The High Latitude and Cold Climate Dust Network

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Context

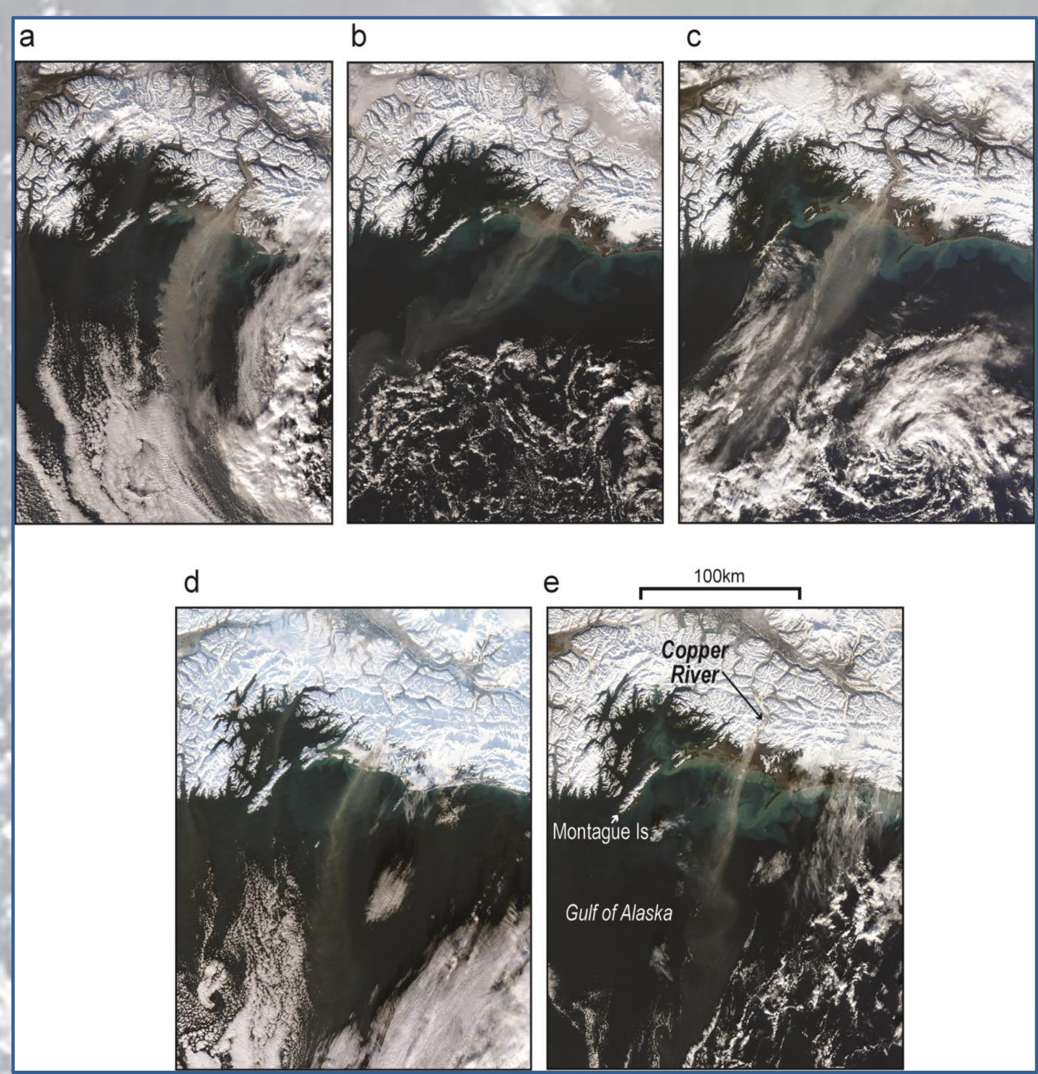
The impact of dust (particles <100 μm) in the earth-atmosphere-ocean system depends on particle characteristics, quantity, timing and location of emissions. Most research into dust emissions has focused on the hot, arid subtropics but whilst dust is often associated with hot deserts, there are 5 million km^2 of cold arid lands on Earth and significant dust events have been reported from these. Strong winds and sparse vegetation mean some humid cold climate areas, such as in New Zealand and Iceland, are also important dust sources. This Network is focusing on dust generated in high latitudes, cold climates and glacier-influenced environments under contemporary and predicted future climate conditions.

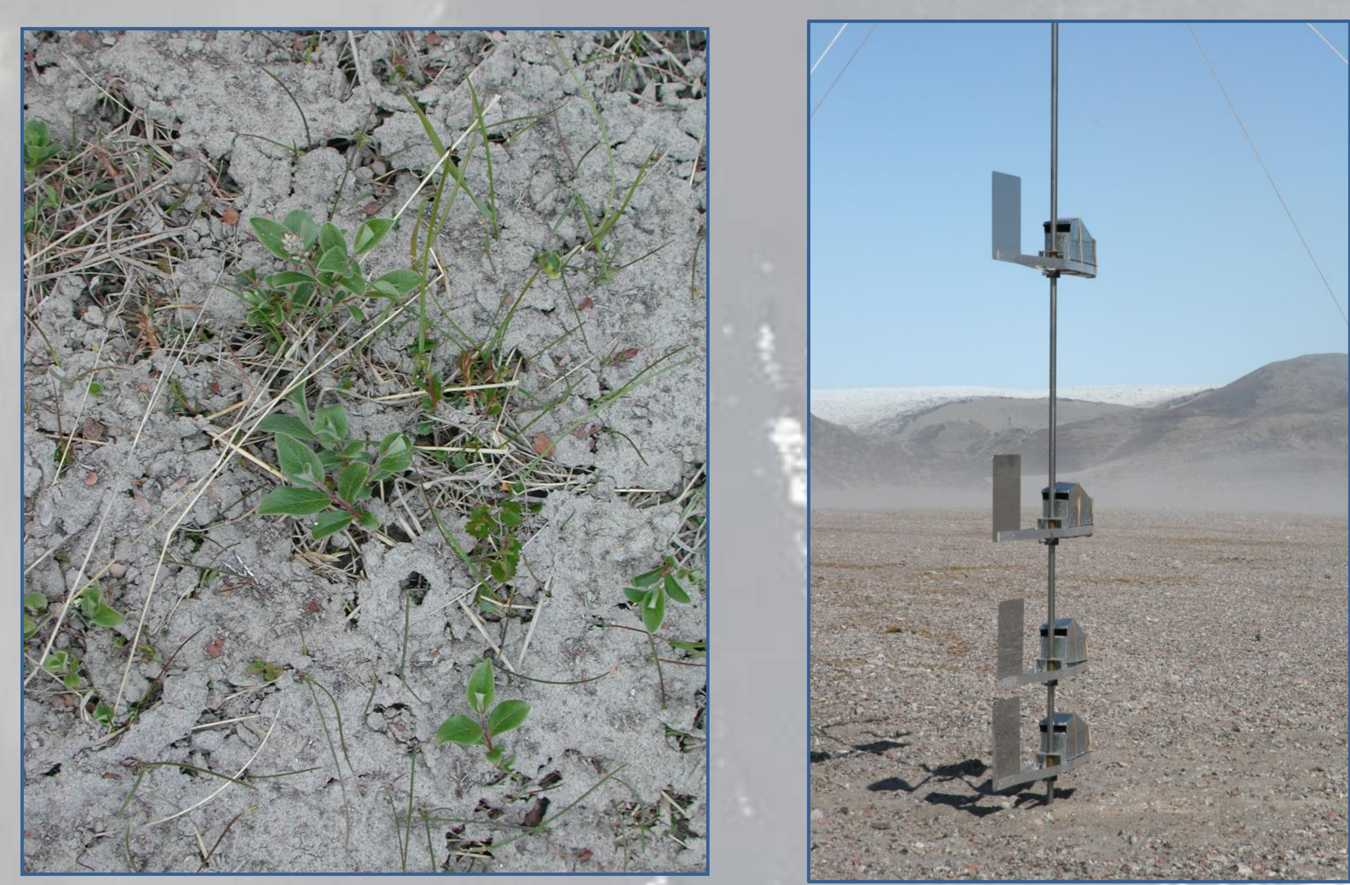
Cold Climate Dust Emissions

Cold climate dust emissions can be seasonally-intense. Emissions during dust storms in Iceland and Canada frequently exceed 50 g m-w s^{-1}; values from lower latitudes are usually <30 g m-w s^{-1}. Emissions are closely-coupled to wind regime and to sediment supply, which in glacierised catchments is linked to meltwater regime and ice extent both of which will change in response to 20th century climate warming. Receding glaciers will expose large quantities of fine sediments increasing the potential area of dust emissions. If the Antarctic ice-sheet shrinks to become land-terminating, the potential dust load available would be c.300 Mt yr^{-1} – equivalent to total contemporary dust emissions from Asia.

High Latitude Dust Deposition

Dust deposition is high in HLCCD areas. In Canada, Iceland and New Zealand deposition rates can exceed 500 kg ha^{-1} $month^{-1}$ – the highest in the world (Arnalds, 2010). HLCCD also travels long distances; Icelandic dust has been found in the United Kingdom, France and Greenland. HLCCD input to oceans is important because areas such as the subarctic Pacific and the Southern Ocean are often deficient in nutrients found in aeolian sediments. For example in 2006 a high latitude dust storm caused 60 - 400 tons of soluble iron to be deposited in the Gulf of Alaska (Crusius et al. 2011). In the cryosphere light dust deposition (<0.2 kg m^3) on snow or ice increases melt rates whilst more dense deposition reduces them.





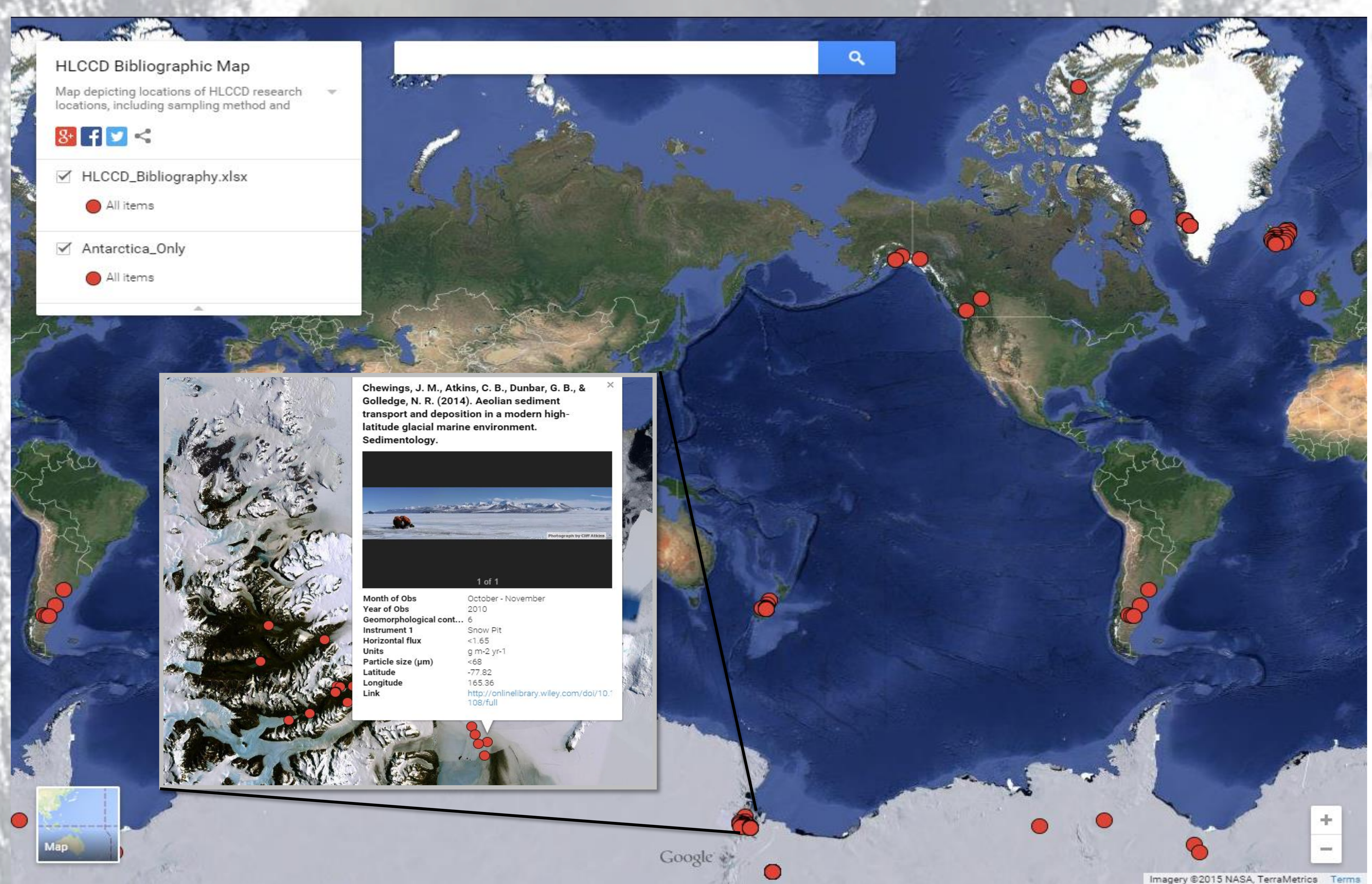
Left: Dust plumes from the Copper River, Alaska. (a) 5 Nov 2005, (b) 6 Nov 2006, (c) 30 Oct 2009, (d) 23 Dec 2010, (e) 2 Nov 2011 (Bullard, 2013). Above left: Contemporary dust deposits in a West Greenland catchment. Above right: Raised dust on sandur in West Greenland.

Network Aims and Objectives

The aim of this International Network is to improve understanding of contemporary and future impacts of high latitude and cold climate dust (HLCCD) in the Earth system using a multi-disciplinary approach. The lack of any attempts to quantify systematically the expanse, characteristics or dynamics of HLCCD sources limits our ability to assess their current and future significance.

Digital Atlas

The main objective of the network is to produce a comprehensive digital database and atlas of contemporary HLCCD sources and associated data. Such databases have successfully been compiled by the glaciological, hot desert and planetary research communities to integrate diverse sources of data and to identify new, strategic research goals. The HLCCD database will provide similar opportunities; it will also be used to identify critical geographical areas that are lacking data and that would benefit from future research endeavours. The database will be hosted at the Network website: www.hlccd.org



Above: Snap shot from the bibliographic database hosted at www.hlccd.org

Contact us:

WWW.HLCCD.ORG @HLCCD

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