SINGULAR SPECTRUM ANALYSIS OF EPISODIC TERMS IN POLAR MOTION

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ABSTRACT

In this paper, we study the 1999-2000 Polar Motion series as derived from GPS (Weber, 2001; Rothacher, 2001) observations. On the basis of Functional Principal Analysis, we focus on the diurnal/subdiurnal variations. By applying the EOPSSA Matlab package developed at Paris Observatory, significant transient components are enlightened at periods of about 8, 12 and 24 hours.

1. INTRODUCTION

We focus on the sub-diurnal/diurnal polar motion variations, possibly inferred by non-linear processes in the atmosphere and oceans. We applied the Singular Spectrum Analysis (SSA) that allows spectral analysis and decompositions of experimental time series as shown in climatology papers (Vautard et al, 1992). It is a form of Principal Component Analysis in the time domain that provides data-adaptive filters and Functional Principal Components for describing the signal variability in terms of its lag-covariance structure. Section 2 presents EOPSSA, a Matlab computer package developed at Paris Observatory for SSA analysis. Its application to a 2-hour GPS Earth Rotation Parameters series is discussed in Section 3.

2. THE MATLAB COMPUTER PACKAGE EOPSSA

EOPSSA (Rouveyrollis, 2001) is a Matlab computer package for SSA analysis. It allows to identify and extract EOF components (trends, quasi-periodic or periodic oscillations) of a signal. Figure 1 shows the EOPSSA analysis window.

Figure 1 : EOPSSA main window showing LOD variations of IERS C04 solution
3. SSA ANALYSIS OF 1999-2000 GPS POLAR MOTION SERIES

We used the 2-hour GPS ERP-Series given on the 1999-2000 period; the series is the concatenation of the CODE subdaily 3-days series. Diurnal and subdiurnal variations induced by the oceanic excitation were removed (Ray et al., 1994). In order to keep variations smaller than a few days, a Vondrak filter (Vondrak, 1977) was applied.

![Figure 2 - Decomposition of the high-frequency signal. Significant components with periods of 12h and 24h appear. They might be in connection with an episodic oceanic excitation. 8-hour and 85-hour components not present in the oceanic model are also transiently appearing. At this point, more investigations are needed to state wether it is connected or not with oceanic S3 or M3 tides.](image)

4. CONCLUSION

- The Singular Spectrum Analysis (SSA), widely used in climatic researches, is an efficient tool for signal decomposition.
- We have developed and implemented a SSA Graphic User Interface in Matlab environment.
- Episodic significant signals with signatures of 8h, 12h, 24h and 85h were identified on the 2-hour GPS series derived by Weber and Rothacher.
- Further studies are in progress to understand the reality and the origin of these components (oceans, atmosphere).

5. REFERENCES