COSMIC RAYS AND THE WIDTH OF TREE RINGS

Y.Muraki[1], K. Masuda[2], K. Nagaya[2] and H. Miyahara[3]

1) Department of Physics, Konan University, Kobe 658-8501, Japan
2) Solar-Terrestrial Environment Laboratory, Nagoya University, Nagoya, Japan
3) Institute for Cosmic Ray Research, the University of Tokyo, Kashiwa, Japan

Outline of talks

- 1. Preceding Results

  The work done by Dengel, Aeby and Grace [1].

  S. Dengel, D. Aeby and J. Grace, New Phytologist. 184 (2009) 545.
- 2. Our data analysis based on the tree ring of Japan
- 3. Results of periodicity analysis
- 4. A possible interpretation for the results

- Talk at the 22nd European Cosmic Ray Symposium @Turk Finland August 4th, 2010

The motive force of this study : an email from Phil Yock

Page last updated at 09:14 GMT, Monday, 19 October 2009 10:14 UK

E-mail this to a friend Printable version

Cosmic pattern to UK tree growth

By Matt Walker
Editor, Earth News

Cosmic record

The growth of British trees appears to follow a cosmic pattern, with trees growing faster when high levels of cosmic radiation arrive from space.

SEE ALSO IN EARTH NEWS

- Sunspots linked to Pacific rain
  28 Aug 09 | Science & Environment
- Where giant plants dare to grow
  24 Jun 09 | Earth News
- Fir 'is tallest tree in England'
  01 Apr 09 | Somerset
- Water's the limit for tall trees
  13 Aug 08 | Science & Environment
- 'No Sun link' to climate change
  03 Apr 08 | Science & Environment
- Sun and global warming: A cosmic connection?
  14 Nov 07 | Science & Environment
- Sunspots reaching 1,000-year high
  06 Jul 04 | Science & Environment

OTHER RELATED BBC LINKS

- Coniferous forest: BBC Wildlife Finder

FROM OTHER SITES

- A relationship between galactic cosmic radiation and tree rings: New Phytologist

1. The preceding results

- In October 2009, an interesting report was given by Dengel, Aeby and Grace [1]. They have measured the width of the tree ring collected at Scotland and tried to seek any periodicity involved in the data. Surprisingly they have found an 11 years cycle of the growth rate in the tree ring. They have compared their data with various parameters, humidity, and temperature and so on. But no strong correlation was found in those parameters. While what they have found is a correlation with solar activity. The tree ring grew up when the solar activity was low. They gave an interpretation for this correlation. According to the data analysis obtained from the meteorological station of Scotland, the cloudiness over Scotland changed with the solar activity. When the intensity of cosmic rays increased, the cloudiness over Scotland was also increased. When the sky was covered by the cloud, the sunlight arrived on the tree as the diffused light. Then photosynthesis was advanced. The diffuse light is more effective for the growth of trees than the direct sunlight since it irradiates from all directions to the leaves of the trees in comparison with the direct sunlight.
- Reference: S. Dengel, D. Aeby and J. Grace, New Phytologist. 184 (2009) 545.
- Reference: M. Kulmara, P. Hari, H. Riipinen, V.M. Kerminen , same, page 511.

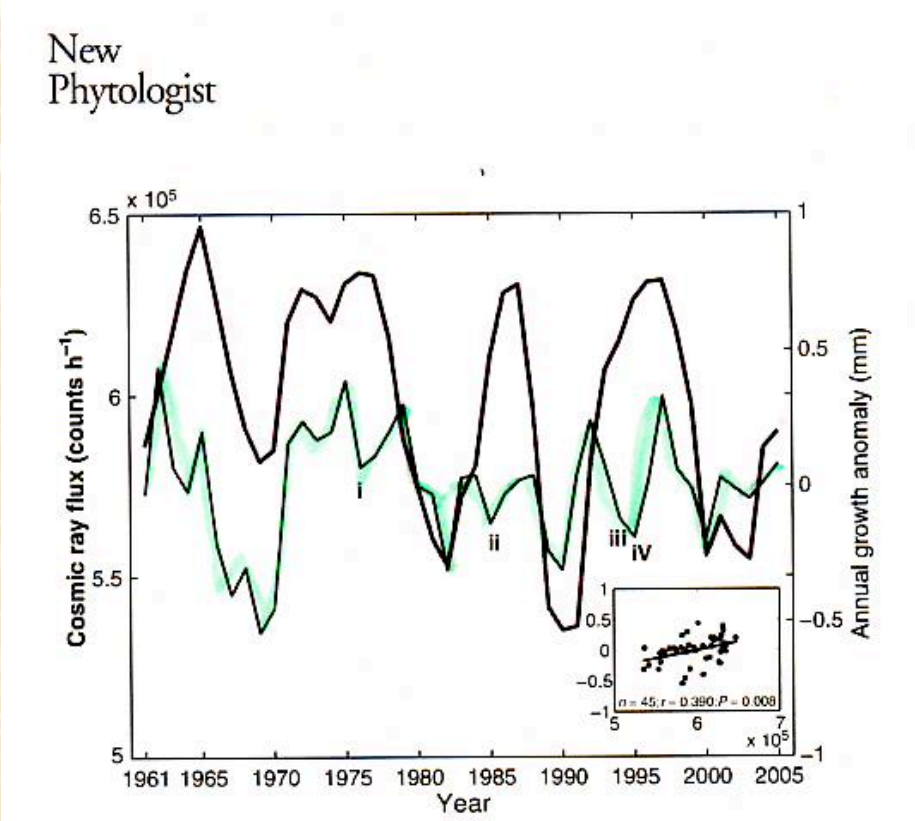
The tree was sampled at Scotland (55 °16'N , 3° 10'W 245m)

planted in 1953 and felled in 2006

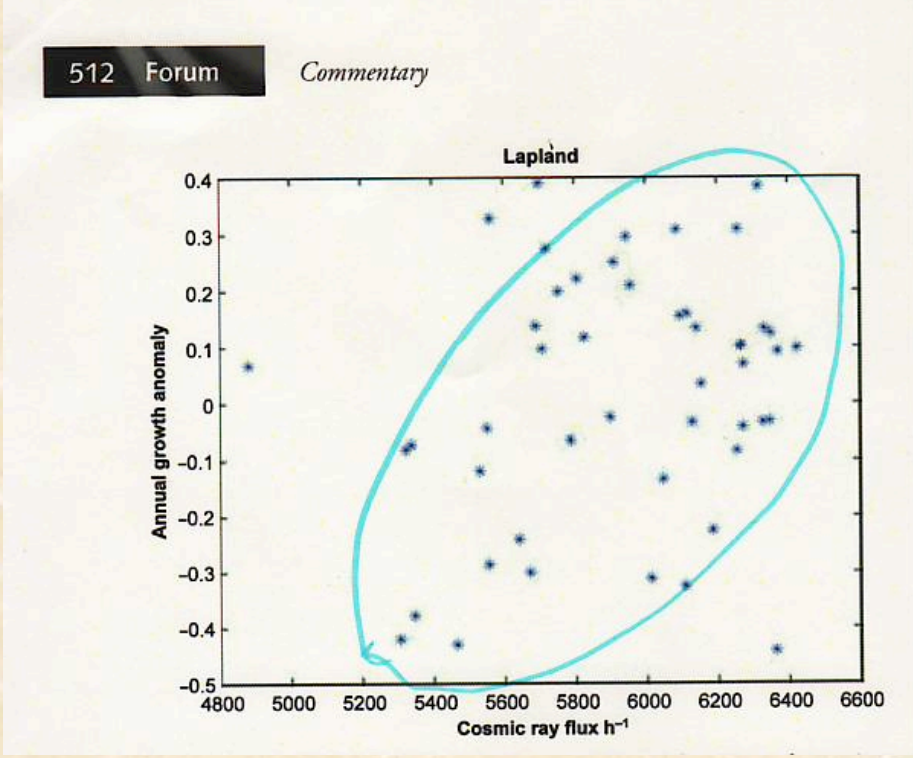
The result of Dengel et al group

green : tree ring width

black : cosmic ray intensity



A comment from Finish



2. The purpose of this report

- Being based on a complete independent sample of the tree ring,
  we would like to check whether their prediction is universal or local.
- We have selected a very good sample of the tree ring
  that was taken at the Muroji temple of Nara prefecture.
- The tree ring was fallen down by the typhoon in September 1998.
  Since the sliced piece of tree has about 1m diameter therefore we can identify clearly each year of the tree ring. (the radius is about 62cm)
- The Identification of the year tells us that the tree had lived for 395 years.
  So the tree was born in 1602, before the Maunder minimum: 1645-1725
- The kind of tree is Japanese cedar tree and the sample was already used
  for the radio carbon 14 analysis during the Maunder minimum
  and published by us.
- But this time, we will use only the data of the width of the tree ring.

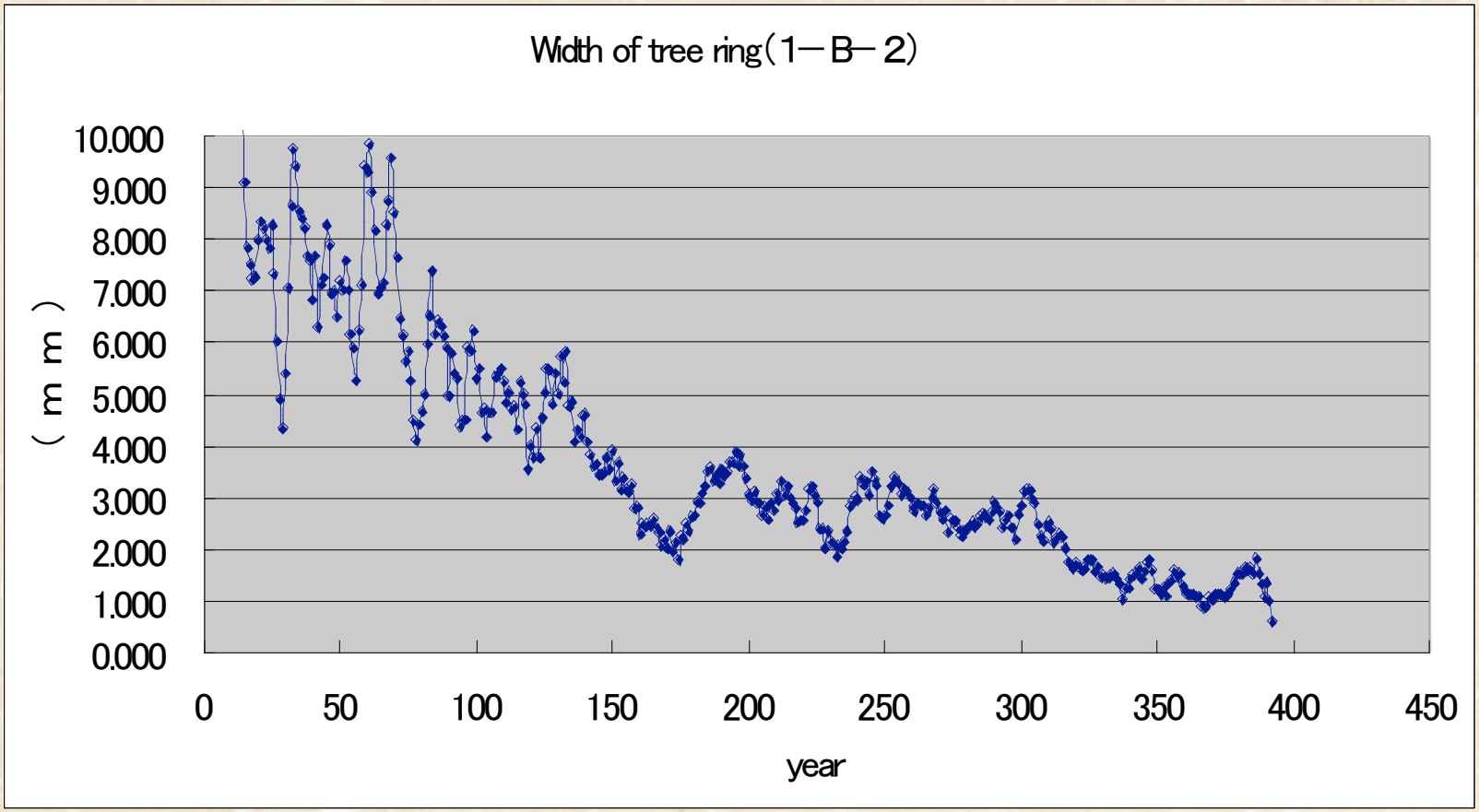
The picture of Muroo-temple and the tree ring (Nara prefecture, national treasure)

Where the sample of the tree ring was grown

With the head of manager of the temple

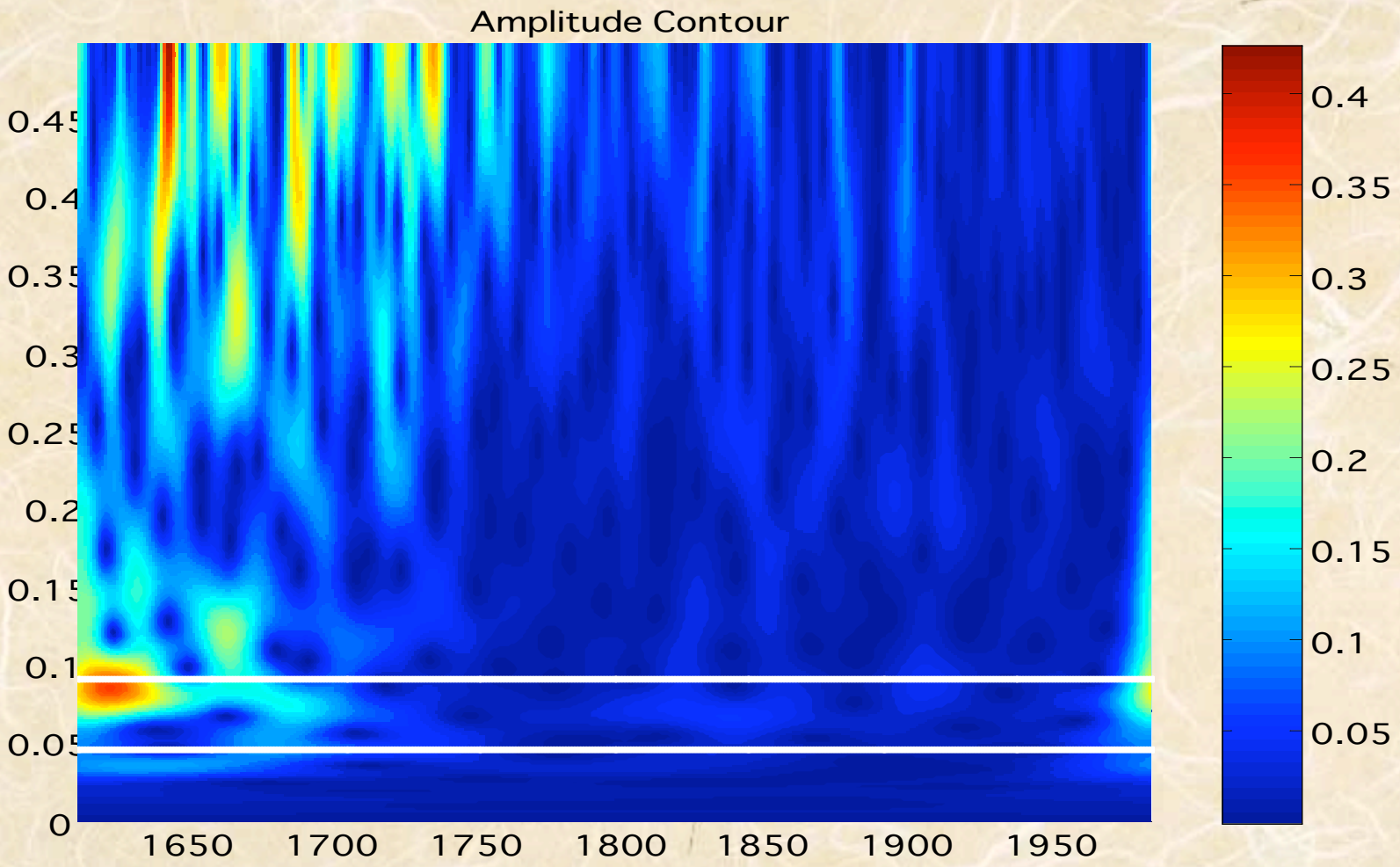
The picture of the tree ring

The variation of the width of the tree ring with the year



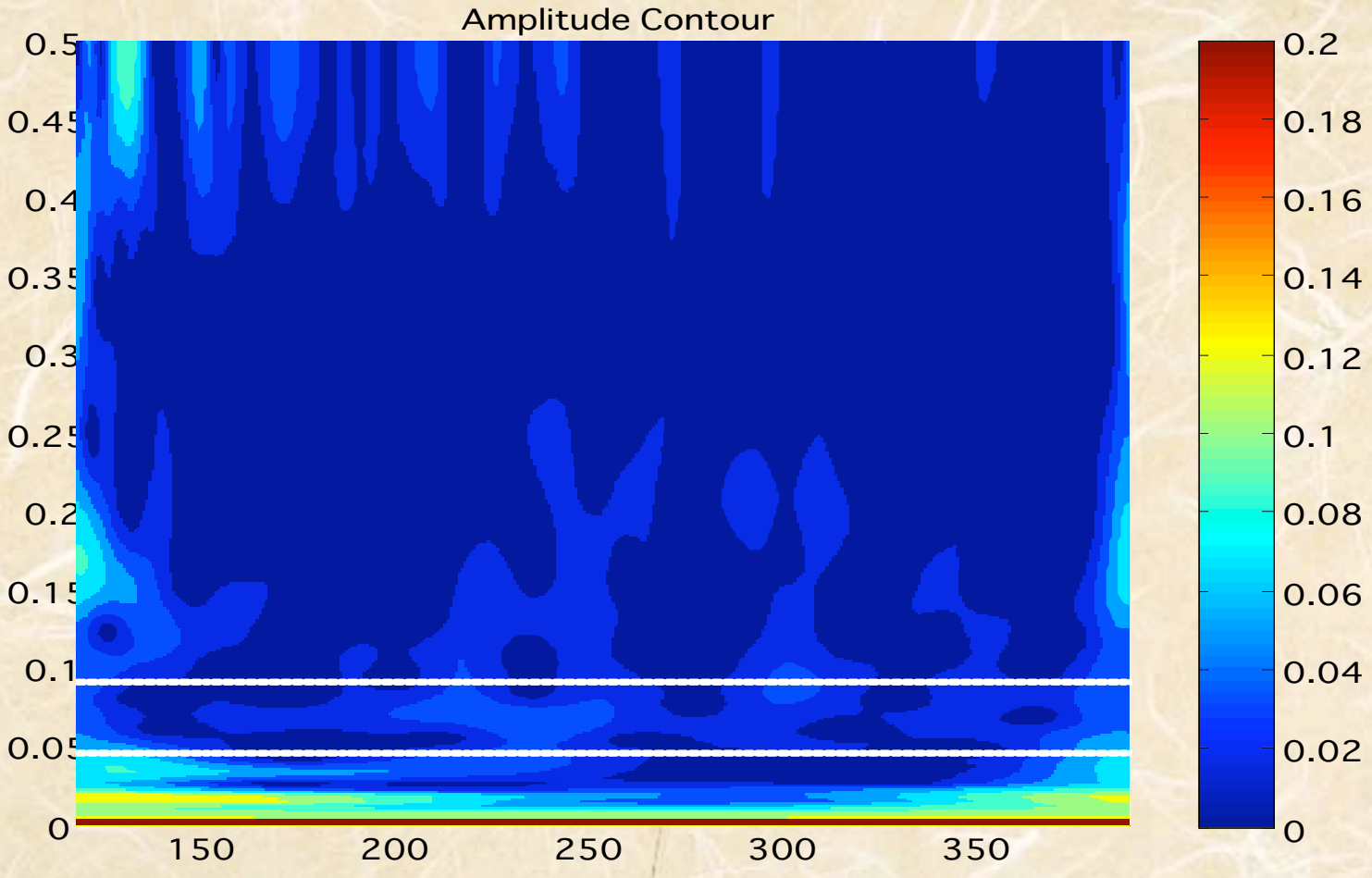
The result of periodicity analysis (1617-1988)

the base line is determined by moving 20 years average



No data before 120 is involved

We may see a weak excess of 14years periodicity



The Result

- In the duration of the Maunder minimum, we have seen a 11 years periodicity in the tree ring during 1620-1720.
- But no strong periodicity has been found in other time.

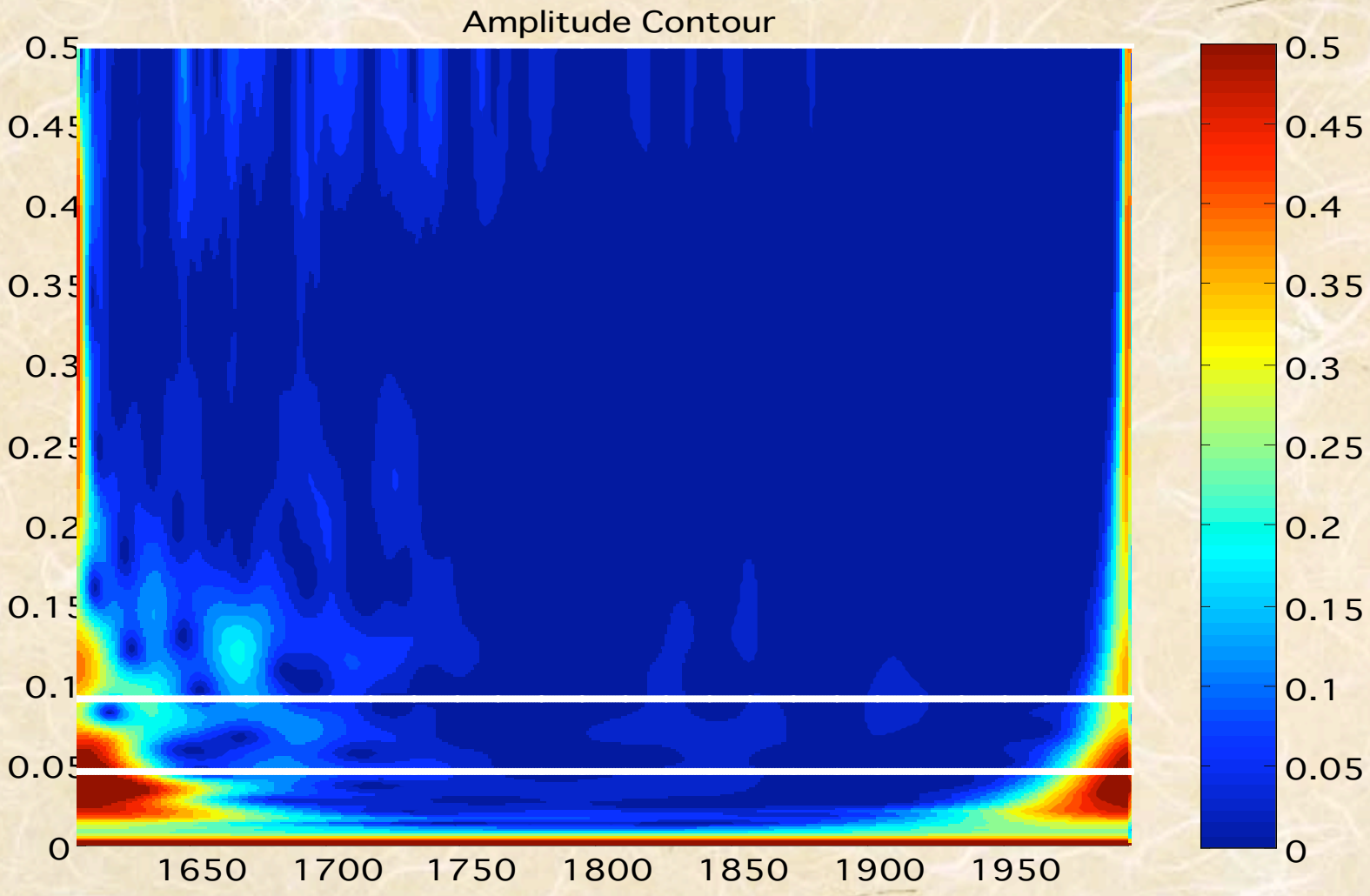
What do we learn from this fact?

An interpretation

- The speed of the photosynthesis does not depend on the light intensity when it exceeds 20,000 lux. For the plants and leaves that survive under shadow region, if the light intensity exceeds 5,000 lux, the speed of the photosynthesis will be constant. Taking account of these properties of the plants, for the cedar tress when they were young, the environment was covered by much taller trees. So they must grow under the shadow for example receiving less than the light flux <10,000 lux.
- Therefore they were very sensitive to the cloudiness and even the fog comes they absorb and use it for the growth positive way.
- The coincidence of the tendency between young Scottish trees and the tree width of young time of which sample was taken in Japan, showing 11 years periodicity, indicates that the global climate changes by the effect of the solar activity, possibly by the process proposed by Fris-Christensen and Svensmark mechanism.

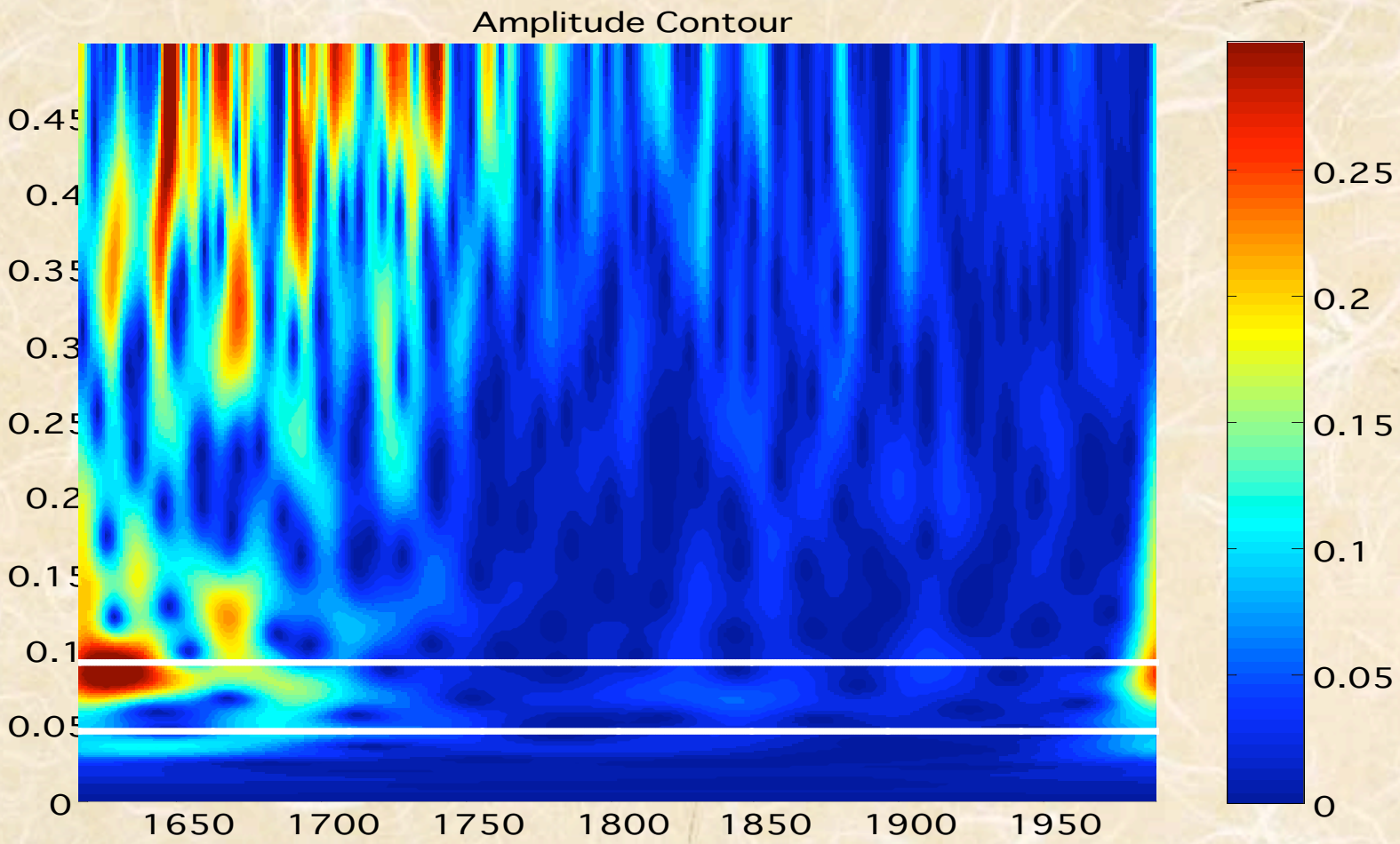
Backup slides

The analysis of periodicity (1607-1998) residual 3 years average



The result of periodicity analysis (1617-1988)

the base line is determined by moving 20 years average



The tree rings