

meteoLCD Weblog

A weblog on climate, global change and climate measurements

« [Modulation of Ice Ages \(part 1\)](#)

[22-July-2016 storm-flood and radon washout](#) »

Modulation of Ice Ages (part 2)

In the [first part](#) of this blog I recalled some fundamentals of Milankovic's climate-relevant cycles: precession, obliquity and eccentricity. In this second part I try to resume as simple as possible the main points of the new paper by Ellis & Palmer.

1. Five major insights

The following 5 points are known and accepted by most scientists:

a. Each major deglaciation coincides with maximum NH (North Hemisphere) solar insolation.

b. Not all insolation maxima ("Great Summers") trigger deglaciation.

c. Eccentricity governs the strength of the Great Summer.

d. During an ice age atmospheric CO₂ levels plunge (colder oceans absorb more), ice sheets extension and albedo (the earth's reflectivity) increase.

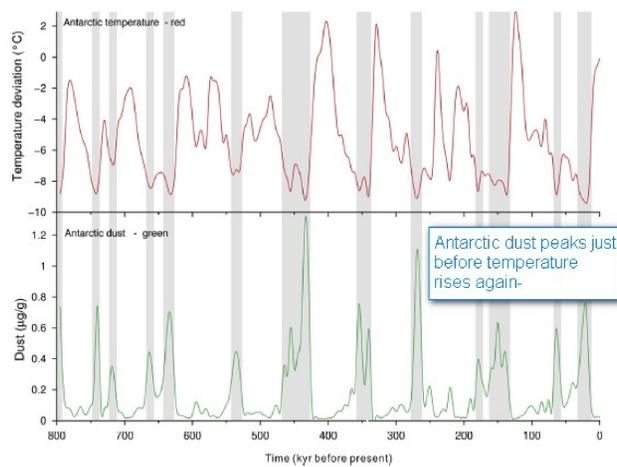
e. When CO₂ levels are at a minimum and albedo is at maximum, a rapid warming will begin and start an interglacial period. Conversely when CO₂ levels are at a maximum and albedo is at minimum (during an interglacial) a new cooling (= ice age) will begin.

2. The Ellis & Palmer paper

The new theory postulated by Ellis & Palmer can be summarized as follows: **A minimum CO₂ (e.g 150 -200 ppm) starves plant life, creates a die-back of forests and savanna's, which increases soil erosion and produces more dust storms. The dust deposits on the ice sheets diminish the albedo, increasing the absorption of solar energy. This increase of about 180 W/m² at higher NH latitudes starts a global warming, i.e. an intra-glacial.**

So ice ages are forced by orbital cycles and changes in NH insolation, but regulated by ice-albedo and dust-albedo feedbacks. The precession cycle is the main forcing agent through the induced albedo changes. **The primary forcing and feedback for intra-glacial modulation is albedo.**

As a consequence CO₂ (by its greenhouse gas properties) can not be the primary feedback because high CO₂ levels during or at the end of an intra-glacial result in cooling, and low CO₂ levels during a glaciation maximum precede the warming.



The grey bands in this figure correspond to maximal dust deposits (>0.35 ppm): the Antarctic temperatures (from the [Epica 3](#) bore-hole) start rising after most of these dust peaks.

3. Main conclusions of the paper.

Regarding IPCC's AR5 published in 2013 the authors write: *"The IPCC has identified dust as a net weak cooling mechanism, when it is probably a very strong warming agent."*

And they conclude with these words: *"The world's dust-ice Achilles heel needs to be primed and ready to fire before an intra-glacial can be fully successful...in which case, intra-glacial warming is eccentricity and polar ice regrowth regulated, Great Summer forced and dust-ice albedo amplified. **And the greenhouse attributes of CO₂ play little or no part in this feedback system.**"*

You should definitively read the full [paper](#)!

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One Response to "Modulation of Ice Ages (part 2)"

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