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Earth: A Ringed Planet?

L. Hancock[1], H. Povenmire[2]
(1) Consultant, Washington, DC, USA. (2) Florida Institute of Technology, Melbourne, FL.

Abstract

Why should the Earth not have a ring system, and if it does, why has the ring system not been observed?

J.A. O'Keefe (1980) first suggested that lunar volcanism might have caused a ring to form around the Earth that could affect climate.

This team is working on the hypothesis that a tenuous ring system has formed and still exists, comprising rings in the equatorial plane, the plane of the lunar orbit, and in a disorganized lens shape comprising a "Moon ring." We hypothesize that the system affects weather and climate.

Herein we use weather records and the geology of the tektite strewn fields to propose orbital elements and structure of a ring in the equatorial plane.

The observational challenge of finding an Earth ring

Below a photo of the Gegenschein taken at Paranal Observatory, Chile, by Yuri Beletsky, an ESO staff member at Paranal.

Identification of an Earth ring system by normal observational methods would be difficult. The equator and ecliptic are the locus of so many special effects that anomalies are difficult to interpret. For example, a vague arc of light in the ecliptic, called the Gegenschein ("counter-glow") is well known. **The Gegenschein looks just the way we would expect a ring in the plane of the lunar orbit to look:** located near the ecliptic, its illumination is modulated by Sun elongation exactly as the phase of the Moon is, and just as we would expect for a billion moonlets. But maybe it's just interplanetary dust.
The team concludes it may be useful to try entirely new means to refresh the question of an Earth ring system.

Expected sky position and climate effects of an Earth ring system

(i) **Ring in the equatorial plane.** Its climate effect: Cool the winter. Its position on the sky: from the equator downward over an extent in altitude depending on observer latitude and the ring's inner radius. If it erodes: Winters warm but summers don't change. If it's replenished: Winters cool.

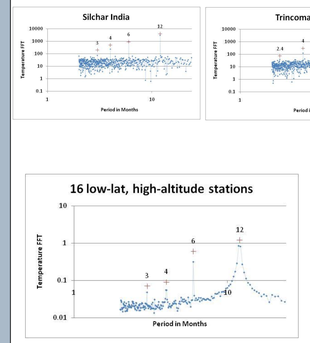
(ii) **Ring in the plane of the lunar orbit.** Climate effect: Rotates through the year. For example, last year, cooling end-December to mid-June; this year, cooling December 11 to late May. (Etc.) Position on the sky: From the ecliptic downward to an extent depending on the altitude of the ecliptic and the ring's inner radius. If this ring erodes: all seasons warm as cold extremes moderate. If this ring is replenished, all seasons cool as cold extremes become more severe.

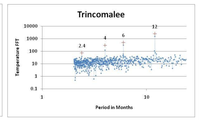
(iii) **Moon ring.** Its climate effect: Cooling at about the time of New Moon. Its position on the sky: Uncertain. Maybe simply a vague lens shape around the Moon. If it erodes: cold extremes moderate all year; if it is replenished: cold extremes deepen.

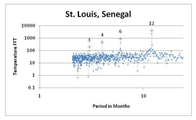
Weather data suggest ring could possibly block 3-5% of sunlight.

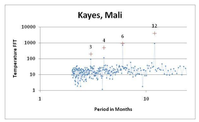
The Fourier transform of temperature records has some persistent peculiarities.

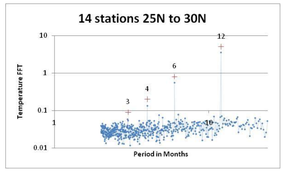
FFTs of temperature records persistently show unexpected peaks at 4 months, 3 months, and sometimes 2.4 months..



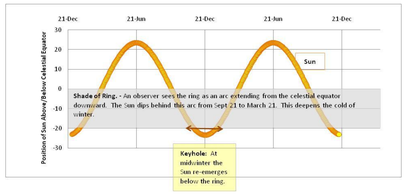


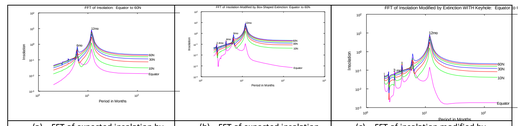






But these unexpected climate rhythms could be explained by a ring in the equatorial plane – shading a few percent of sunlight from autumn until spring





(a) FFT of expected insolation by latitude. The only peaks are at 12 months and 6 months.

(b) FFT of expected insolation modified by boxcar-shaped extinction of 95% from Sep 21 to Mar 21. Now there is a 4-month spectral peak.

(c) FFT of insolation modified by extinction at 95%T, with a keyhole of no extinction from 11 December to 11 January. Now there is also a 3-month spectral peak.

It seems there is a "keyhole" of undimmed sunlight around midwinter,

a real Twelve Days of Christmas.

India (30N latitude) sees the winter sunlight (3mo spectral peak). So

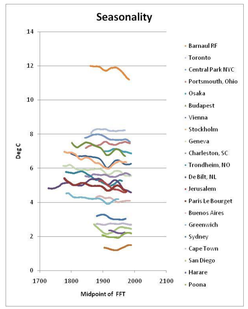
Surely $R_{inner\ radius\ of\ ring} > 2 * R_{earth}$

If London (50N) refers to this keyhole by its Twelve Days of Christmas-

Then $R_{inner\ radius\ of\ ring} > 2.4 * R_{earth}$

Moscow (55N) can see it only if $R_{inner\ radius\ of\ ring} > 2.5 * R_{earth}$

Global warming could be caused by ring erosion - seasonal unevenness is the sign of ring effects.



A ring in the equatorial plane should make winter colder. An eroding ring in the equatorial plane would cause winters to become warmer, while summers did not change. Either way, the effect is seasonally uneven so it should be reflected in changing seasonality of climate (the difference between winter and summer). Such uneven climate change would be a sign that changing climate could be due to the effects of a changing ring.

To search for changes in seasonality, short-time Fourier transforms of worldwide temperature data were obtained . Each datapoint assesses the FFT of monthly mean temp over 43 years, and successive datapoints represent increments of one year in the timeframe considered. Two near-annual Fourier coefficients were summed to yield the time series presented here.

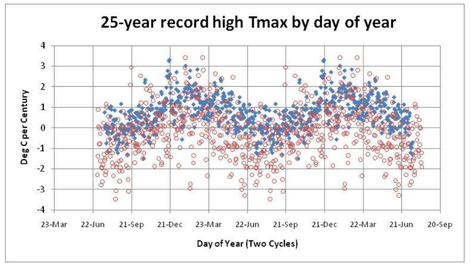
Global trends in seasonality are evident. In many places, the difference between winter and summer has been reduced by a degree in the past few centuries. Winter/summer unevenness is what we expect from the climate effects of a ring in the equatorial plane.

When winters are warming, but the hottest summers don't change, the Eq ring is eroding. When winters grow colder while the hottest summers don't change, the Eq ring is growing.

Let's define a climate variable that will identify the climate effects of a ring in the equatorial plane:

The trend in 25-year record-high maximum temperatures, by day of year.

The strategy here is that a running time series of 25-year maximum temperatures will filter out overall trends and trends due to the lunar-plane ring. Sorting out trends by day of year will put a highlight on the effects that have seasonal unevenness.



In this figure, trends were averaged for 41 northern hemisphere locations (averages shown in blue) and 22 southern hemisphere locations (red).

Winter T_{max} is warming (1-2 degrees per century). Summer T_{max} is not warming at all. This is the climate pattern of warming caused by ring erosion.

Geology of tektites suggests ring fragments may be glassy black material in a range of sizes

A long-standing problem in geology is the origin of glassy black rocks called tektites that don't seem to have a mother lode, yet are found in wide (100s of km) homogeneous swathes generally within 30 deg of the equator. O'Keefe suggested tektites could be matter fallen from an Earth ring at various times when the ring was disturbed. A ring could be easily disturbed by various events; after all, even a solar storm has been known to massively perturb the orbits of artificial satellites from their orbits (cf. March 13, 1989).

On this theory, the rings are largely comprised of glassy black material. And as to size, the Georgia tektite strewn field has a size distribution that seems to be centered perhaps at about 8 grams, ranging from 100 g down to a few mg.

Closing remark

We have showed that there are unaccounted for climate effects that are easily explained if the Earth has a ring system. In this presentation we have focused on evidence of a ring in the earth's equatorial plane, blocking about 3 percent of sunlight incident on it. We think its inner radius has been greater than $2*R_{earth}$ during the 20th century, but ring size can change. We think this ring partly caused global warming. We think that it may be growing now because winters are growing colder, though alternatively the colder winters could be caused by the second ring (in the lunar plane) not discussed here, which also chilled the winter season for the last 4-5 years and will do so for the next 5 years or so.

Finding and assessing an Earth ring if it is there is very important because seasonal weather forecasting can never really succeed if the Earth has a ring system and the forecasters don't know about it. **Astronomy is called for .**

Among the many who would be positively affected by improvement in seasonal forecasting are farmers, from the beginning of human history the most interested party in whatever can be learned of how the Sun and Moon drive weather and climate.

Kerbstone from Newgrange.

References and acknowledgments

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- The national meteorological service of each country whose data was used is the ultimate source of the data, hundreds of years of regular observations undertaken through heat, rain, snow, droughts, wars and famines. They knew we would need this.
- Klein Tank, A.M.G. and Coauthors, 2002. Daily dataset of 20th-century surface air temperature and precipitation series for the European Climate Assessment. Int. J. of Climatol., 22, 1441-1453. Data and metadata available at http://eca.knmi.nl">http://eca.knmi.nl
TOA insolation, a simple version with an M file:
http://www.esrl.noaa.gov/psd/people/joseph.barsugli/morsels/insolation/insolation.html
- Twentieth Century Reanalysis, http://www.esrl.noaa.gov/psd/data/20thC_Rean/
- Climate Explorer (source of data), see http://climexp.knmi.nl/
- Octave (algorithms for STFT and most data processing), GNU Octave version 3.2.4, copyright 2009 John W. Eaton and others.

Contacting the authors

Lucy O'Keefe Hancock, lohancock@aol.com 202-250-9127
Hal Povenmire, katiehal1@yahoo.com
John O'Keefe died in 2000. "The firmament declares his handiwork."