G22B-0312 1330h POSTER

Multi-reference Evaluation of Uncertainty in Earth Orientation Parameter Measurements

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The earth orientation parameters including the length of day (LOD) and polar motion (PM) are routinely estimated by measurements from various techniques such as the very long baseline interferometer (VLBI), satellite laser ranging (SLR), and global positioning system (GPS). Objective combination of multiple data sets, such as weighted least-squares or Bayesian statistical (Kalman filter) estimation, requires some quantification of the relative accuracy of these measurements. While statistical sampling of measurement error variances and covariances is usually dependent on some assumed values for the ground-truth earth orientation parameters, we present here the evaluation of these statistics using a technique, referred to as the "three corner hat", that does not require the ground-truth values. We perform such evaluation on as many as eight measurement data sets (4 VLBI, 1 SLR, 3 GPS) as well as two combined products that are based on daily sampling and that, when necessary, have been interpolated to common epochs. Daily variability of some parameters, particularly LOD, can be high enough so that numerical interpolation error can account for a significant fraction of the evaluated variances. This can affect apparent error in measurement sets, such as the VLBI data, that typically have a nominal sampling interval longer than a day.

G22C MCC: Level 1 Tuesday 1330h

Effect of Atmosphere and Ocean on Geodesy and Geodynamics: Observation and Modeling II Posters

(joint with A, OS)

Presiding: **O de Viron,** Royal Observatory of Belgium**; R Gross,** Jet Propulsion Laboratory, California Institute of Technology

G22C-0313 1330h POSTER

Interannual Atmospheric Torque and ENSO: Where is the Polar Motion Signal?

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Climate variability on interannual time scales is dominated by the El Nino / Southern Oscillation (ENSO), an ocean-atmosphere instability originating in the equatorial Pacific. ENSO has a strong signature in length-of-day (LOD), which can be accounted for almost entirely by atmospheric angular momentum (AAM) variations. It has been noted, however, that ENSO effects on polar motion (PM) are much weaker and hard to detect. In this study, we use the torque approach to explore Earth-atmosphere interaction associated with ENSO, and seek to understand why the large atmospheric fluctuations arising from ENSO are not effective in exciting PM variations. PM is affected by atmospheric torques acting in the equatorial plane, which arise largely from gravitational and surface pressure interactions with the Earth's bulge. Using the inverted barometer (IB) approximation for the effect of atmospheric loading on the ocean, we find that the bulge torque exhibits significant coherence with the Southern Oscillation Index (SOI), confirming that the atmosphere acts to force PM in association with ENSO. While the bulge torque is correlated with geodetic excitation at high (sub-annual) frequencies, however, the two series are not coherent at longer (interannual) periods, presumably due to the effects of other excitation sources (e.g. oceans) on these time scales. Local (i.e., non-bulge) torques are also found to be coherent with the SOI, in particular due to the interaction of surface pressure anomalies with the large-scale topography of Antarctica. The local torques can be directly related to wind term anomalies of equatorial AAM, largely associated with extratropical vortices located over the Pacific ocean.

G22C-0314 1330h POSTER

Geodetic effects of global warming.

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The anthropogenic increase of greenhouse gas will probably induce significant changes of the atmospheric and oceanic global circulation. We have evaluated the variation of the Earth's gravity field, geocenter motion and rotational variations using the available atmospheric and oceanic outputs from coupled general circulation models participating to Couple Model Intercomparison Project (CMIP 2+) and the corresponding ice sheets (Antarctica and Greenland) changes according to Huybrechts et al. (2003). We discuss on the possible detection of these geodetic effects, especially with new space gravity missions such as GRACE.

G22C-0315 1330h POSTER

Atmospheric Pressure Loading Service for VLBI and SLR

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Time series of 3D site displacements caused by atmospheric pressure loading are computed for all VLBI and SLR sites from May 1976 using 6-hourly pressure field with a spatial resolution of 2.5x2.5 degrees from NCEP Reanalysis. Atmospheric pressure tides are removed from the NCEP Reanalysis data. Loading due to atmospheric tides is computed separately using Ponte-Ray (2002) model. These series are automatically updated on a daily basis. They are available on the Web at http://gemini.gsfc.nasa.gov/aplo . We have validated our model of atmospheric pressure loading by estimating the admittance factors of the pressure loading time series using the data set of 3.5 millions of VLBI observations. These admittance factors can be interpreted as correlation coefficients between the true (unknown) site displacements and our model. The average admittance factors are 0.95 -+ 0.02 for vertical displacement and 1.00 -+ 0.07 for the horizontal displacements. Closeness of these admittance factors to unity allows us to conclude that our model is adequate at the level of measurements noise.

G22C-0316 1330h POSTER

Evaluating Hydrology Estimated From Atmospheric Models And J2

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There have been many studies that have used atmospheric and oceanic numerical models to indicate the importance of the atmosphere and oceans in explaining temporal variations in Earth's rotation and gravitational field. These studies were also useful in imposing limits on the role of the continental hydrology in these variations. However, modeling the continental hydrology is extremely difficult and most atmospheric models only give estimates of the soil moistures for the upper 200 cm of soil, thus ignoring the deeper ground water variations. This study uses ground water observations from over 100 US Geological Survey wells to examine the usefulness of atmospheric models in estimating ground water recharge. It also shows the effects of the recent drought conditions in the US on ground water and variations in J2.

G22C-0317 1330h POSTER

Excitation of Non-Atmospheric Polar Motion by the Migration of the Pacific Warm Pool

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Changes in the annual variation of the Earth's polar motion are found to be largely caused by the variation of the atmospheric angular momentum (AAM). Recent simulation results of oceanic general circulation models further suggested global oceanic effects on the annual polar motion other than the atmosphere. In parallel to previous model studies of global oceanic effect, this research particularly singles out an active large-scale ocean anomaly and investigates its effect on the annual polar motion, determined from satellite observations of the movement of the Western Pacific Warm Pool (WPWP). Although the scale of the warm pool is much smaller than that of the solid Earth, analysis of the non-atmospheric polar motion excitation has shown that the WPWP does contribute non-negligible effects to the annual polar motion. The analysis consisted of over thirty years of the WPWP data (1970-2000) and shows the polar motion excitation is (2.5mas, -78o) for the x-component and (0.1mas, -14o) for the y-component. Comparing this result with the total geodetic non-atmospheric polar motion excitation of (10.3mas, 59o) for the x-component and (10.6mas, 62o) for the y-component, shows the significance of the WPWP. The difference between the WPWP's excitation on (x, y) components of the polar motion may originate from the WPWP's location and general pattern. Changes in the Earth's polar motion has attracted significant attention, not only because it is an important geodetic issue, but also because it has significant value as a global measure of variations within the hydrosphere, atmosphere, cryosphere, and solid Earth; hence global changes. Key Words. Polar motion - Western Pacific Warm Pool

URL: http://www.ocean.udel.edu/cms/xyan

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G22C-0318 1330h INVITED POSTER

Fluid Effects on Earth Rotation: What is Next?

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The interaction between the solid Earth and its fluid layers (the liquid core, the ocean, the hydrology and the atmosphere) is the main cause of Earth rotation fluctuations. Recently, significant progress in atmospheric, oceanic and coupled ocean-atmosphere models has been demonstrated; in parallel, associated data sets and quantity continues to advance. Current and future interdisciplinary geodesy missions (such as Jason, GOCE, GRACE and ICESat) will provide synergistic information that enables unique insights into Earth subsystem processes. Together, joint analyses will results in improvement of fluid models, which will result in better Earth rotation models. In this presentation, we will discuss what we can expect for the future of Earth rotation modeling, and the great challenges ahead.