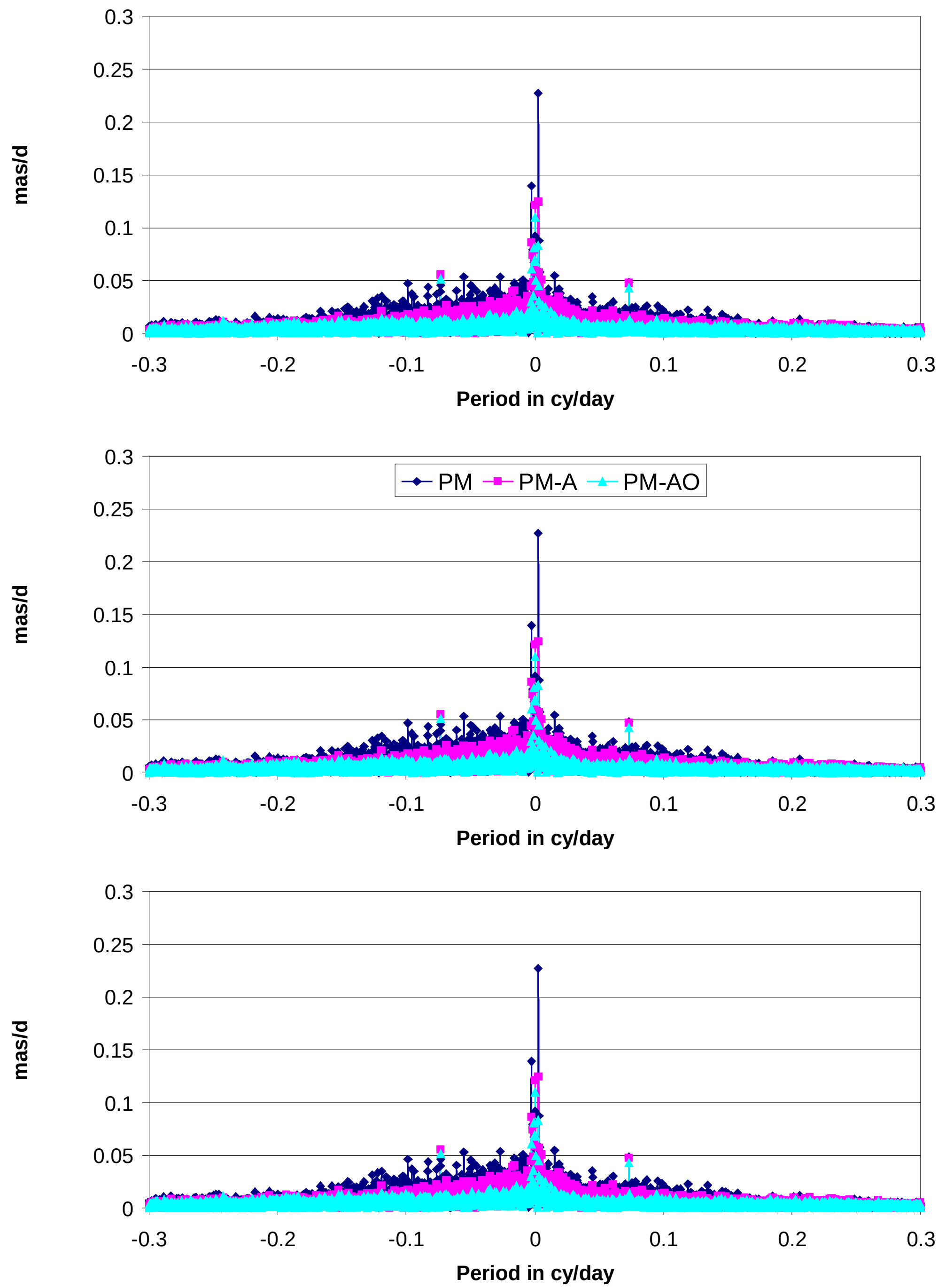


Figure 1. Reduced PM rate (PM excitations functions (χ_2, χ_1) times the Chandler wobble rotational rate) amplitudes (*PM*) and the residual amplitudes with respect to inverted barometer (*ib*) AAM_{ib} (*ncep.reanal*) (*A*) and AAM_{ib}+OAM(*kf080*) (*AO*) for *IG1*(*top*), *IGN*(*middle*) and *DGFI*(*bottom*) PM's. The amplitudes (~ 0.23 mas/d) near the 0 cycle/day spectral line reflect PM and/or (OAM/AAM_{ib}) long periods (> 11 years) and drifts. Here and after, the PM rates, needed for the reduced PM rate generations, were obtained from the PM values by cubic line fitting. These (cubic line) PM rates are more accurate representations of PM series, since unlike to the PM rate solutions, they are insensitive to aliasing of sub-daily eart rotation (ERP) effects and model errors. These sub-daily errors/effects are largely mitigated by the 24-hour PM values averages (see e.g. Kouba 2005). Retrograde (-) are clockwise and prograde (+) are counter-clockwise rotations.

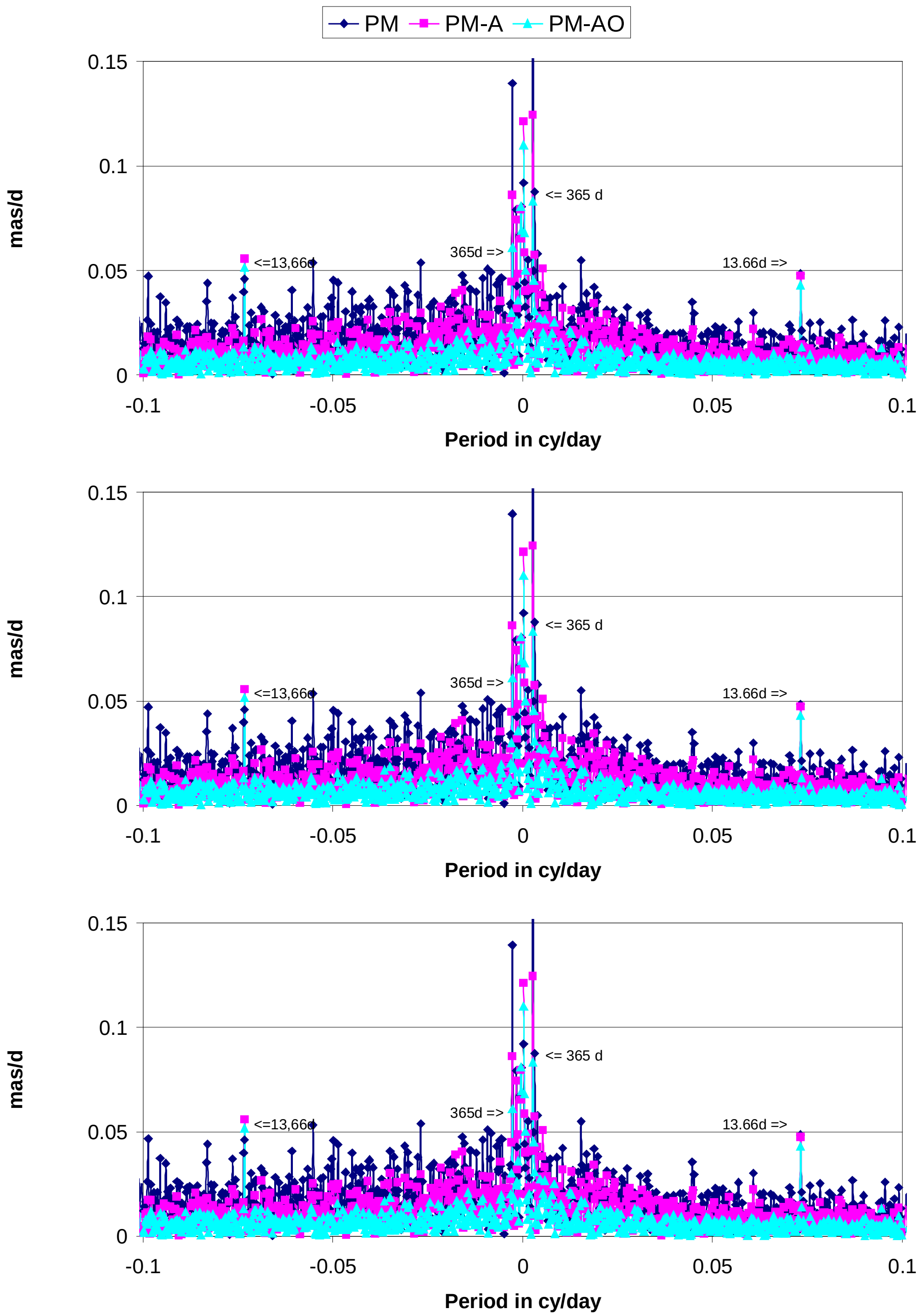
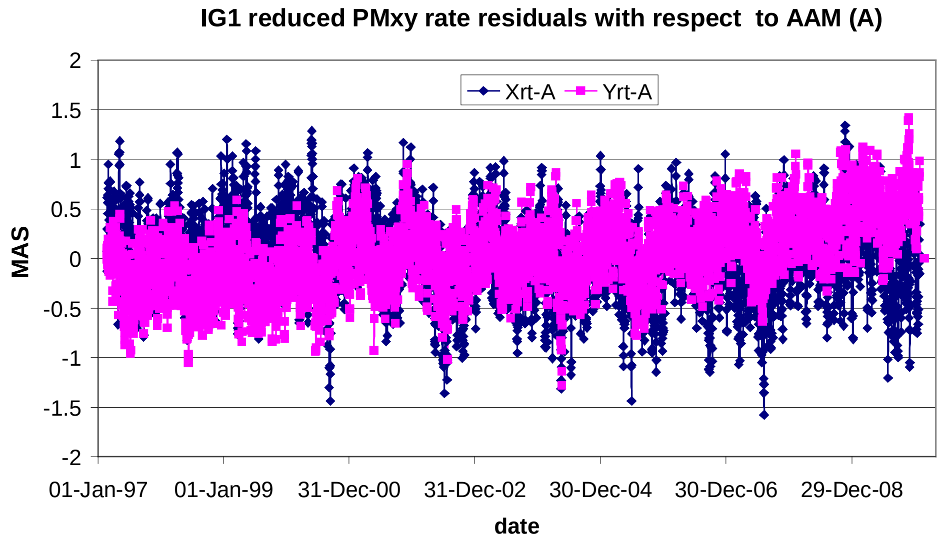


Figure 2. Zoomed Fig.1: 10 days - 11 year periods; the seasonal *IG1* (*top*), *IGN* (*middle*) and *DGFI* (*bottom*) amplitudes of reduced PM rate (*PM*) and of the differences wrt AAM_{ib} (A) and AAM_{ib}+OAM (AO) : annual retrograde amplitudes are (61.0, 61.0, 61.0) and prograde are (83.2, 83.2, 83.4) μas/day, respectively. Fortnight (13.66 day) peaks (~ 50 μas/day) are due to tides (see the latest IERS Conventions Table 8.4: *Ocean tidal variations in polar motion and polar motion excitation*). Note that $\sqrt{83.4^2 - 83.2^2}$ = 6 μas/day, which corresponds to an additional seasonal (prograde) PM signal of about 300 μas.



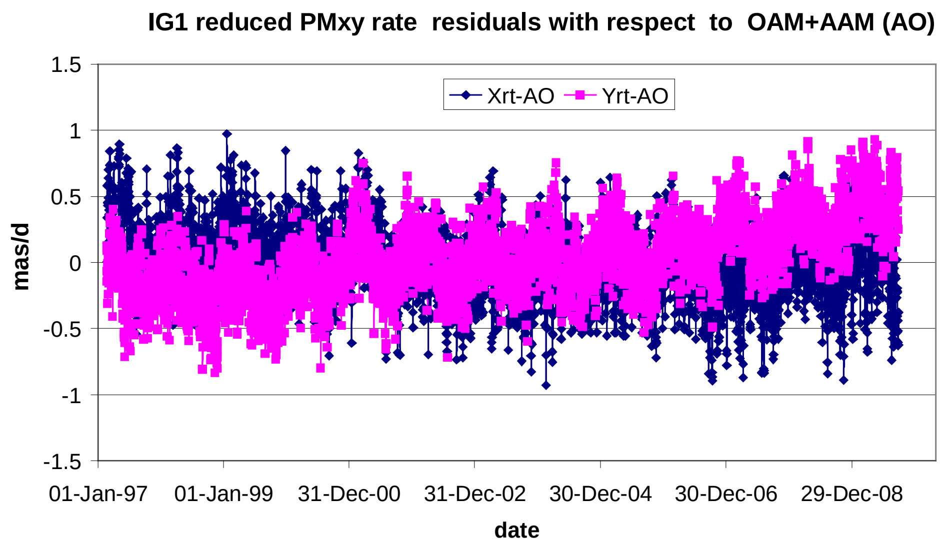


Figure 3. The reduced PM rate residuals wrt AAM_{ib} (A) (*top*) and AAM_{ib}+OAM(AO) (*bottom*) for the reprocessed IGS (IG1) PM, using inverted barometer (*ib*) AAM_{ib}. The AAM_{ib} +OAM residual RMS is smaller by a factor of up to 1.5 than the AAM_{ib} residuals (see also Figs 1-2). The seasonal effects, the same slope and long period (> 11year) effects remained after adding OAM. The seasonal effects (see Fig. 2) are mainly due to neglected hydrology effects and possible deficiencies in AAM_{ib} (e.g. neglected the upper most portions), etc. The residual series of the other two PM solutions (IGN, DGFI) are quite similar, so they are not shown here.

Table 1. Correlation of reduced PM rate (excitations) wrt to AAM_{ib}+OAM (χ_2, χ_1) for different intervals, during the common period of Feb. 27, 1997 to Dec. 26, 2008. The 95% significance level is about 0.01, so the differences below this level cannot be considered statistically significant. Note DGFI have the lowest correlation for all the intervals, the 5-day and 3-day correlation decreases are statistically significant.

interval	Xrt/X2			Yrt/X1		
	IG1	IGN	DGFI	IG1	IGN	DGFI
all	0.904	0.904	**0.902**	0.769	0.769	**0.765**
30 d	0.892	0.892	**0.888**	0.858	0.858	**0.852**
5 d	0.785	0.785	**0.775**	0.732	0.732	**0.719**
3 d	0.703	0.700	**0.687**	0.634	0.634	**0.616**

Table 1a. The same as Table 1, but for a more recent period of May 20, 2003-Dec 26, 2008

interval	Xrt/X2			Yrt/X1		
	IG1	IGN	DGFI	IG1	IGN	DGFI
all	0.923	0.923	**0.922**	0.814	0.814	**0.811**
30 d	0.900	0.900	**0.898**	0.866	0.866	**0.862**
5 d	0.795	0.794	**0.788**	0.751	0.752	**0.746**
3 d	0.729	0.727	**0.718**	0.647	0.648	**0.639**

Table 2. Reduced PM (*Xrt*, *Yrt*) rate AAM_{ib}+OAM residual RMS (mas/day), during the common period of Feb. 27, 1997-Dec. 26, 2008, also shown are RMS for periods up to 6 and 3 days, obtained from respective spectral window amplitudes. Note that the small increase of overall DGFI RMS represents an additional noise of about 37 μas/day.

Solution	Xrt	Yrt	Xrt(<6d)	Yrt(<6d)	Xrt(<3d)	Yrt(<3d)
IG1	0.270	0.255	0.162	0.139	0.111	0.106
IGN	0.270	0.254	0.162	0.139	0.111	0.106
DGFI	**0.273**	**0.257**	**0.173**	**0.148**	**0.122**	**0.112**

Table 2a. The same as Table 2, but for a more recent period of May 20, 2003-Dec 26, 2008, in mas/day.

Sol	Xrt	Yrt	Xrt(<6d)	Yrt(<6d)	Xrt(<3d)	Yrt(<3d)
IG1	0.243	0.228	0.155	0.137	0.106	0.101
IGN	0.243	0.228	0.156	0.137	0.106	0.101
DGFI	**0.245**	**0.231**	**0.164**	**0.144**	**0.117**	**0.107**

Conclusions

The spectra of AAM_{ib}+OAM residuals are practically the same for all 3 PM series (DGFI, IG1 and IGN) (see Fig.1). However, DGFI has a slightly larger seasonal prograde amplitude, which corresponds to an anomalous (wrt AAM_{ib}+OAM) seasonal PM effects of up to 0.3 mas (see Fig. 2). However, we're cautioned here that the seasonal signal of AAM_{ib}+OAM residuals is many times larger (see Figs. 2, 3), likely due to neglected effects (hydrology) as well as inadequacies of AAM_{ib}+OAM

IG1 and IGN PM gave the best correlation wrt AAM_{ib}+OAM in all the investigated intervals, ranging from 3 days up to about 11 years. In particular, the 3-day and 5-day DGFI correlations are significantly lower than for IGN and IG1, which have practically the same correlations (see Tables 1).

A lower correlation, by itself, may not be a sufficient indication of a better agreement, since it is insensitive to scale (e.g. some smoothed series may give a high correlation for a fairly poor agreement). However, both higher correlation and lower residual RMS are both sufficient and necessary to indicate a better agreement. Table 2, compiles AAM_{ib}+OAM residual RMS of DGFI, IG1 and IGN for different intervals. Consistently with the lowest DGFI correlations (Tables 1), DGFI also has the highest overall RMS, the slight RMS increase corresponds to an additional RMS of about 37 μas/day. The 6-day and 3-day RMS of DGFI are also higher than the IG1/IGN ones. Note that the IG1 and IGN RMS are the same, and the slightly lower the overall *Yrt* RMS of IGN than that of IG1, may not be statistically significant (it corresponds to only 12 μas/day). Table 2 also implies (from the 3-day RMS) that all the PM series have about the same high frequency smoothing, or that the IGN & DGFI solutions did not smooth the input IG1. For the sake of completeness Tables 1a and 2a compile correlations and residual RMS for a more recent period than the common 11-year period of Tables 1 & 2.

The AAM (*ncep.reanalysis*) and OAM (*kf080)* are readily available from the IERS http://www.iers.org/nn_10968/IERS/EN/DataProducts/GeophysicalFluidsData/fluids.html?__nnn=true and at the URL's given there. The methodology used to generate the above results is described in Kouba (2005) and Kouba and Vondrak (2005), so that with the above information, if needed or necessary, anyone should be able to reproduce the above results. The IGN and DGFI combined ITRF 2008 PM series (*ITRF2008P-IGN-EOP.DAT*, *ITRF2008D-DGFI-EOP.DAT*), and the input IG1 (reprocessed IGS) ERP series (*IG1-ERP-97.DAT*) were obtained from ftp://ftp.ensg.eu/altamimi/.

In summary*, despite of rather crude AAM_{ib}+OAM residual RMS's, likely caused by neglected effects (hydrology) and/or possible deficiencies of the available AAM_{ib}+OAM, the agreement of the DGFI PM series with AAM_{ib}+OAM is worse than IG1 and IGN PM agreement. This is so in terms of seasonal effects, correlation as well as RMS residuals. IG1 and IGN PM, on the other hand, gave practically the same agreement with AAM_{ib}+OAM in the above 3 categories****.***

J. Kouba, *March 28, 2010*

References

Kouba J (2005) Comparison of polar motion with oceanic and atmospheric angular momentum time series for 2-day to Chandler periods. J Geod(2005): DOI 10.1007/s00190-005-0440-7

Kouba J and Vondrák J (2005) Comparison of length of day with oceanic and atmospheric angular momentum series. J Geod (2005): DOI 10.1007/s00190-005-0467-9