Author's Feedback

Signs of stability of the Arctic sea ice thickness from Cryosat-2

The paper discusses the latest Cryosat-2 findings for the Arctic sea ice thickness and summarizes all the data available for temperatures and sea ice thickness and extension to understand the Arctic climate over a proper long term time scales 1800s to present. The paper also discusses the issue of data manipulation that may prevent a proper understanding of the climate pattern.

The paper builds on the analysis and discussion of the latest Cryosat-2 Arctic sea ice thickness, plus the Arctic temperature and sea ice extension since 1979, plus some fragmented but consistent data since the 1900s and the 1800s.

The paper concludes that the shrinking of the Arctic sea ice started in the 1800s and it is characterized by oscillations of periodicity up to quasi 60 years about this trend. Presently, the Arctic sea ice seems to be turning stable due to the phasing of the quasi-60 years oscillations.

New title

Signs of stability of the Arctic sea ice thickness from Cryosat-2

New Abstract

Abstract

The latest Cryosat-2 results for the Arctic sea ice thickness are discussed. The signs of stability of the sea ice thickness are shown to be consistent with the Lower Troposphere Temperatures (LTT) and the sea ice extension available since 1979. The correct long term perspective is debated by using time series of sea ice extension and temperatures starting from the 1800s. The current Arctic climate is likely at the start a cooling and recovery phase. This is part of the same quasi-60 years' oscillation that was responsible of most of the warming since the late 1970s. This natural variability is superimposed on a longer-term trend of warming temperatures and shrinking of sea ice that started in the 1800s.

Keywords: Arctic, sea ice, temperature, climate models, simulations, experiments

New sections

Introduction

Possible periodicities of the Arctic climate oscillations

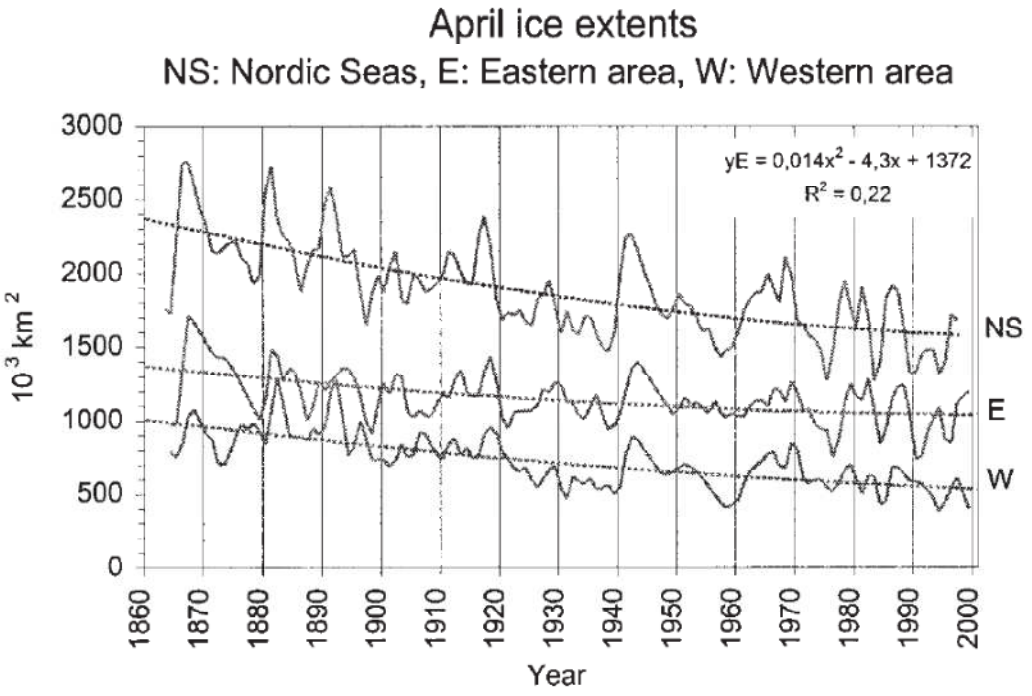
Some results since the 1800s for understanding the longer term trend

The latest Cryosat-2 monitoring of the sea ice thickness since 2010

Consistency with temperatures and sea ice extension since 1979

Consistency with temperatures since the 1900s and the issue of data manipulation

Discussion and Conclusions



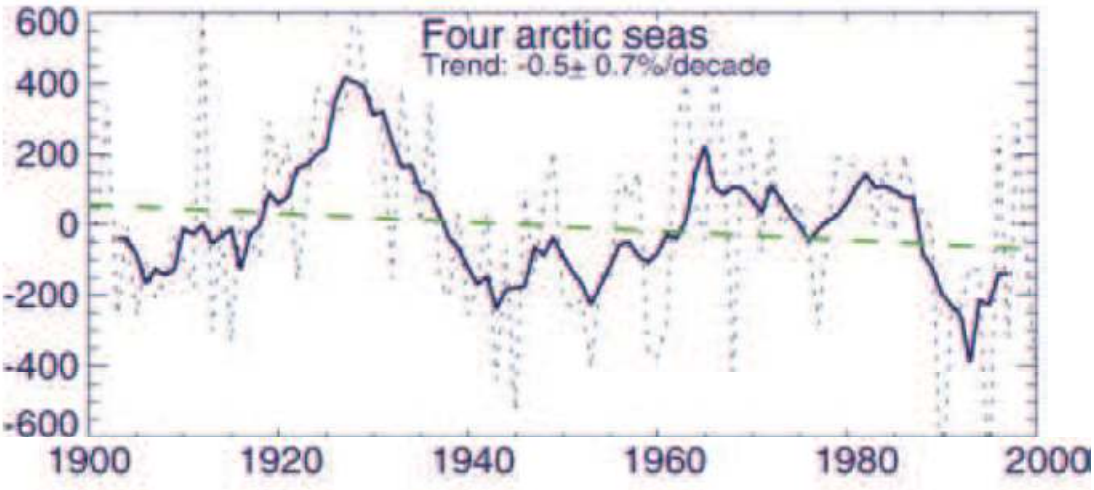


Figure 1 – Top: Time series of the April ice extent (10^3 km^2) in the Nordic Seas (NS), eastern area (E), and western area (W) given by 2-yr running mean and regression lines from [38]. The area here referred to as the Nordic Seas comprises the Greenland, Iceland, Norwegian, Barents, and Western Kara Seas, bounded by 308W, 708E, and 808N. The results show a constant declining trend over 135 years. Bottom: Ice extent in the Kara, Laptev, East Siberian, and Chukchi Seas (10^3 km^2) from [39]. The long term ice extent trends are small but evident over the full century. Trends for shorter records are not indicative of the long-term tendencies due to large-amplitude low-frequency variability. The ice variability in these seas is dominated by a multi-decadal low-frequency oscillation and to a lesser degree by higher-frequency decadal fluctuations. ©American Meteorological Society. Used with permission.

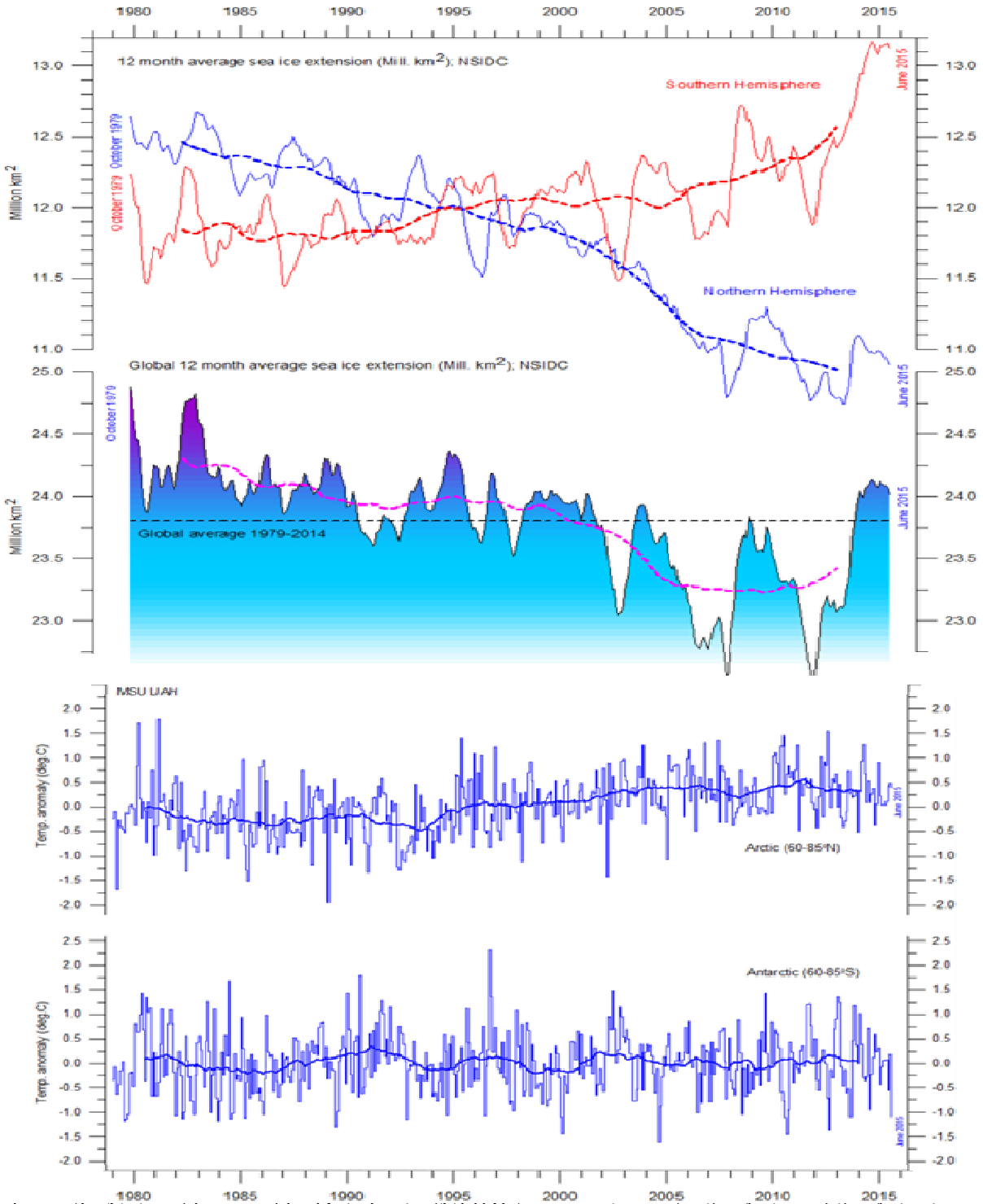
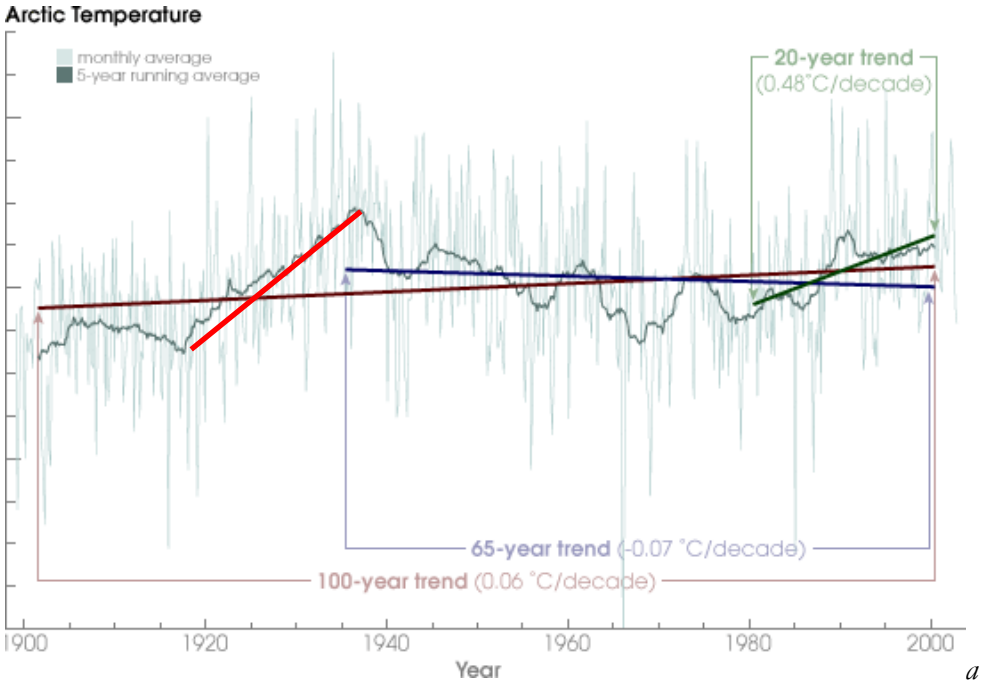
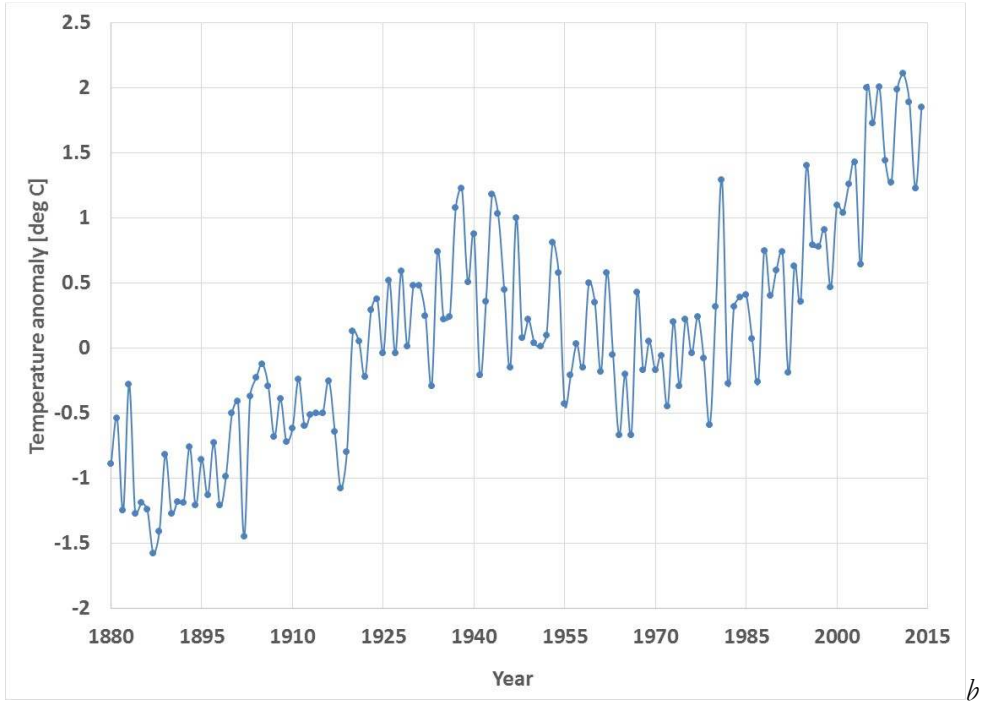


Figure 2 - National Snow and Ice Data Center (NSIDC) sea ice extension for the Arctic and the Antarctic and University of Alabama at Huntsville (UAH) lower troposphere temperatures (LTT) global and for the Arctic and Antarctic regions. The 12 month running average of sea ice extension since 1979 have the stippled lines representing a 61 month average. The thick lines in the lower troposphere temperatures since December 1978 are the simple running 37 month average. The Arctic ice volume is becoming stable and possibly on the way of a partial recovery, and the Antarctic ice volume is expanding, as the sea ice extension and the temperatures are behaving consistently. The images are modified after [20, 21].



a



b

Figure 3 –Trickery and Manipulation of data. a) Arctic temperature from [11]. The temperature about 1940 was largest than 2000 temperature. The warming 1920 to 1940 was much stronger than the warming 1980 to 2000. Over one period of an evident quasi 60 years' oscillation there is no warming. Over a century the warming is about 0.6 C, possibly larger than the global average, but far from dramatic, and includes two complete warming phases and only one complete cooling phase. Image modified after [11]. b) Recently manipulated Arctic temperature from [14]. The temperature of 1940 is now smaller than the temperature of 2000 and there is a much stronger warming trend over the past century. By accepting these arbitrary revisions of the past history the opportunity to understand the actual climate patterns reduce drastically.