EXCITATION OF POLAR MOTION BY ATMOSPHERIC AND OCEANIC VARIABILITIES

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ABSTRACT. It is widely accepted that atmospheric and oceanic variabilities play a major role in the excitation of polar motion at period longer than 10 days. However for shorter periods the effect is not clear. We have reanalysed the role of Atmospheric Angular Momentum (AAM) and Oceanic Angular Momentum (OAM) variabilities on the excitation of high frequency polar motion variations taking advantage of a recent Oceanic Angular Momentum (OAM) series derived by Ponte and Ali. We show that the correlation significant at periods between 2 and 10 days.

1. DATA

The oceanic influence on polar motion is investigated by using three different series of OAM time series considered as the sum of the signals resulting from changes in the oceanic mass and velocity fields. The input OAM series assumes an oceanic inverted barometer correction (IB) response to surface atmospheric pressure signals. The following three OAM series are used in the present analyses: G03 (Gross et al. 2003); ocean model: ECCO-JPL time span 1980 - 2002.2; PO - (Ponte and Ali, 2002) ocean barotropic mode, sampling interval 1 hour, time span 1993 - 2002; PN - (Ponte and Ali, 2003 - private communication) ocean barotropic model from 4 times daily series sampling interval 1 hour, time span 1993 - 2002.

The atmospheric excitation series AAM is derived from six-hour series (Salstein et. al, 1993) based on products obtained from the US NCEP/NCAR reanalysis project. We used here a sum of the wind and the pressure terms with the Inverted Barometer (IB) correction for the ocean response.

The excitation function of polar motion referred as geodetic (GEOD) excitation was inferred from the polar motion observations by applying the Barnes formaliam to the following polar motion series: 9070, Combined GPS series derived by the EOP Product Center of the IERS, 9083 Combined analysis GPS series derived by the IGS, 5522 Operational GPS series derived by JPL analysis center, 5422 Operational GPS series derived by CODE analysis center, NEOS Combined multi-technique solution of the USNO rapid service center and SPACE Combined multi-technique solution of the JPL.

2. ANALYSES

The amplitude coherence and phase spectra are computed using either one selected geodetic series and one of the tree oceanic-atmospheric series or using one selected oceanic-atmospheric series and one of four geodetic series.

All AAM+OAM models show similar coherences with the IGS combined solution (9083) for periods greater than 6 days (Fig.1a). For shorter periods, the best agreement is obtained for PN, (Ponte and Ali) model. This is clearly evident in the case of the power spectra where only AAM+PN series have power almost equal to the geodetic series power. There is a significant drop of the coherence level in the spectral range below 4 days in all cases, still the coherence values remain significant. It is also clear that there are differences in the coherence, amplitude spectra, and phases between geodetic series and AAM+PN, in the spectral range below 3.5 days (Fig. 1b). Here the best result was obtained when the 9083 was used for comparisons. It is unexpected that results obtained from the CODE data are slightly worst to those concerning the 9083 series. Analyses of correlation and variance relation between the chosen AAM+PN and different geodetic series in the two spectral bands spectral bands (2 - 8 days; 2-4 days, performed in sliding window confirmed the results mentioned above. The best correlation and values of variance ratio (near 1) is obtained for the series 9083.

3. CONCLUSION

The origin of polar motion variations in spectral band below 4 days needs more investigation and also more accurate geodetic, atmospheric and oceanic series. Since oceanic series are based on models, it is not clear whether comparison between geodetic on one hand and atmospheric + oceanic series on the other hand may serve as estimation of accuracy of the geodetic solutions to allow discrimation between various independant EOP solutions.

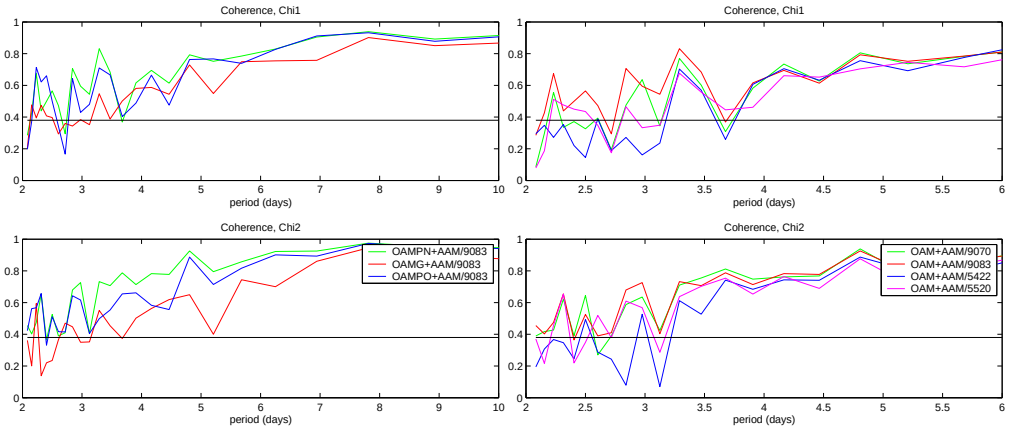

Figure 1: a -left panels) Coherence spectra between the three joint atmosphere+ocean series and the geodetic series(9083), b - right panels) coherence spectra between the chosen joint atmosphere ocean spectra (PN + AAM) and different geodetic series.

4. REFERENCES

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