Global Temperature in 2014

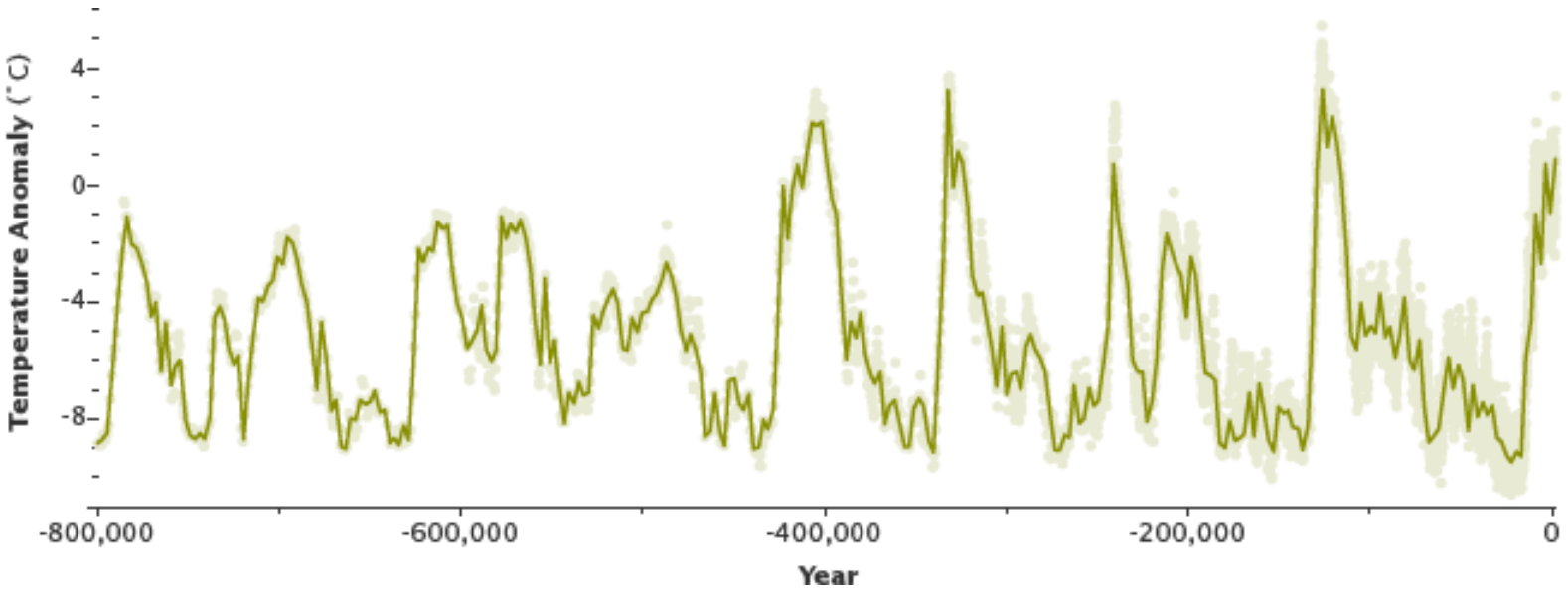
James Hansen et al 16 January 2015

In looking at today's global warming the long term rate of warming context matters. Warming today is 10 times faster than in the 800,000 ice core record, (and probably the same for tens of millions of years). The projected warming rate is 20 times faster.

'The paleoclimate record combined with global models shows past ice ages as well as periods even warmer than today. But the paleoclimate record also reveals that the current climatic warming is occurring *much more rapidly* than past warming events.

As the Earth moved out of ice ages over the past million years, the global temperature rose a total of 4 to 7 degrees Celsius over about 5,000 years. In the past century alone, the temperature has climbed 0.7 degrees Celsius, roughly ten times faster than the average rate of ice-age-recovery warming.'

(NASA Earth Observatory How is Today's Warming Different from the Past?)



Peter Carter

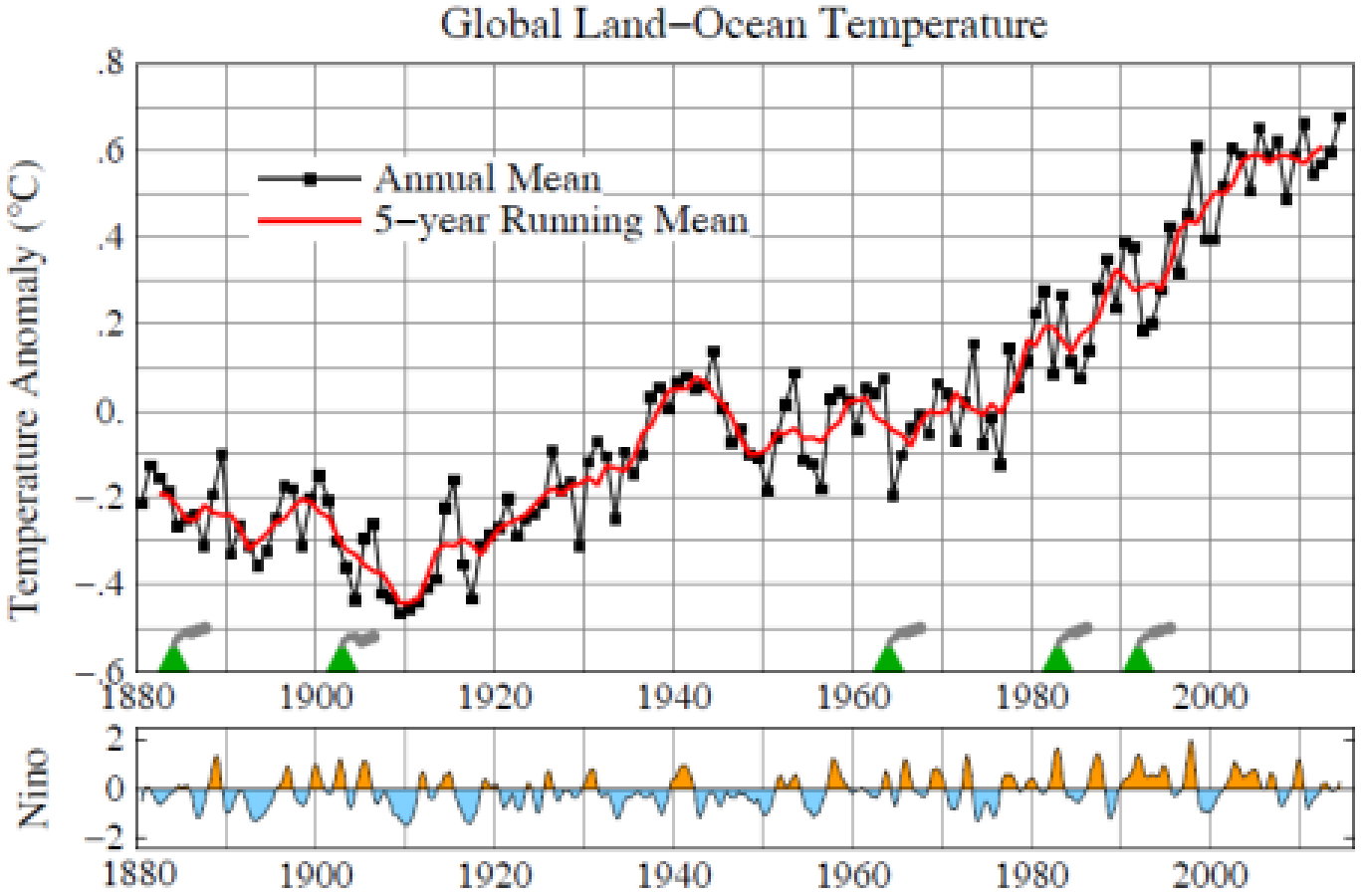
Global Temperature in 2014

James Hansen, Makiko Satoa , Reto Ruedyc, Gavin A. Schmidt , Ken Lo 16 January 2015

Abstract. Global surface temperature in 2014 was +0.68°C (~1.2°F) warmer than the 1951-1980 base period …making 2014 the warmest year in the period of instrumental data,… Record warmth at a time of only marginal El Niño conditions confirms that there is no "hiatus" of global warming, only a moderate slowdown since 2000. Global temperature in 2015 may further alter perceptions.

Quotes from the paper are in blue

2014 global warming new record year

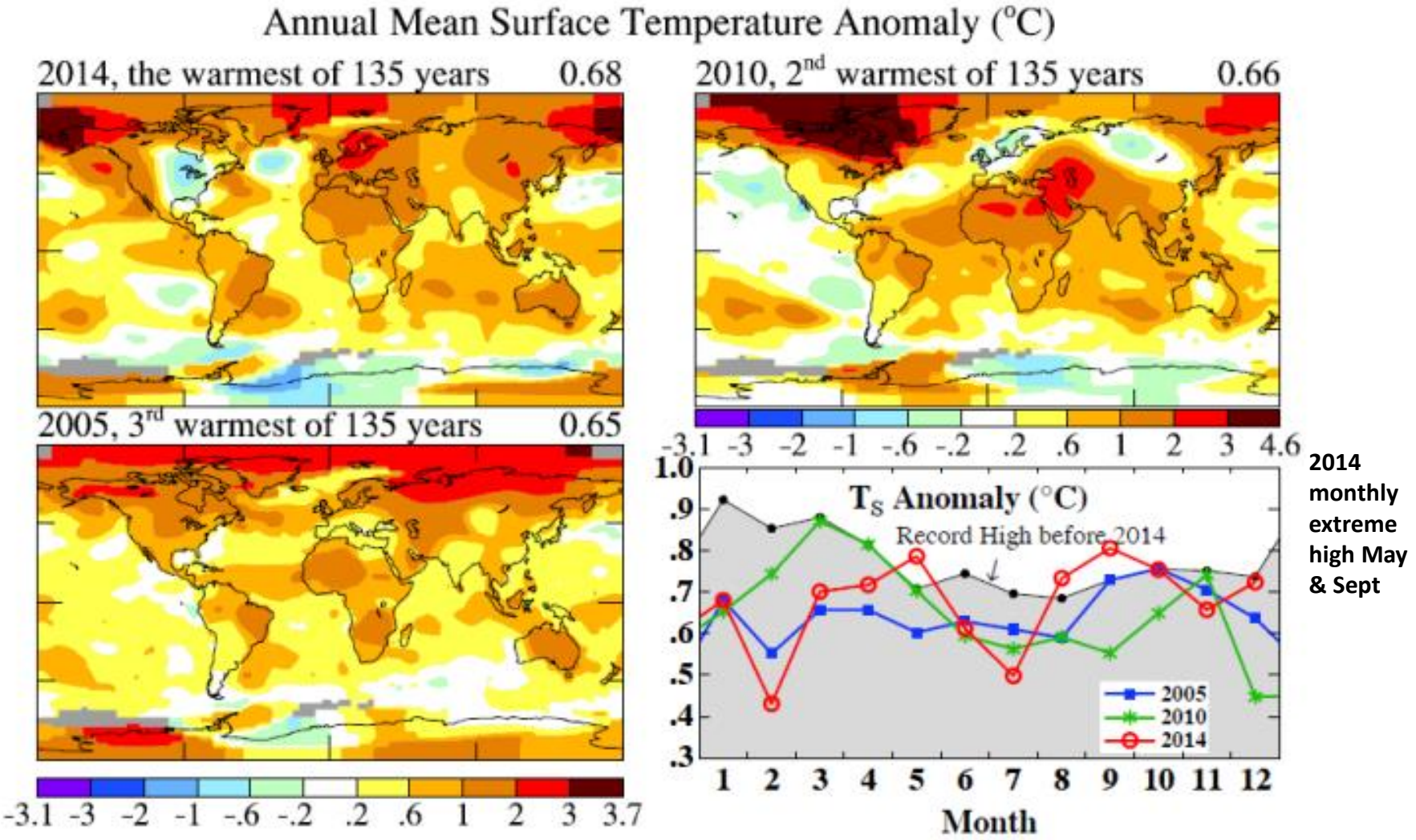


To correct warming to the 1900 baseline add 0.6°C

Fig. 1. Global surface temperatures relative to 1951-1980. ENSO index (12-month running mean) is based on sea surface temperature in Niño 3.4 area (5N-5S, 120-170W) in tropical Pacific3 for 1951-1980 base period. Green triangles mark volcanic eruptions producing an extensive stratospheric aerosol layer.

Fig. 2. Temperature anomalies in the three warmest years and their monthly global anomalies.

Arctic amplification is evident in all three highest warming years , with extreme regional Arctic warming in 2010 & 2014
Extraordinary 2014 cold affecting Eastern US may be due to Arctic warming and loss of summer sea ice



2014 monthly extreme high May & Sept

Fig. 3. Seasonal-mean temperature anomalies.

Arctic amplification is projected to be highest in winter. It is due to Arctic albedo cooling loss as spring-summer snow recedes faster and summer –autumn sea ice extent declines (low is in September)

2014 winter had extreme Arctic warming.

2014 also had extreme spring Arctic warming over Alaska and even more so over Arctic Siberia.- large effect to permafrost. A similar Arctic situation recurs in autumn.

Large warming of West Antarctica occurs summer and fall, with also East Antarctica in autumn.

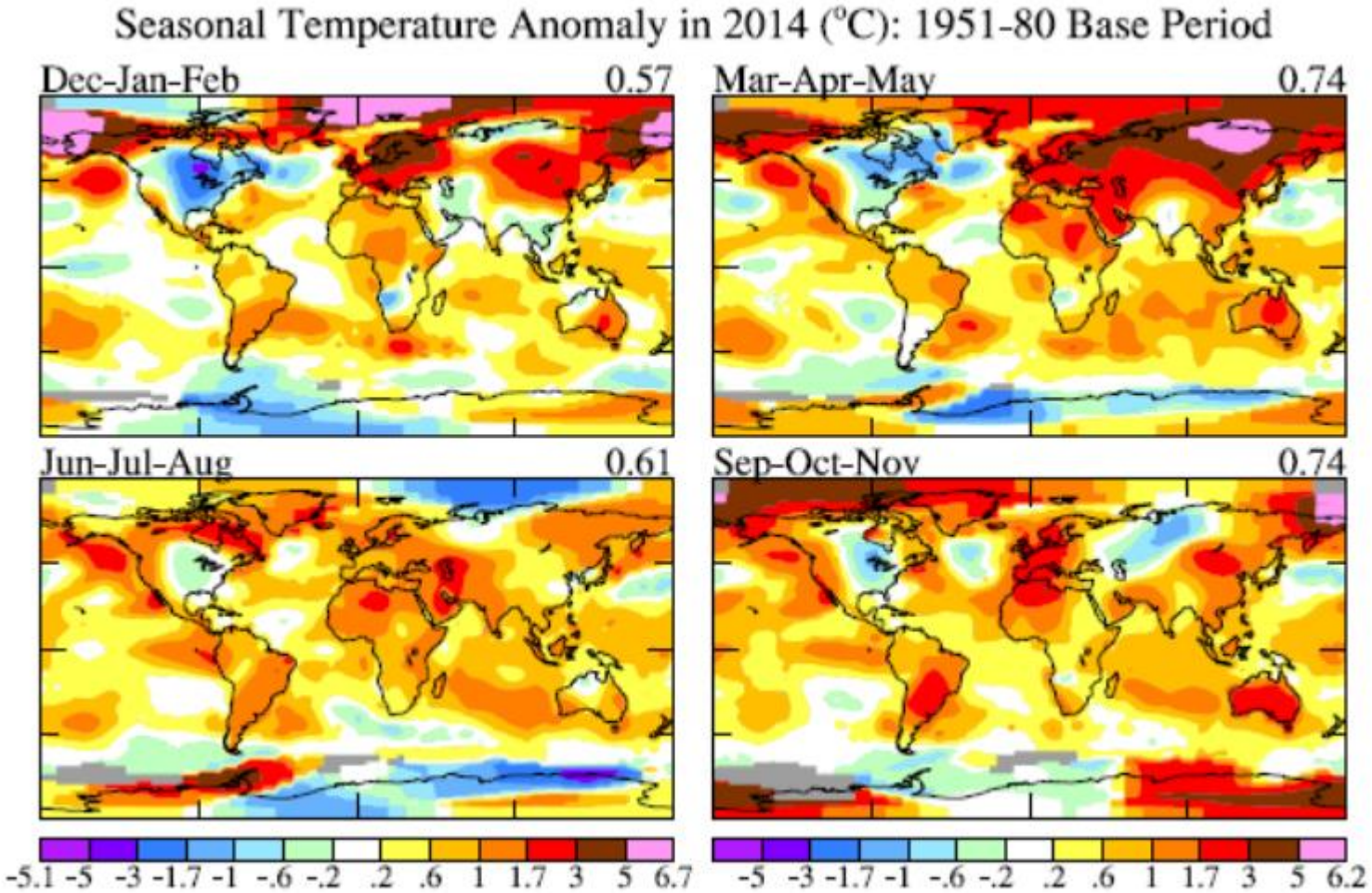


Fig. 5. **Decadal surface temperature anomalies**

relative to 1951-1980 base period

The extremely rapid rate of global and regional warming is clear. The northern hemisphere is warming faster than the southern hemisphere. Warming is fastest in the entire Arctic and regions of Antarctica (north-west and north-east)

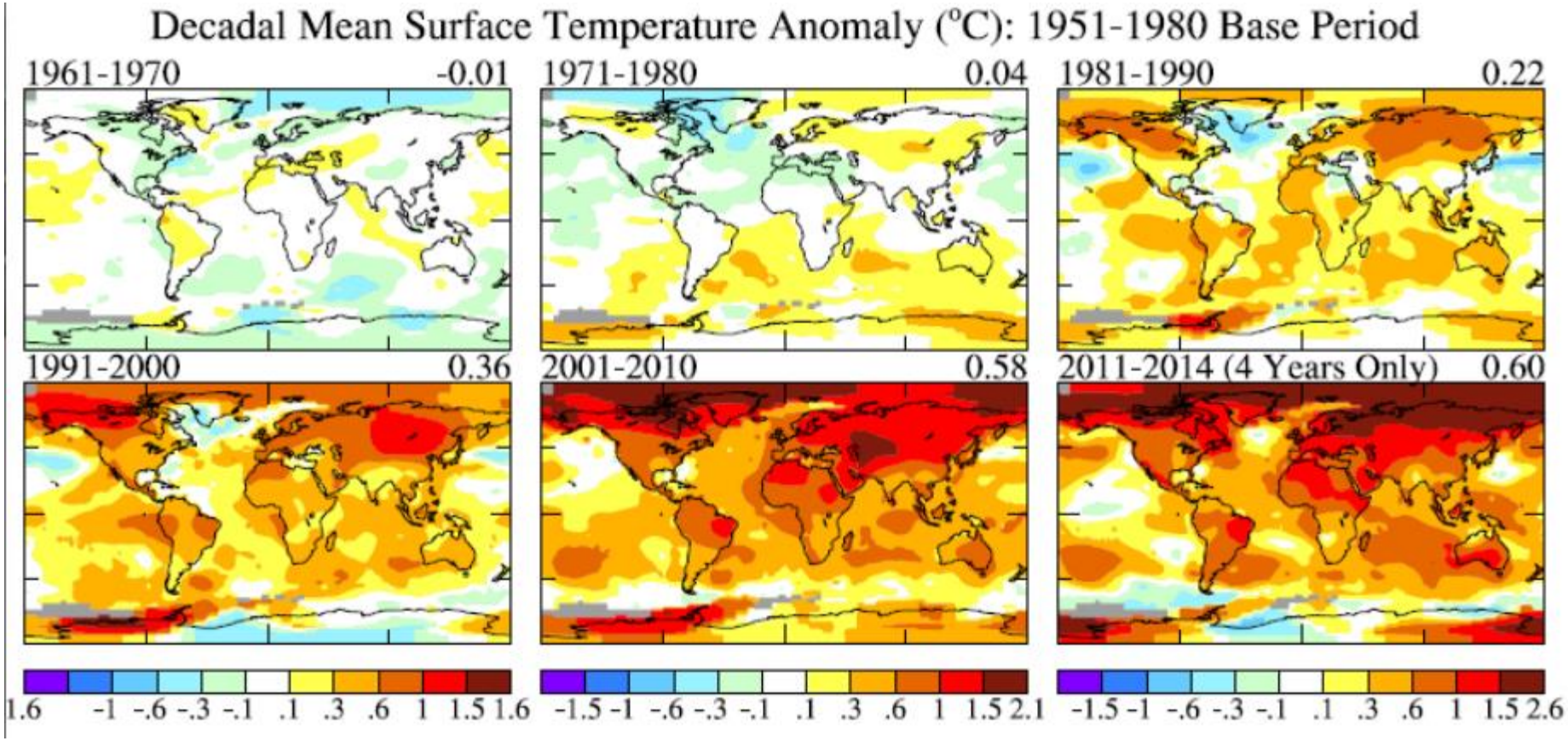


Fig. 6. **12-month, 60-month and 132-month running means of global surface temperature.**

The 12 month running mean (green) suggests we are entering a period of accelerated warming.

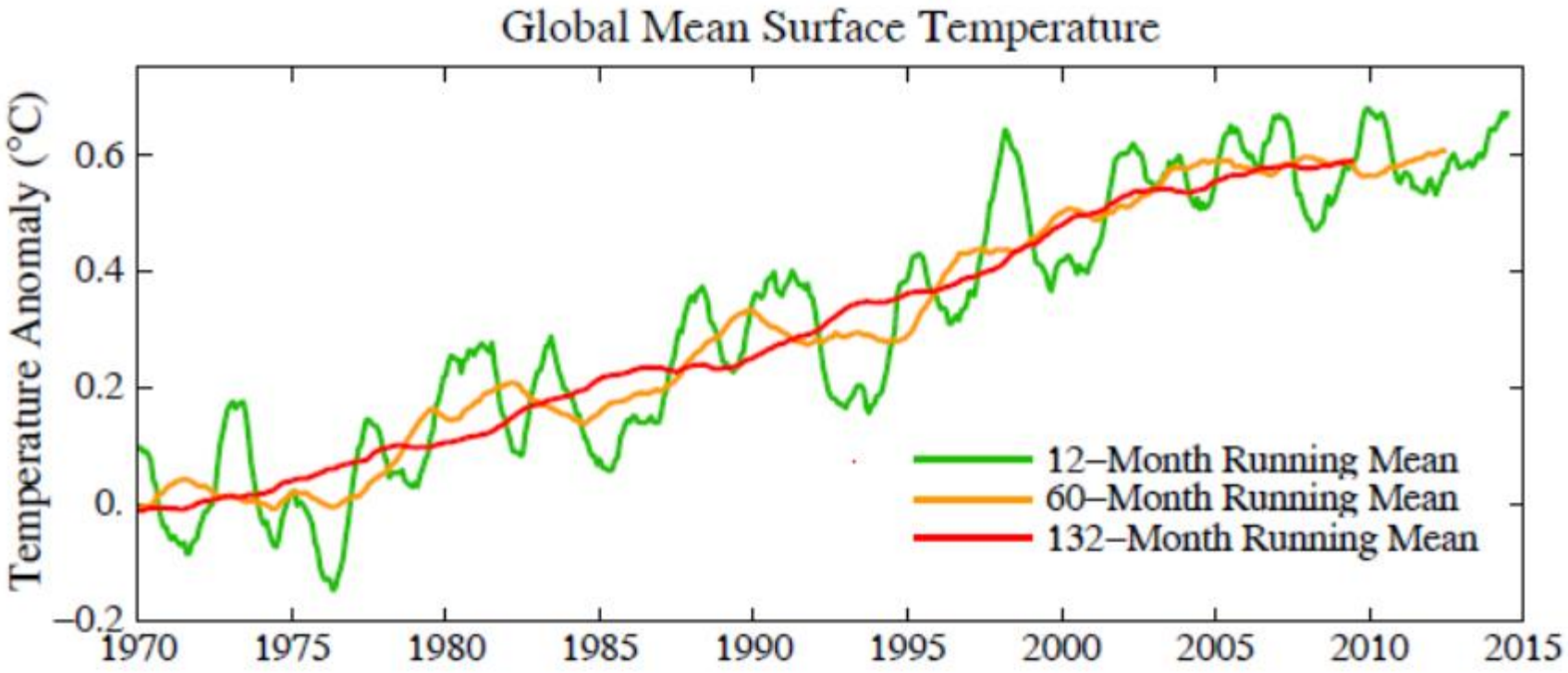


Fig. 7. **Monthly and 12-month running means temperatures and Niño index**

It is notable that the record global warmth of 2014 was achieved in a year in which the tropical Pacific Ocean surface temperatures were in a nearly ENSO (El Niño Southern Oscillation) neutral or very weak El Niño state (Fig. 1). There is a high correlation of global temperature with the Niño index, global temperature lagging the Niño index by a few months (Fig. 1). Thus it is expected, as a consequence of the slightly elevated Niño index, that the 12-month running mean global temperature will continue to rise in the next few months to its highest level in the record

This shows how erratic global warming is over short periods. It is expected that land surface warming will be more than the average land-sea global average warming. This record shows a global warming of 0.65°C and a land warming 1.0°C. The difference increases with the warming.