EFFECTIVE ATMOSPHERIC ANGULAR MOMENTUM FUNCTIONS COMPUTED FROM THE JAPAN METEOROLOGICAL AGENCY DATA

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ABSTRACT. The Atmospheric Angular Momentum (AAM) functions based on the 6-hourly Japan Meteorological Agency (JMA) data are briefly introduced.

The effective atmospheric angular momentum (EAAM) functions proposed by Barnes, Hide, White and Wilson (1983) have been computed from the Japan Meteorological Agency (JMA) global analysis data since September 28, 1983. In general, the operational numerical weather prediction produces the three data sets called the analysis data, the initialized analysis data and the predicted values. The JMA global analysis data are the analysis data.

For the use of this file, it should be noticed that the results during 1983/12/1 - 1986/6/30 are 24-hourly (daily mean) values computed from the JMA global analysis averaged data at each grid and each level, during 1986/7/1 - 1992/6/20 are 12-hourly (00UTC and 12UTC) values computed without averaging, and from 1992/6/21 are 6-hourly (00UTC, 06UTC, 12UTC, 18UTC) values. The most important fact is that the 6-hourly values from 1992/6/21 are based on a new computational method different in part from an old computational method for the other values. It should be thus noticed that the 12-hourly values during 1992/6/21 - 1992/9/30 based on the old method are also added in the file prior to the 6-hourly values for comparison.

The JMA global analysis data have been made on 1.875-degree (2.5-degree before 1988/3/1) latitude-longitude grid system at sixteen levels (fifteen levels before 1988/3/1) from surface to 10hPa. The data are made from the forecast-analysis cycle by the following analysis and forecast models. The analysis model is based on a multi-variate optimum interpolation method with the initial guess of 6 hour forecast in troposphere, and on a sinusoidal fitting method in stratosphere. It should be noted that the predicted values are not used for the analysis above 100hPa. The forecast model is a global spectral model with a horizontal resolution of triangular truncation at wavenumber 106 (63 before 1989/11/14, and 42 before 1988/3/1), and vertically it has 21 levels (16 levels before 1989/11/14, and 12 levels before 1988/3/1). Full physical processes are incorporated in the model through 1.125-degree Gaussian grid, and a non-linear normal mode initialization is applied. The details for the analysis and forecast models from 1989/11/14 can be found in Numerical WeatherPrediction Division, Japan Meteorological Agency (1990), during 1988/3/1-1989/11/13 in Kitade (1988), and before 1988/3/1 in Kashiwagi (1987) and Kanamitsu, Tada, Kudo, Sato and Isa (1983).

For computing the EAAM functions, the sea level pressure, the height of the each level, and the wind velocity at each level of the global analysis data are used. In addition, mountain height of the same grid system made from the 10-minute (1-degree for the 12-hourly values) latitude-longitude grid data are used for estimating surface pressures on land that are computed from the geopotential height by using a cubic spline interpolation technique applied for the thickness temperatures. Also land-sea index data of the same grid system made from the 1-degree latitude-longitude grid data are used for computing sea level pressures on ocean with the Inverted Barometer (IB) hypothesis. Vertical integration of the wind terms of the EAAM functions is carried out from surface pressure on land (or the sea level pressure on ocean) to 10hPa. However, surface wind data are not used for the 6-hourly values from 1992/6/21.

The integral formula to evaluate the EAAM functions are basically due to the equations (5.1), (5.2), and (5.3) of Barnes et al (1983), but the axial component of the EAAM functions is multiplied by -1 for convenience. No smoothing have been done after evaluation. Details of the evaluation can be found in Naito, Kikuchi and Yokoyama (1987).

The file is given as

Year, Month, Day, MJD,
Chi-1-wind, Chi-1-press without IB, Chi-1-press with IB,
Chi-2-wind, Chi-2-press without IB, Chi-2-press with IB,
Chi-3-wind, Chi-3-press without IB, Chi-3-press with IB

with format (I4, I3, F6.2, F9.2, 9F10.6), where the EAAM functions have been multiplied by 1.0E7.

The variations during SEARCH'92 (6/21-9/22, 1992) are shown in Figure 1.

References:

Barnes, R.T.H, Hide, R., White, A.A. and Wilson, C.A. (1983) Atmospheric angular momentum fluctuations, length-of-day changes and polar motion, Proc. R. Soc. Lond., A387, 31-73.

Kanamitsu, M., Tada, K., Kudo, T., Sato, N. and Isa, S. (1983) Description of the JMA operational spectral model, J. Meteorol. Soc. Japan, 65, 189-220.

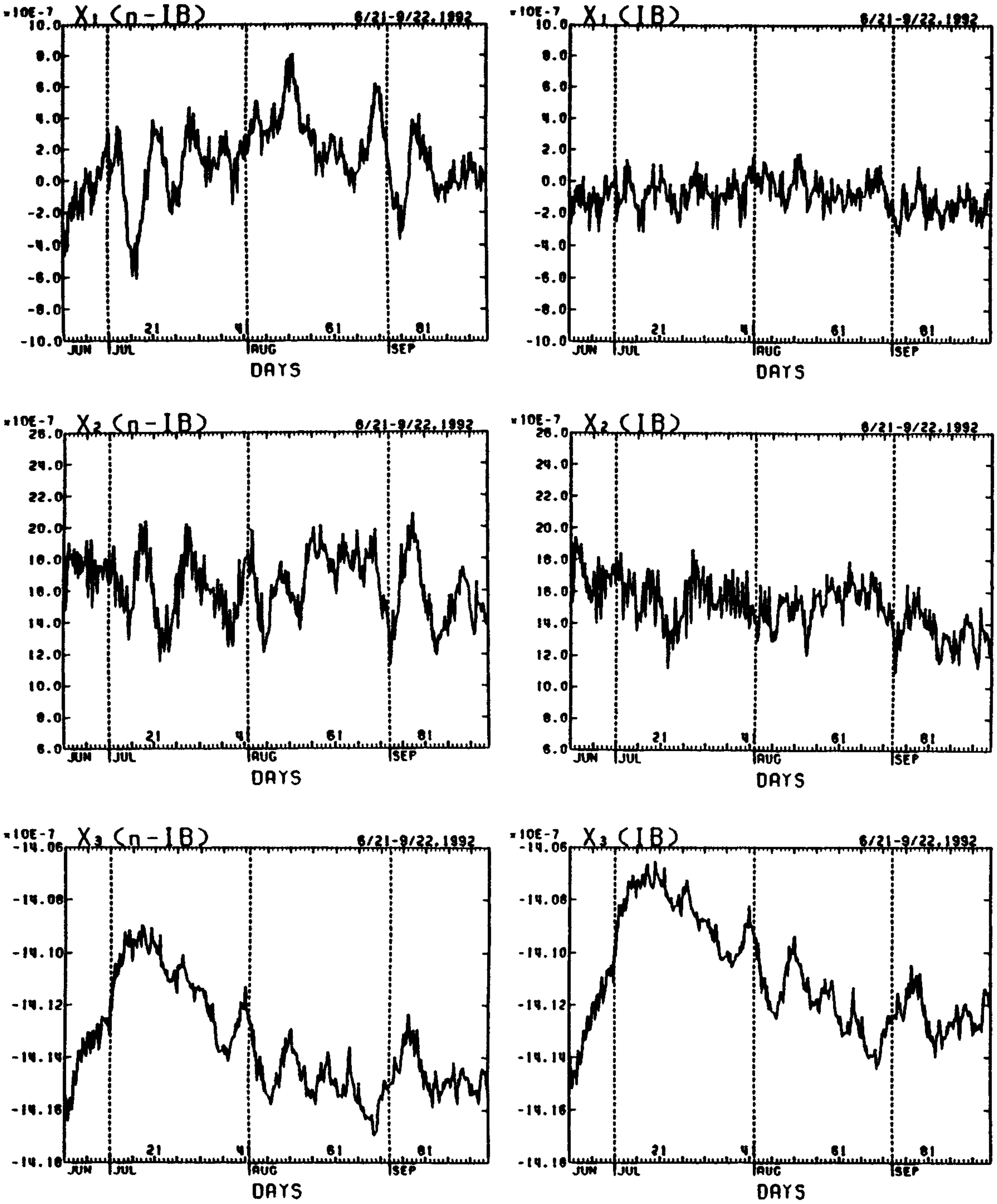
Kitade, T. (1988) Numerical weather prediction in the Japan Meteorological Agency, JMA/NPD Technical Report, No.20.

Naito, I., Kikuchi, N. and Yokoyama, K. (1987) Results of estimating the effective atmospheric angular momentum functions based on the JMA global analysis data, Publ. Int. Latit. Obs. Mizusawa, 20, 1-11.

Numerical Weather Prediction Division, Japan Meteorological Agency, (1990) Outline of Operational Numerical Weather Prediction at Japan Meteorological Agency, Appendix to Progress Report on Numerical Weather Prediction.

Figure 1. The variations of the AAM functions based on the 6-hourly JMA data during SEARCH'92 (6/21-9/22, 1992), where units are 10E-7.

X_1(n-IB) : Chi-1-Wind plus Chi-1-Press without IB.
X_1(IB) : Chi-1-Wind plus Chi-1-Press with IB.
X_2(n-IB) : Chi-2-Wind plus Chi-2-Press without IB.
X_2(IB) : Chi-2-Wind plus Chi-2-Press with IB.
X_3(n-IB) : Chi-3-Wind plus Chi-3-Press without IB.
X_3(IB) : Chi-3-Wind plus Chi-3-Press with IB.



X1 (n-IB)
X1 (IB)
X2 (n-IB)
X2 (IB)
X3 (n-IB)
X3 (IB)
*10E-7
6/21-9/22,1992
JUN
JUL
AUG
SEP
21
41
61
81
DAYS