Space and Science Research Center

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Research Report 1-2010 (Preliminary)

Correlation of Solar Activity Minimums and Large Magnitude Geophysical Events

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[1] An independent review of historical records was performed for 350 years of global volcanic activity (1650-2009) and seismic (earthquake) activity for the past 300 years (1700 to 2009) within the continental United States and then compared to the Suns record of sunspots as a measure of solar activity. All three data sets were examined to determine whether a relationship existed between them and if the results of such a study could be used to develop methodology for identifying future geophysical events. The preliminary results from the study have shown that ***there exists a strong correlation between the solar activity that causes climate changes and the Earths largest seismic and volcanic events*****. The impressive degree of correlation for global volcanic activity (>80.6%) and for the largest USA earthquakes (100% of the top 7 most powerful) vs. solar activity lows provides a basis for future estimates of the time periods and magnitudes for the largest volcanic and seismic events many decades in advance.** Finally, the coincidence of the Centennial and Bi-Centennial cycles of the RC Theory showed unmistakable relationships to these largest geophysical events. The use of such a tool may provide a new and valuable method for protection of people and property located in and around high risk geologic zones. Further, a significantly increased risk is indicated during the next 20 years for volcanic and earthquake events of historic scale. Citation: Casey, John. L. (2010),

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1. Introduction.

[2] Previous work by Casey (2008) known as the RC Theory, established solar activity as a reliable model for prediction of the Earths climate changes. During the course of the research it was observed that there may be a positive correlation between solar activity as measured by sunspot counts over a long term base line average, and major geophysical events specifically earthquakes and volcanic eruptions. This previous research found for example, that the largest ever recorded volcanic eruption, Mt. Tambora in Indonesia (1815), as well as the largest earthquakes in the history of the United States, the New Madrid earthquakes of 1811-1812, all occurred near the bottom of the last solar hibernation known as the Dalton Minimum (1793-1830). Given this initial relationship, a more detailed study of geophysical records was made to assess the degree of correlation if any that may exist between the Suns activity and such events.

2. Review of Global Volcanic Activity vs. Solar Activity from 1600AD to 2009AD.

[3] Using the historical record of volcanic eruptions developed by the Smithsonian Institution, an extraction was made of all those eruptions that were rated at a Volcano Explosive Index (VEI) of 5 or greater. The level of 5 on the VEI scale of 0-8 was selected since it was the beginning class of large eruptions. Many are familiar with the scale of such via Mt. St. Helens. This volcano has an established eruptive history and up to and after the May 18, 1980 VEI 5 event, was well documented and instrumented.

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Table 1. Volcanoes of greater than or equal to VEI of 5 from 1650 to 2009. This list of large volcanic eruptions since 1650 was used as the baseline list for comparison against solar activity, i.e. periods of reduced sunspot count to determine any apparent associations. 5* = a class five VEI with potentially large date uncertainty, P* = plinian large class eruption, assumed >VEI 5. The study did not include activity associated with geological hot spots or caldera (super volcano) sites. Source: Smithsonian Institute.

Volcano Location Year VEI

1. Shiveluch Kamchatka Penninsula 1650 5

2. Long Island N.E. New Guinea 1660 6

3. Usu Hokkaido, Japan 1663 5

4. Shikotsu Hokkaido, Japan 1667 5

5. Gamkonora Halmahera, Indonesia 1673 5*

6. Tongkoko Sulawesi, Indonesia 1680 5*

7. Fuji Honshu, Japan 1707 5

8. Katla So. Iceland 1721 5*

9. Shikotsu Hokkaido, Japan 1739 5

10. Katla So.Iceland 1755 5

11. Pago New Britain 1800 P**

12. St.Helens Washington State, USA 1800 5

13. Tambora Lesser Sunda Islands,Indo. 1815 7

14. Galungung Java, Indonesia 1822 5

15. Cosiguina Nicaragua 1835 5

16. Shiveluch Kamchatka Penninsula 1854 5

17. Askja N.E.Iceland 1875 5

18. Krakatau Indonesia 1883 6

19. Okataina New Zealand 1886 5

20. Santa Maria Guatemala 1902 6

21. Lolobau New Britain 1905 P*

22. Ksudach Kamchatka Penninsula 1907 5

23. Novarupta Alaska Penninsula 1912 6

24. Azul, Cerro Chile 1932 5+

25. Kharimkotan Kuril Islands 1933 5

26. Bezimianny Kamchatka Peninsula 1956 5

27. Agung Lesser Sunda Islands, Indo. 1963 5

28. St. Helens Washington State, USA 1980 5

29. El Chichon Mexico 1982 5

30. Pinatubo Philippines 1991 6

31. Hudson, Cerro So. Chile 1991 5+

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Of the 31 eruptions documented since 1650 with a VEI greater than or equal to 5, a total of 25 occurred during a reduced period of sunspots if not a major reduction in sunspots or a solar hibernation, e.g. the Dalton or Maunder Minimums. This preliminary study showed 80.6% of the largest eruptions took place during extended solar activity minimums. Significantly, the following list of the eight largest volcanic eruptions globally (VEI>6) since 1650, shows all but one took place only during a solar hibernation, or significant reduction in solar activity as measured by sunspot count.

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Table 2. Volcanic eruptions that took place during major solar minimums and solar hibernations.This table establishes the strong relationship between the largest volcanic eruptions and solar activity lows on the order of the Centennial and Bi-Centennial Cycles defined by the RC Theory.

Volcano Location Year VEI Associated Solar Minimum

1. Long Island N .E. New Guinea 1660 6 Centennial: Maunder

2. Pago* New Britain 1800 P Bi-Centennial: Dalton

3. Tambora Lesser Sunda Islands 1815 7 Bi-Centennial: Dalton

Indonesia

4. Krakatau Indonesia 1883 6 Centennial: Year 1900

5. Santa Maria Guatemala 1902 6 Centennial: Year 1900

6. Lobobau New Britain 1905 P Centennial: Year 1900

7. Novarupta Alaska Peninsula 1907 6 Centennial: Year 1900

8. Pinatubo Philippines 1991 6 No Correlation

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* P = plinian level large eruption.

3. Solar activity time line for comparison with volcanic and earthquake activity.

[4] Extended sunspot minimums, i.e. covering two or more 11 year Schwabe cycles, intermediate minimums, and solar hibernations were extracted from the chart below for use in volcanic and earthquake vs. solar activity comparisons:

Figure 1. 400 years of sunspot observations depicting the Maunder and Dalton Minimums and the Modern Maximum. Source: Graphics; R. A. Rhode, Global Warming Art, from data sets by Hoyt and Schatten (1998a, 1998b).

4. Correlation of the Largest Continental Earthquakes to Solar Activity for the Period 1700 to 2009.

[5] Identification of the largest continental US earthquakes was done with data from the US Geological Survey (USGS). The table below shows the top seven largest earthquakes and is taken from the revised June 7, 2005 published list of the largest fifteen earthquakes and reexamined for completeness on September 8, 2009. All of these largest seven are strongly correlated to an associated solar activity minimum.

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Table 3. Top seven largest continental USA earthquakes. Source: USGS*

Location Date Magnitude Associated Solar Minimum

1. Cascadia subduction zone 01-26-1700 ~9 Centennial: Maunder

2. New Madrid, Missouri 12-16-1811 8.1 Bi-Centennial: Dalton

3. New Madrid, Missouri 02-7-1812 ~8 * Bi-Centennial: Dalton

4. Fort Tejon, California 01-09-1857 7.9 Intermediate Minimum***

5. San Francisco, California 04-18-1906 7.8 Centennial Minimum

6. Imperial Valley, California 02-24-1892 7.8 Centennial Minimum

7. New Madrid, Missouri 01-23-1812 7.8 Bi-Centennial: Dalton

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* Measurement methods vary. The USGS says the New Madrid Feb 7 1812 temblor may have been 8.8 on the Richter scale.

** Centennial and Bi-Centennial cycles from the RC Theory have periods of 90-100 years and 206 years respectively.

*** Intermediate Minimums are easily observed declines in solar activity (sunspots) though lesser in magnitude than Centennial or Bi-Centennial events.

5. Conclusions.

[6] As a result of research conducted, it is reasonable to conclude there exists a strong correlation between global volcanic activity among the largest of classes of eruptions and solar activity lows. With the 80.6% occurrence of large scale global volcanic eruptions taking place (>VEI 5) during solar activity lows and with 87.5% occurring for the very largest (>VEI 6) eruptions during major solar minimums, it is concluded that any reliable predictive tool for forecasting future solar activity would also lend itself to forecasts for future global volcanic eruptions of the most powerful magnitudes. For example the RC Theory of solar activity may be an effective tool for forecast of global volcanism.

[7] The occurrence of each of the largest seven USA earthquakes during solar activity lows and in particular during solar hibernations indicates a predictive tool like the RC Theory for future extended solar minimums may also be effective in forecasts of major USA earthquakes.

[8] Given the unusually high degree of correlation found in the study for both the highest levels of global volcanism and USA earthquake activity when compared to extended solar activity lows, it can be concluded that there exists a significant likelihood (greater than 80%) that the current recently started solar hibernation may result in historic scale global volcanic eruptions and record earthquake activity within the continental United States.

[9] The determination that solar activity cycles may indicate timing and intensity of geophysical events like volcanism and earthquakes points toward a possible connection between solar activity and the underlying cause of these geophysical events, namely plate tectonics.

[10] The solar hibernation identified by Casey (2008) is currently under way. The results of this study and the high correlation between described volcanism and earthquakes and solar hibernations warrants the widest

dissemination of warnings to personnel and governing organizations in high risk geophysical zones. It is expected beginning at any time and during the next twenty years of the solar hibernation, that potentially historic volcanic eruptions are likely globally and similarly record setting new earthquakes are likely within the continental United States.

[11] Acknowledgements.

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