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Effects of ENSO on sub-seasonal to interannual length-of-day (LOD) variability

E. Lehmann, G.C. Leckebusch, U. Ulbrich, P. Nevir
Institut für Meteorologie, FU Berlin, Berlin (elfrun.lehmann@met.fu-berlin.de)

Changes in the wind-driven axial relative atmospheric angular momentum (AAM) are reflected in variations of the length-of-day (LOD) since the global angular momentum is conserved. Previous studies have shown that observed variations in LOD on time scales from months to a few years are well correlated to variations in zonal winds. However, comparing the mean annual cycle of AAM and the LOD for a time period between 1962 and 2001 a time lag is observed with LOD (IERS EOP C04) leading the AAM (ERA40 reanalysis) by about 1 month. This time lag, also observed during strong ENSO events, reflects processes that effect the LOD and are not resolved in the atmospheric data. However, our analysis suggests that strong ENSO events effect the strength and amplitude of the mean annual cycle of the LOD and AAM. During El Nino years the AAM data shows a stronger increase for winter and spring months than for La Nina periods. Comparison of the mean annual cycles of LOD and AAM during ENSO events with those over the study period shows that during El Ninos the mean amplitudes of LOD and AAM are increased by +18% and +15%, respectively. During La Ninas the mean amplitude for LOD decreases to -5% and for AAM to +5% compared to the time mean. This observation suggests that strong El Ninos have a stronger effect on the variability of LOD and AAM than La Nina events. For individual La Nina periods the LOD displays a semi-annual cycle that is also expressed in the LOD-AAM residual. Comparing mean amplitudes of the LOD-AAM residual for the study period with ENSO events shows a higher variability of the residual (+3%) for La Nina years than for El Nino times (+1%).

Our study also investigates in how far the choice of reanalysis data (ERA40 vs NCEP/NCAR) effects discussed results.