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극운동과 범지구적지진발생의 주기분석

나성호[1], 정태웅[2], 강태섭[3], 백정호[1], 신영홍[4]

[1]한국천문연구원, sunghona@kasi.re.kr
[2]세종대학교, [3]부경대학교, [4]한국지질자원연구원

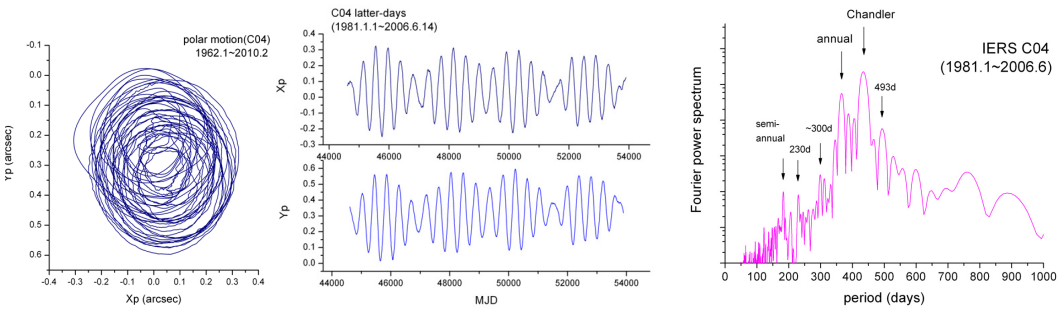
Spectral Analyses of Polar Motion and Global Earthquake Occurrence

Sung-Ho Na[1], Tae-Woong Chung[2], Tae-Seob Kang[3], Jeongho Baek[1], Young-Hong Shin[4]

[1]KASI, [2]Sejong Univ., [3]Pukyong Nat'l Univ., [4]KIGAM

Characteristics of Earth's polar motion have been studied, and its two major components are 'Chandler' and 'annual' components (see, for example, Hoepfner, 2004). Other components of polar motion are 'linear drift', 'Markowitz', '300-day', 'semi-annual' components, and *etc*. It is generally regarded that polar motion is excited mostly by atmospheric perturbations. Annual wobble is evidently driven oscillation, while Chandler wobble must be a resonance (Gross *et al.,* 2003).

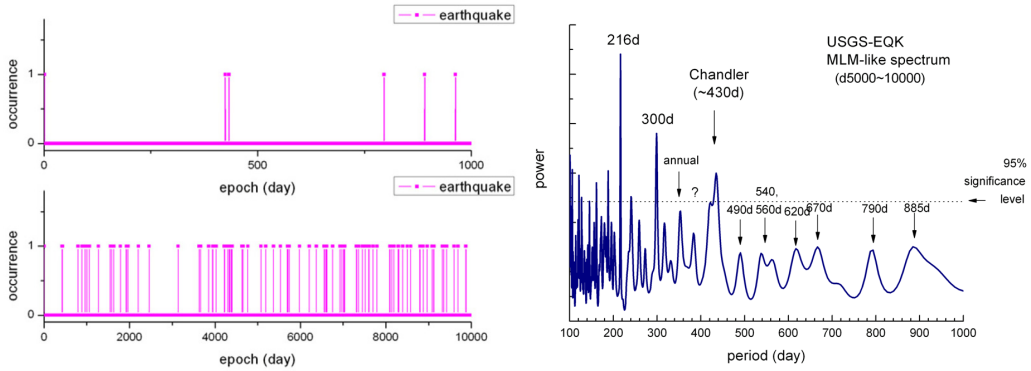
We carefully re-analyzed the most relevant polar motion dataset, and found a **formerly unknown component of polar motion** (Fig. 1). The **period of this component is roughly 500 days**, and **its amplitude is 20 milliarcseconds in average**. We also found that this component is entirely prograde motion like Chandler wobble. So we speculate this component **could be associated with the inner core wobble**.



a) (b) (c)

Fig. 1. Polar Motion: (a) data - IERS C04, (b) x_p and y_p components (Jan 1981~ Jun 2006), and (c) Fourier power spectrum of (b) in log scale.

We constructed a simple time series of global earthquake occurrence based on a dataset inferred from USGS geophysical database. During a time span between 1800 and 1994, total 2423 earthquakes were recorded. The time series is consisted of zeroes and ones, which correspond to days of no earthquakes or days of earthquakes. So it looks like the following - (1, 0, 0, 0, 0, 0, 0, . . . , 0, 0, 1, 0, 0, 0, . .), which is illustrated in Fig. 2(a). The power spectrum of this simple time series was attained by using the Burg-Anderson algorithm, and shown in Fig. 2(b). Among the spectral peaks over 95% significance level, exist periodicities of 420~440, 300, 216, 76, 26, 12 days. (We also have other evidences of annual signal in the local earthquake occurrence.) The peak of 420~440 days manifests earthquake triggering effect of Chandler wobble deformation in the crust. 300 day periodicity is interpreted as an atmospheric perturbation effect on the global earthquake occurrence. Other peaks may also be caused by atmospheric disturbances. 216 days is, in fact, semi-Chandler period. As summary of latter part of this study, we hereby report the **existence of Chandler period and other geophysical periods of atmospheric origin in the global earthquake occurrence**.



(a) (b)

Fig. 2. Global Earthquake Occurrence: (a) first 1,000 or 10,000 days of the simple time series based on USGS dataset (b) Maximum likelihood spectrum of the constructed simple time series of global earthquake occurrence.

References

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Hoepfner, J, 2004, Low-Frequency variations, Chandler and Annual Wobbles of Polar Motion as observed over one century, *Sur. Geophys.*, **25**, 1-54.

http://earthquake.usgs.gov/earthquakes/eqarchives/epic/