

figures from NSIDC

The Arctic sea ice extent has been on the decline since the beginning of the satellite era in the later 1970's. With the most pronounced decline of summer sea ice extent seen in 2007. Microwave Satellites like SMMR, SSM/I and AMSR-E have allowed us to closely watch this decline in sea ice over the years. Daily sea ice extent maps are available from the NSIDC.

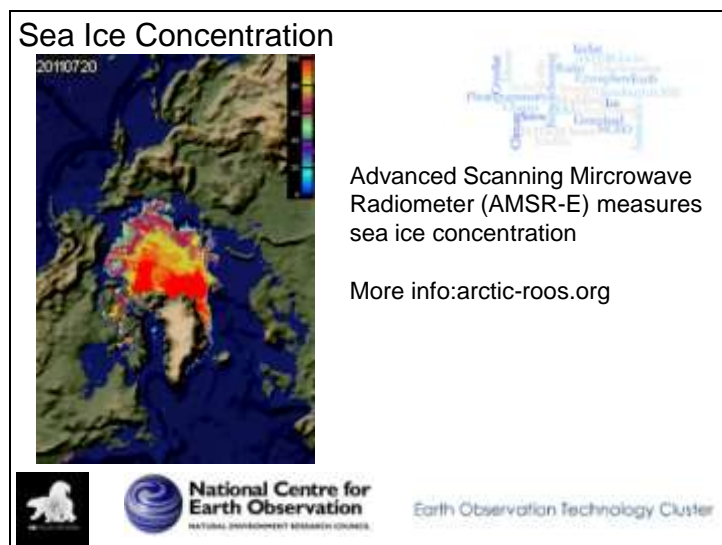
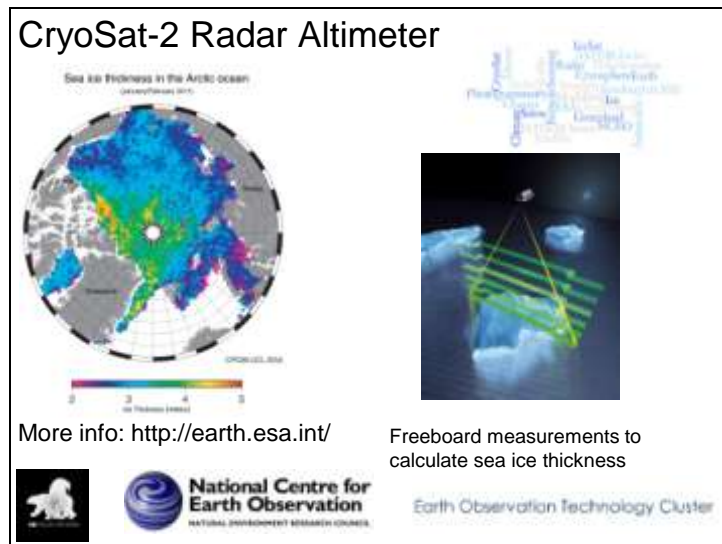


Figure from NERSC [arctic-roos.org](http://arctic-roos.org)

Also well known and measured since the beginning of the satellite era sea ice concentration. Picture shows: Advanced Scanning Microwave Radiometer (AMSR-E) onboard NASA's Aqua satellite measures daily sea ice concentrations since 2002. The large differences in emissivities between the dark ocean surface and the light ice surface allows for the ice concentration and extent to be easily calculated.

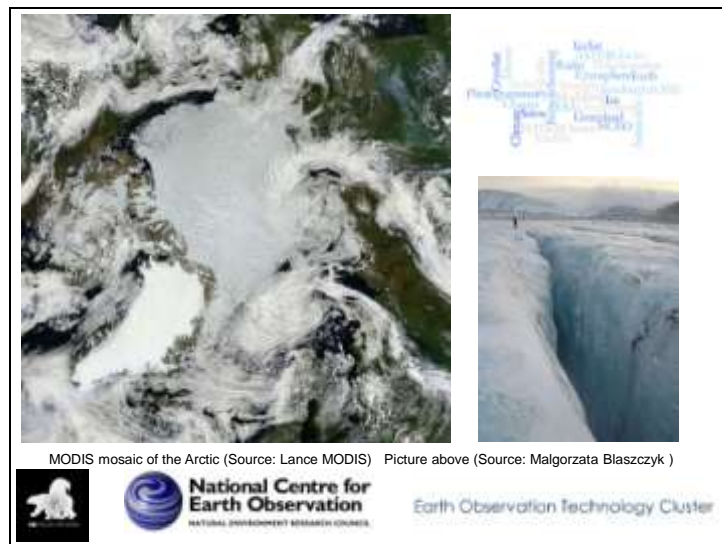


Figures from ESA  
New Satellite since June 2010.

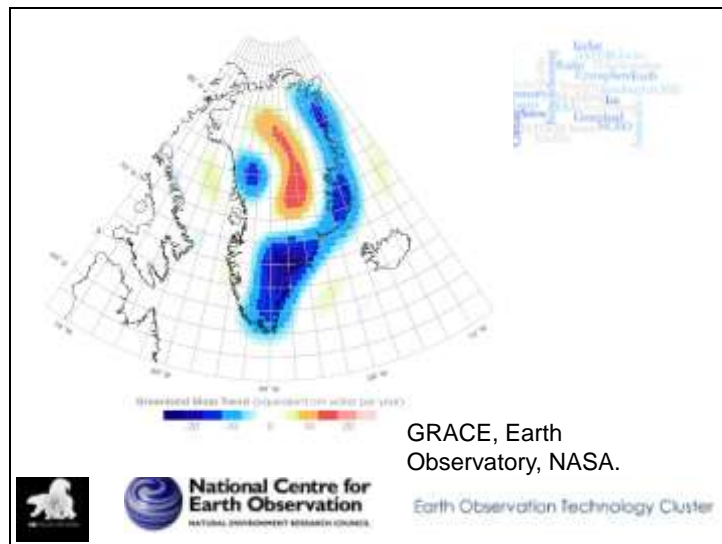
Cryosat-2 carries a radar altimeter that sends down a signal which is reflected of the surface. This allows to retrieve the height of the ice above the water surface and from this we can calculate the ice thickness.

Until now we only have been able to study the decline of the sea ice extent, but to know the thickness of the ice from CryoSat allows us to calculate the volume of the ice. The change in ice volume is a good indicator of climate change.

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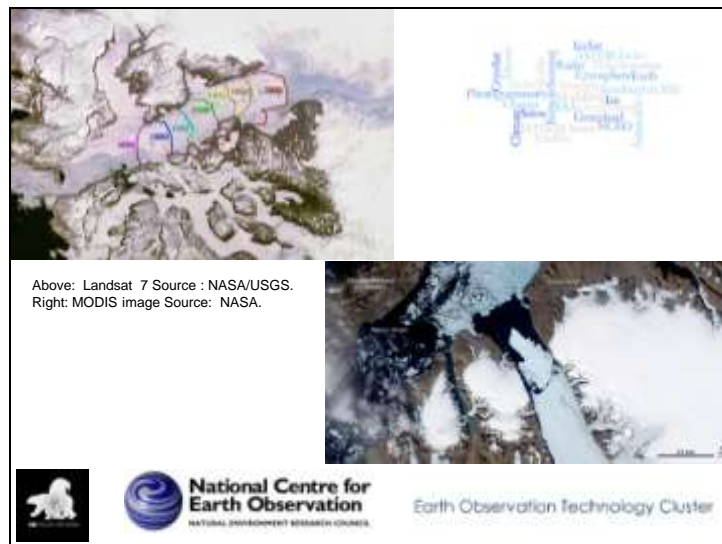


Remote Sensing provides the main source of data in this remote and inhospitable environment. It can provide data covering large areas very quickly in locations which would be otherwise inaccessible during ground based fieldwork. The satellite orbits can provide repeat coverage allowing scientists to make comparisons over the same area over a variety of timescales.



The image here depicts the mass loss/gain in water equivalent over Greenland between 2003 and 2005. GRACE satellite stand for Gravity Recovery and Climate Experiment. It detects changes in the earth's gravity field. The image above illustrates the amount of ice loss in the coastal areas of Greenland gain at the ice sheet interior. This linked to recent changes in the increase in summer melt and precipitation at the interior.

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The top left image shows the frontal retreat of Jakobshavn Glacier (one of the fastest flowing outlets in Greenland) between 1850 to 2003. The bottom right image shows a massive calving event on Peterman glacier which occurred in 2010. The amount of ice lost was 97 square miles, which is four times the size of Manhattan. Both these events were captured by repeat satellite optical images which would have gone unnoticed without the use of Remote Sensing techniques.