2013/bg-10-699-2013.pdf