**Larch Growing and Solar Activity.**

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**Abstract.** This article describes the relationship between Solar Activity and speed of Larch growing

**Key words**: Chizhevsky; Solar Activity; larch; wood growing;

**1. Introduction: problem and terminology**

To find relationship between Solar Activity and speed of Larch growing

It proves that there is such relationship.

**2. Chizhevsky Ideas review**

**3. Larch growing data (biology)**

R(t)

1631 – 2005 (16 years in a row):

1631 - 0.55 0.64 0.88 0.91 1.90 1.88 1.22 0.44 0.85 0.97 0.76 0.58 1.12 1.56 1.82 1.34

1647 - 0.77 0.73 1.04 0.80 1.19 1.36 1.13 1.03 1.34 0.82 0.87 1.30 0.82 1.37 0.82 0.98

1663 - 0.43 0.67 0.93 1.26 1.69 1.45 0.88 1.22 1.11 1.14 0.43 0.63 0.66 0.90 1.02 1.44

1679 - 0.86 1.22 0.64 0.78 1.06 0.50 0.55 1.07 1.44 0.61 1.20 1.25 1.03 0.78 0.83 1.01

1695 - 1.43 0.60 1.01 1.43 1.14 1.38 1.78 1.18 1.09 0.44 0.45 0.35 1.09 1.06 0.45 1.11

1711 - 1.59 1.50 0.61 0.73 0.61 1.28 1.29 1.56 1.88 0.73 1.44 1.55 0.50 0.99 0.76 0.67

1727 - 0.48 0.92 1.01 0.79 0.80 0.65 1.12 1.08 1.39 0.75 1.59 1.16 1.80 1.36 0.39 0.87

1743 - 0.50 0.26 0.37 0.77 0.78 1.48 1.92 0.87 0.85 1.41 0.94 1.16 0.71 1.18 0.92 0.47

1759 - 0.53 0.83 1.06 0.63 1.39 1.24 0.49 0.95 0.65 0.73 0.34 0.88 1.04 1.64 1.37 1.44

1775 - 1.34 1.39 1.26 0.93 1.38 1.71 0.57 1.80 0.92 0.80 0.69 0.66 1.23 0.43 1.07 0.75

1791 - 1.12 1.10 1.06 1.43 0.42 1.03 1.24 1.46 0.51 0.72 1.18 1.31 1.51 1.60 0.84 0.75

1807 - 0.81 0.59 1.00 0.74 1.06 0.77 1.00 0.68 0.58 1.06 1.18 1.57 0.59 0.74 0.29 1.40

1823 - 0.74 1.49 0.83 0.61 1.12 0.86 1.16 1.30 1.13 0.48 0.36 0.94 1.30 1.30 1.80 1.67

1839 - 0.87 0.85 0.43 0.84 0.63 0.96 1.33 1.33 1.35 0.41 0.60 0.80 1.16 1.24 1.62 0.95

1855 - 1.78 1.36 1.36 1.43 1.12 0.56 1.01 0.74 0.87 0.39 0.50 0.78 1.13 1.44 0.63 1.14

1871 - 0.93 0.89 0.50 1.25 1.70 0.90 1.08 0.97 0.52 1.04 1.84 1.76 1.03 1.25 0.83 1.90

1887 - 1.63 0.43 0.90 0.56 0.20 0.86 0.81 1.79 1.19 1.59 0.93 0.71 1.03 0.59 1.12 0.93

1903 - 0.70 0.88 1.55 0.52 0.79 0.66 0.75 0.81 0.44 0.65 1.19 0.71 1.07 1.36 0.93 1.11

1919 - 1.47 0.58 0.29 1.02 0.55 0.83 0.68 1.88 1.12 1.02 0.77 1.62 0.78 0.69 0.46 1.29

1935 - 2.37 0.65 0.89 1.10 0.44 1.15 1.23 1.19 0.75 1.80 1.18 1.77 2.65 0.78 1.08 1.42

1951 - 0.91 0.37 0.68 0.80 0.23 0.78 0.40 0.36 0.73 1.46 0.48 1.49 1.20 1.44 0.74 0.96

1967 - 1.24 1.48 1.68 1.17 1.92 0.75 0.74 1.05 0.32 0.49 0.43 0.92 0.97 0.89 0.80 0.45

1983 - 1.61 0.62 1.22 1.37 0.88 0.78 0.62 1.22 0.39 0.68 1.99 2.24 0.79 0.55 0.95 0.40

1999 - 1.3 2.23 0.76 0.99 1.21 0.96 0.51

Histogram of R(t): Picture

**4. Graph of Larch growing data**

Picture 2

Autocorrelation graph and its analysis -Picture 3



R’(t)

Its histogram

Graph of R’(t)

Autocorrelation function

**5. Solar activity Description**

- The core of the Sun rotates

- Rotation of the Core creates SMF = Solar Magnetic Field or SMF

- The rotation of the Core slows down and speeds up

- Jupiter and Saturn control the rotation of the Core!

- When the rotation stops, the output of protons into outer space in the plane of the ecliptic increases sharply

- Sunspots appear at the maximum rotation speed, while the SMF is maximum and the number of emitted protons decreases sharply

- The time between two stops is called the Solar Cycle (SC)

- Last stop was December 22, 2020. We have now entered SC 25.

- The next stop will be on November 30, 2030, the start of Cycle 26

**6. SMF data**

F(t) – Solar Magnetic Field as unction of time

1631 – 2005

For every year two points 2 January and 2 July

Histogram of F(t)

Graph -Picture 3,

Autocorrelation function – Picture 4

Reference to data in Mathship.com.

**7. First and second derivatives of SMF (from Mathship.com)**



Calculate first derivative F’(t)

Histogram

Its graph Picture 5, its autocorrelation function picture 6



Calculate second derivative F’’(t)

Its graph Picture 7, its autocorrelation function picture 8

**8. Solar Activity (x) – larch growing**

Graph F(t) - R(t) Picture 9

Histogram

Correlation Matrix [ R(t); F(t); F’(t); F’’(t)]

Regression Analysis:

R(t) = a + b\*F(t) + c\*F’(t) + d\*F’’(t)

**9. Two-way ANOVA**

**10. Ideas for future.**

R(t) / F(t)

R(t) / F’(t)

R’(t) / F(t)

R’(t) / F’(t)

**11. Conclusions.**

We gave proof of dependency of

**12. Acknowledgments.**

We are very thankful to Viktoria Levkine who discussed with us subject of the article and gives us very good critics of it

**12. Literature**

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Picture 1. Map of Points …



Picture 2. Graph of Larix 1631 - 2005

Picture 4. Graph of SMF 1631 – 2005