

## About the 18.6-year periodicity observed in the occurrence of huge earthquakes of the plate convergence zones near Japan

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### 1. Introduction

It has been understood that tidal force driven by the Moon and the Sun works as a trigger of earthquakes (Tanaka et al., 2004). The related function is called the tidal triggering. Since move of the celestial bodies have periodicities, then the earthquakes which are triggered by such forces should have these same periodicities. In fact, in the case of long periods, the presence of a 18.6-year cycle have already been reported by such several researchers for instance concerning the Southern California (Kilston and Knopoff, 1983), several regions in the Pacific-rim (Petukhin and Gusev, 2007) and the Vrancea zone in Romania (Souchay and Stavinschi, 1999).

### 2. Investigation of the 18.6-year periodicity for the case of earthquakes in Japan

In this paper we investigate the 18.6 y cycle for the earthquakes occurring in Japan.

#### 2.1 Method

The time intervals of the largest earthquakes in the plate convergence zones near Japan, and more specifically the regions of the Sanriku-Oki of the Japan trench, of the Sagami trough, and of the Nankai trough are investigated. The results are shown below.

#### 2.2 Results

In the following we present the name of each historical earthquake, their date (Y/M/D), as well as the corresponding fraction of the 18.6 y cycle.

##### Sanriku-Oki region

(Tested Earthquakes: Meiji-Sanriku earthquake 1896/06/15 M8.5, Showa-Sanriku earthquake 1933/03/03 M8.1, 2011Tohoku earthquake 2011/03/11 M9)

1933/03/03 - 1896/06/15 = 13409 days = 36.71 yrs = 1.97 x 18.6 yrs

2011/03/11 - 1933/03/03 = 28497 days = 78.02 yrs = 4.20 x 18.6 yrs

##### Sagami trough

(Tested Earthquakes: Genroku earthquake 1703/12/31 M8.2, Taisho Kanto earthquake 1923/09/01 M7.9)

1923/09/01 - 1703/12/31 = 80232 days = 219.67 yrs = 11.81 x 18.6 yrs

##### Nankai trough

(Tested Earthquakes: Hoei earthquake 1707/10/28 M8.4, Ansei Nankai earthquake 1854/12/24 M8, Showa Nankai earthquake 1946/12/21 M8)

1854/12/24 - 1707/10/28 = 53748 days = 147.16yrs = 7.91 x 18.6 yrs

1946/12/21 - 1854/12/24 = 33599 days = 91.99 yrs = 4.94 x 18.6 yrs

### 3. Conclusion

All the 5 studied cases show close to integer multiple of 18.6 years, which suggests a real periodicity of the events. The errors are 18.6 years x 0.2 = abt. +/- 4 years for the Sanriku-Oki and the Sagami trough, while for the Nankai trough it is 18.6 years x 0.1 = abt. +/- 2 years. From the viewpoint of physics, this means that same amount of tidal forces work on the regions from same direction.

The period when the same stresses will be loaded to the Sagami trough and the Nankai trough regions are shown below. The more specific value of 18.613 yrs is used for the calculation. It should be noted that the following figures only show highly stressing periods, but not forecast occurrence of large earthquakes, because stress situations in each regions are not known today.

##### Sagami trough

1923/09/01(Taisho Kanto eq)+ 5 x 18.613yrs = 2016/09/24 +/- 4yrs

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Nankai trough

1946/12/21(Showa Nankai eq)+ 4 x 18.613yrs = 2021/06/03 +/- 2yrs

We know that this work must be considered as a preliminary report, and more specific tests are necessary to confirm the effect.

References:

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