into account. Preliminary results using CHAMP in-situ potential data for a spherical wavelet geopotential representation and for the gravity field estimation are presented. The development of this mathematical tool if successful, would have many advantages in the exploitation of highly accurate advanced gravity missions (i.e., GRACE) data for gravity field determination than the classical spherical harmonics approach.

G72A-0967 1330h POSTER

The Optimal Selection of GPS Double-Differenced Measurements for GRACE

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The GRACE mission currently generates approximately 150,000 GPS double-differenced measurements each day from a network of roughly fifty ground stations. The volume of data collected from these ground stations far exceeds the number of inter-satellite range measurements collected and processing these GPS measurements consumes the bulk of the computing time involved in estimating the gravity field. The GPS data only influence the recovery of the low to mid degree gravity signals, with most of the gravity signal being determined from the inter-satellite range measurements. The limited contribution of the GPS measurements, along with the significant computing time required to process them suggest that a strategy be developed by which only the minimal set of GPS measurements required be processed. The purpose of this study is to demonstrate that a reduced ground station network, combined with an optimal GPS parameterization, will provide a quality gravity field solution which satisfies the overall mission requirement with much greater processing efficiency

URL: http://www.csr.utexas.edu/grace/

G72A-0968 1330h POSTER

Assessment of the first static gravity field from GRACE in terms of surface ocean circulation

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GRACE's promise are monthly estimates of the Earth's gravity field, to degree 70 or more, for about 5 years. Being the first mission of its kind, preliminary versions of such fields need to be evaluated for reasonableness in various spectral bands and against a variety of data, including their effect on orbit computation, ocean circulation estimates, etc. Here we compare the difference between the geoid heights from one such preliminary field and the mean sea surface of Y.-M. Wang (2001), a measure of the time-averaged surface ocean currents, against output from the ECCO ocean model (which assimilates TOPEX altimetry), against various dynamic topographies derived from the Levitus (2001) hydrographic compilation, and against selected ADCP data.

G72A-0969 1330h POSTER

GRACE Orbit Deterimation for Gravity Field Recovery at CSR

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Determining the orbits of the GRACE satellites is an important aspect of the operational data processing for gravity field recovery. Precise orbits are required for data quality assessment and verification and finally as reference for the gravity field estimation step. Several stages are needed as part of the preparation for the gravity field solution. Using GPS tracking data, initial orbits are computed to produce model accelerometer and attitude data, edited tracking data and improved initial conditions. The model data are used to assess the performance of the accelerometer and star tracker as well as the quality of the measurements from these instruments. The tracking data are further edited to remove anomalous data. A final converged orbit is determined using the on-board accelerometer and attitude data along with the edited tracking data. Results of initial and final orbit fits for a period of data from April and May 2002 will be presented. Orbit quality metrics including GPS data residuals and SLR residuals will be presented. Improvement of the orbit fits due to an improved gravity field will be demonstrated. Using an initial GRACE derived gravity solution, an orbit accuracy at the few cm level is achieved.

G72A-0970 1330h POSTER

Ocean Bottom Pressure from GRACE — Utility & Validation

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The GRACE satellites were launched in March 2002, and will measure the gravity field of the Earth. Each month for 5 years they will produce a monthly-averaged gravity estimate sensitive to mass changes equivalent to a cylinder of water about 500 km in diameter and 1 mm in height (0.001 dbar in pressure). Month to month, the main source of geoid changes is the redistribution of water mass in the hydrosphere. Over the ocean, the time-varying gravity field can be interpreted as the fluctuating part of the ocean bottom pressure. This will be the first time such measurements are made from space, and because of the complexity of deriving gravity changes from the satellite-to-satellite tracking data, it will be beneficial to have some in-situ data against which these observations can be compared. The issue discussed here is how to compare such GRACE bottom pressure estimates to in-situ bottom pressure recorder data for the purposes of providing groundtruth for the former. The presence of short spatial-scale variability in ocean bottom pressure requires enough bottom pressure recorders be deployed in an area so their average achieves an accuracy comparable to 0.001 dbar on monthly scales. Short time-period variability in ocean bottom pressure brings up an additional issue of aliasing in the GRACE signal, which requires a combination of one month of the gravity data to produce an estimate of the geoid. We will discuss the planned deployment of an array of bottom pressure recorders to provide an ocean-based, in-situ dataset to validate the time-varying component of the GRACE observations. The location of the proposed array is an area around 16°N in the subtropical North Atlantic Ocean, and is the location of an on-going study of the meridional overturning circulation called the Meridional Overturning Variability Experiment (MOVE). This location was selected by virtue of having suitable bottom pressure signal, one that is dominated by large spatial-scale variability on monthly and longer timescales, and is the site of an on-going climatological observation program. Other opportunities to provide groundtruth observations to compare against the GRACE measurements will also be discussed.

The interpretation and utility of the GRACE observations over the oceans will be presented. We describe a method of using those gravity measurements to estimate temporal variations in deep ocean currents. We examine the probable accuracy of the current estimates by constructing synthetic GRACE data, based in part on output from an ocean general circulation model. We ignore the possible contamination caused by short-period gravity signals aliasing into the 30-day solutions. We conclude that in the absence of aliasing, GRACE should be able to recover the 30-day variability of mid-latitude currents at 2 km depth. Additionally, a method for combining satellite altimetry observations with satellite measurements of the Earth's time-varying gravity to give improved estimates of the ocean's heat content will be illustrated. It is found that the inclusion of bottom pressure improves the ocean heat storage estimates. The improvement comes from a better estimation of the steric sea surface using a combination of sea surface height and bottom pressure than over using sea surface height alone.

G72A-0971 1330h POSTER

Progress in the Ground Calibration of GRACE data.

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The calibration / validation of GRACE data is being actively pursued using a ground array of superconducting gravimeters in Europe. This is a project that will be ongoing for a number of years as the improvements to the processing of both satellite and ground-based data are realized. For example, the atmospheric corrections using a 3-D model have been shown to be important to the GRACE mission, and are only now being developed for gravity applications. We continue to analyze the ground-based mean gravity field over Europe from the GGP project, this time for more cent epoch that overlaps with the time window of the CHAMP mission. Previous results have been extended to show that the accuracy of the mean field recovery is at the microgal level. This will provide an interesting comparison with the accuracy of the actual GRACE data that will be presented in this session.

G11A MCC: 123 Monday 0830h

Geodesy at the Solid-Fluid Interface I

(joint with A, H, OS)

Presiding: **R S Gross,** Jet Propulsion Laboratory**; C R Wilson,** University of Texas at Austin

G11A-01 0830h

Inversion of Solid Earth's Varying Shape 1: Global Mean Sea Level Variations

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We develop a spectral approach to invert for the redistribution of mass on the Earth's surface given precise global geodetic measurements of the solid Earth's geometrical shape. We use the elastic load Love number formalism to characterize the redistributed mass as a truncated spherical harmonic expansion on an epoch-by-epoch basis. Integration of the resulting mass distribution over oceanic areas gives us an estimate of ocean-continent mass exchange, and hence the non-steric (mass) component of changes in global mean relative sea level.

We apply this theory to study the contribution of seasonal inter-hemispheric (degree-1) mass transfer to global mean sea level, using weekly GPS station coordinates of the global IGS network after removal of secular motions [Blewitt et al., 2001]. Our inversion yields a seasonal ocean-continent mass exchange with annual amplitude of $(2.9 \pm 0.3) \times 10^{15}$ kg and maximum ocean mass on 25 August. Semi-annual mass exchange takes place with amplitude $(3.6 \pm 2.6) \times 10^{14}$ kg such that the maximum ocean mass increase, in Northern Hemisphere spring, occurs more rapidly than the maximum ocean mass decrease later in the year (consistent with run-off data).

Our estimate of the annual amplitude of global mean relative sea level is therefore 8.0 ± 0.8 mm. Comparison with satellite altimetry, which measures geocentric sea level, requires a small correction for the average deformation of the ocean floor that is consistent with the total loading [Blewitt and Clarke, this meeting], which results in an annual amplitude of global mean geocentric sea level of 7.6 ± 0.7 mm. Results from TOPEX/POSEIDON corrected for steric effects are in the range 7.1 mm to 9.5 mm with maximum sea level occurring between 12 September and 24 September. Assuming the large steric corrections (of order 5 mm in amplitude, half the total effect) are correct, this good agreement between our result and that of altimetric methods implies that seasonal inter-hemispheric mass transfer is indeed the dominant driving mechanism for seasonal change in sea level. In contrast, hydrological models of global mean sea level differ by up to a factor of three between themselves and from geodetic results.

G11A-02 0845h

Inversion of Solid Earths Varying Shape 2: Using Self-Consistency to Infer Static Ocean Topography

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We have developed a spectral approach to invert for the redistribution of mass on the Earths surface given precise global geodetic measurements of the solid Earths geometrical shape. We used the elastic load Love number formalism to characterize the redistributed mass as a spherical harmonic expansion, truncated at some degree and order n. [Clarke and Blewitt, this meeting]. Here we incorporate the additional physical constraint that the sea surface in hydrostatic equilibrium corresponds to an equipotential surface, to infer the non-steric component of static ocean topography.

Our model rigorously accounts for self-gravitation of the ocean, continental surface mass, and the deformed solid Earth, such that the sea surface adopts a new equipotential surface consistent with ocean-land mass exchange, deformation of the geoid, deformation of the sea floor, and the geographical configuration of the oceans and continents. We develop a self-consistent spectral inversion method to solve for the distribution of continental surface mass that would generate geographic variations in relative mean sea level such that the total (ocean plus continental) mass distribution agrees with the original geodetic estimates to degree and order n.

We apply this theory to study the contribution of seasonal inter-hemispheric (degree-1) mass transfer to seasonal variation in static ocean topography, using a published empirical seasonal model for degree-1 surface loading derived using GPS coordinate time series from the global IGS network [Blewitt et al., Science 294, 2,342-2,345, 2001]. The resulting predictions of seasonal variations of relative sea level strongly depend on location, with peak variations ranging from 3 mm to 19 mm. The largest peak variations are predicted in mid-August around Antarctica and the southern hemisphere in general; the lowest variations are predicted in the northern hemisphere. Corresponding maximum continental loading occurs in Canada and Siberia at the water-equivalent level of 200 mm.

The RMS spatial variability about global mean sea level at any given time is 20% for geocentric sea level (as measured by satellite altimetry) versus relative sea level, which is a consequence of degree-1 sea floor displacement in the center of figure frame. While land-ocean mass exchange governs global mean relative sea level, at any given point the contribution of geoid deformation to relative sea level can be of similar magnitude, and so can almost cancel or double the effect of change in global mean sea level.While the sea surface takes on the shape of the deformed geoid, the sea surface everywhere seasonally oscillates about the deformed geoid with annual amplitude 6.1 mm. This effect is due mainly to an 8.0 ± 0.7 mm contribution from land-ocean mass exchange, which is then reduced by a 1.9 mm seasonal variation in the mean geoid height above the sea floor (to which a mass-conserved ocean cannot respond). Of this, 0.4 mm is due to the mean geocentric height of the sea floor, and 1.5 mm is due to the mean geocentric height of the geoid over oceanic areas.

The seasonal gradients predicted by our inversion might be misinterpreted as basin-scale dynamics. Also, the oceans amplify a land degree-1 load by 20–30%, which suggests that deformation (and models of geocenter displacements) would be sensitive to the accuracy of ocean bottom pressure, particularly in the southern hemisphere.

G11A-03 0900h

Degree-1 Earth Deformation From Very Long Baseline Interferometry.

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The presence of degree-1 deformations in very long baseline interferometry (VLBI) measurements is detected for the first time. We compare Goddard Space flight Center 2001 VLBI Terrestrial reference frame solution 2001a_bas [L. Petrov and C. Ma, pers. comm, 2002] with the deformation field predicted by the GPS-determined load moment of Blewitt et al., 2001. The predicted degree-1 series in the center of figure frame have root mean square values up to 3 and 1.5 mm in the up and horizontal components respectively. The predicted baseline series are compared with VLBI baseline series where there are > 50 matching epochs. For the period 1996-2001, 14 baselines out of 35 are significantly correlated (5% significance level). For the period 1985-2001, when a sinusoidal fit to the GPS degree-1 deformation series are used to predict baseline series at all VLBI epochs, 49 out of 110 baselines are significantly correlated (5% significance level).

Both amplitude and phase of annual signals estimated from the VLBI series are consistent with the degree-1 predictions but the average amplitude from VLBI is approximately twice the size and there is a slight phase shift. These differences could be due to higher-degree loading, the VLBI atmospheric pressure loading model or thermal deformation of the VLBI antennas. All four VLBI baselines between sites only in the southern hemisphere have a phase in agreement with the degree-1 series and within the opposite quadrant to the majority of the northern hemisphere-located VLBI baselines, so it is likely that degree-1 dominates the phase of the VLBI annual signals. Since VLBI cannot directly observe an Earth fixed frame these results unambiguously show that the Earth deforms in a degree-1 mode. They also demonstrate the potential of VLBI to indirectly infer changes in the solid Earth center of mass relative to the entire Earth system center of mass (geocenter motions) using knowledge of the Earth's elastic properties (Love numbers).

G11A-04 0915h

Analysis of Possible Global Modes of Earth Deformation from VLBI Measurements

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Observed VLBI site position variations contain significant contributions at annual (3-7 mm for the vertical) and semiannual frequencies. These variations lead to apparent global modes of Earth deformation. For instance, a recent paper by Blewitt et al. (Science, 2001) studied the degree-1 spherical harmonic mode of elastic deformation and estimated components of a degree-1 load moment vector from GPS site position time series at annual and semiannual frequencies. Our analysis of VLBI data shows a similar but smaller annual variation. We examine the sensitivity of the VLBI result to the fact that there are more GPS sites and the GPS sites have better global distribution. We also observe a variation of the VLBI terrestrial reference frame length scale of about 0.5 ppb at the annual period and 0.2 ppb at the semiannual period.

We have investigated the contribution of several geophysical sources or modeling errors to the observed variations of VLBI site position time series and as explanations of the above global modes. Possible geophysical sources are examined using different models for atmospheric pressure loading, hydrological loading, non-tidal ocean loading, and tidal ocean loading. We also estimate the contribution of possible modeling errors that are specific to VLBI measurements: troposphere delay mismodeling and antenna thermal deformation.

G11A-05 0930h

GPS Measurements of Tidally Induced Solid Earth Displacements

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We study load and solid earth tides using globally distributed continuous GPS data and models of ocean and solid earth tides. A two-step strategy is used to maintain reference frame consistency and to allow economical tidal determination for a large number of global sites. First, a fixed network of 45 sites with good geographic coverage and available data is used in daily global analyses to estimate site coordinates, tidal displacements, orbits, and other parameters simultaneously. The daily estimates of tidal displacements are subsequently merged with the least squares method and decomposed into network displacements and deformation with respect to the network. Once tides are determined for the network, the data will be processed again with tides fixed to optimally smooth the orbits and clocks. Tides on any other sites can then be determined using the point-positioning method.

About 500 days of data with a time span of 30 months have been processed for the global network to estimate the amplitudes and phases of 3-dimensional displacements due to M2, S2, N2, K2, K1, O1, P1, and Q1 tides. Displacements with respect to the reference frame attached to the network for M2, N2, O1, and Q1 are determined very well, with RMS repeatabilities between two subsets at the level of 1 to 2 mm for the amplitudes. The RMS amplitude differences between the GPS estimates and predictions from a combination of solid and load tide models are at the level of 1 mm for these 4 tides. GPS results for the other 4 frequencies are a factor of 2 to 3 noisier. The two pairs of frequencies are very close to each other with a beat period of 183 days. Improved results with more data and reduced contamination will be presented. We will also discuss load-induced network transition with respect to the geocenter and earth orientation changes.

G11A-06 0945h

Diurnal Angular Momentum Exchange in the Earth-Atmosphere System

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Diurnal Angular Momentum Exchange in the Earth-Atmosphere System

In the absence of external torques, the Earth system (consisting of the atmosphere, hydrosphere, the solid Earth and core) conserves its total angular momentum. On diurnal time scales, changes in atmospheric angular momentum (AAM) are compensated primarily by opposite changes in the angular momentum of the solid Earth (i.e., crust and mantle). The equatorial component of angular momentum exchange is dominated by pressure torques on the Earth's bulge, while changes in axial AAM are dominated by the effects of local mountain torques. The strongest signals in the motion term (i.e., wind component) of AAM are seen over areas of significant topography, where both mountain and friction torques are active.

At retrograde diurnal frequencies the equatorial AAM budget becomes ill-conditioned, with the torque and momentum approaches giving contradictory results. Since retrograde diurnal motion has low frequency when viewed in a space-fixed (inertial) reference frame, these motions (in particular, the S1 atmospheric tide) can directly impact low-frequency changes in the absolute orientation of the Earth's rotation axis, collectively referred to as nutation. In this study, we explore some of the theoretical and observational obstacles to closing the AAM budget at diurnal frequencies, and present constraints which can be used to verify the consistency of torques calculated from numerical models and reanalysis products.

G11A-07 1000h

Time-variable atmospheric and oceanic excitation of the nutation and comparison with the nutation residuals.

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The major part of nutation is the results of a luni-solar gravitational torque acting on the equatorial bulge. Nevertheless, the interaction between the Earth and the atmosphere/ocean associated with the diurnal cycle in the solar heating also causes slow motion of the Earth rotation axis in space. The effect of the fluid layers on the Earth nutation is computed from the angular momentum conservation of the fluid layers. From the output of high-frequency global circulation models of atmosphere and ocean, 6-hourly angular momentum series are generated. The presently adopted nutation model (MHB2000) only considers constant ocean contributions at the major tide frequency and a constant atmospheric contribution at the one-solar day (S_1) frequency. We compare the residuals between the observed and modeled nutation in the time domain with the atmospheric and oceanic excitation.

G11A-08 1035h INVITED

A Time-Variable Gravity Anomaly due to Recent Extratropic Pacific Water Mass Redistribution

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Cox and Chao [2002] reported the detection of a large anomaly in the form of a positive "jump" in the time series of Earth's lowest-degree gravity harmonic J2, or the dynamic oblateness, during 1998. In this paper we identify strong evidences that point to a likely major cause for this J2 anomaly–a seesaw of the sea-surface height (SSH) in the extratropic north + south Pacific basins. Referred to here as the ExtraTropic Pacific Seesaw (ETPS), it is the leading (nonseasonal) EOF/PC mode in SSH, that we solved from the 10-year TOPEX/Poseidon altimetry data in the extratropic Pacific region. The mode underwent a step-like jump with magnitude and time evolution that match remarkably well with the observed J2 anomaly, assuming that most of the SSH jump was mass-induced and that the steric effect only played a secondary role in this particular seesaw event. In addition, for the steric effect we analyze the leading EOF/PC mode of the sea-surface temperature (SST) in the same region; the result corroborates the above assertion. The behavior of ETPS appears to be part of the Pacific Decadal Oscillation, which shows some level of long-term correlation with the observed J2 series. This study exemplifies an interdisciplinary endeavor where a geophysical observation made by space geodesy leads to insights about certain climatic phenomenon; further studies are needed to help piece together a more complete story.

G11A-09 1050h

An Investigation of Recent Observed Changes in the Earths Oblateness

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Large changes in the Earths oblateness beginning in 1998 have recently been detected using Satellite Laser Ranging (SLR). These changes are consistent with mass moving from the higher latitudes into the equatorial region, and are the largest such changes observed since SLR started tracking the phenomena in the late 1970s. We have conducted a comprehensive investigation into the source of these changes. We have compared SLR results from several different research groups, and concluded there is no problem with the data analysis. We have considered a variety of possible geophysical sources including tide modeling errors, atmospheric mass redistribution, and ocean mass redistribution. Of these, the ocean appears to be the most likely source of the observed oblateness changes. Specifically, the changes appear to be concentrated in the Pacific Ocean. The observed oblateness variations are highly correlated with the Pacific Decadal Oscillation (PDO). We investigated the mass variations in the oceans using two different sources: 1) the ECCO ocean model, and 2) TOPEX/Poseidon sea level measurements corrected for steric sea level change using sub-surface temperature observations. These results explain a significant fraction of the observed oblateness changes, but are somewhat smaller in magnitude. Detailed results from these calculations will be presented.

G11A-10 1105h

Variations in the Earth's Gravitational Potential Caused by Pressure Changes at the Core-Mantle Boundary

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The elliptical part of Earth's gravitational potential field (J_2) varies with time. The main cause of the variations is the redistribution of mass in the ocean-atmosphere-cryosphere system, which produces a seasonal signal. Once this signal is subtracted from the data, there remains a slow linear drift, which can be accounted by postglacial rebound. However, recent observations suggest that a considerable departure from this linear trend has occurred since 1998. The change in the trend is difficult to reconcile with the slow process of postglacial rebound and therefore suggests the presence of at least one additional physical mechanism that participates in the temporal changes of J_2.

One plausible agent for the variations in J_2 is the flow in the Earth's core. A geomagnetic jerk has been observed at the time of the trend shift, which indicates a possible correlation between the flow in the core and changes in J_2. Furthermore, a recent study showed that geomagnetic jerks are well explained by simple flow models in the core which consists of rigid azimuthal oscillations of co-axial cylindrical shells. Such a flow produces equatorially symmetric variations in the pressure field at the core-mantle boundary (CMB), which create small radial deformations of the fluid-solid interface and lead to changes in J_2. In this work we investigate the amplitude and the variations in J_2 that are produced in this manner. We show that the same flow that explains the magnetic jerks can also explain some of the changes in J_2.

G11A-11 1120h

Local Sea Level Fingerprinting of Glacier Mass Balance

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Recent research has demonstrated that melting of individual ice reservoirs produces a distinct signature, or 'fingerprint', in the accompanying global sea level record [Mitrovica et al., 2001; Plag and Juttner, 2001]. These fingerprints, in combination with suitably robust and geographically distributed observational constraints, provide a method for estimating the individual sources of present-day global sea-level rise. In our previous work, we examined the mass balance of the Antarctic and Greenland ice sheets using secular sea-level rates obtained from a subset of the available tide gauge data base. In this talk we focus on the regionally localized patterns of sea-level change associated with melting of mountain glacier complexes. In this case, significant melting (or growth) of the glacier produces a region of rather dramatic sea level fall (or rise) surrounding the glacier, and thus sea-level records close to the complex will be a highly sensitive indicator of ice mass flux and dynamics. As an illustration, we show predictions of the impact on tide gauge and sea-surface levels of a rapid melting event recently inferred for the Alaskan/British Columbian glacier system [Arendt et al., 2002].

G11A-12 1135h

Seasonal Re-distribution of Atmospheric Mass on Mars Detected From Radio Tracking of Mars Global Surveyor

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Space geodetic techniques pioneered for application to Earth dynamics are now achieving a level of accuracy that enable analog studies of the terrestrial planets. Using X-band radio tracking of the Mars Global Surveyor spacecraft, we have measured temporal changes the long-wavelength gravity field of Mars that correlate, to first order, with the pattern expected due to the seasonal re-distribution of carbon dioxide between the atmosphere and surface. Detecting these gravity field changes requires isolating perturbations in the velocity of the MGS spacecraft of $\sim 5\ \mu s^{-1}$. A comparison of very low degree gravity coefficients determined every 5 days shows an annual variation in the relative position of Mars' center-of-mass ($C_{1,0}$ spherical harmonic gravity coefficient) is 4% smaller in amplitude and 21° different in phase compared to the signal predicted by a simulation of CO_2 exchange over a typical Mars year by the Ames General Circulation Model (GCM). The temporal change in the planetary flattening ($C_{2,0}$ spherical harmonic coefficient) displays both annual and semi-annual components that are more complex than predicted by the GCM. These temporal gravity measurements can be used as a proxy for the global re-distribution of CO_2 and can be related to the mean global atmospheric pressure. Results for the MGS mapping mission are generally consistent with but more complex than predicted by the GCM and may provide a measure of the stochastic variability of the seasonal process of volatile exchange.

G12A MCC: Hall C Monday 1330h

Geodesy at the Solid-Fluid Interface II Posters *(joint with A, H, OS)*

Presiding: **R S Gross,** Jet Propulsion Laboratory**; C R Wilson,** University of Texas at Austin

G12A-1043 1330h INVITED POSTER

The Global Geophysical Fluids Center of IERS (and its Special Bureau for Mantle)

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The Global Geophysical Fluids Center (GGFC) was established by the International Earth Rotation Service (IERS) on IERS's 10th anniversary day January 1, 1998, in an effort to expand IERS's services to the scientific community. Under the GGFC, eight Special Bureaus (SB) have been selected, each to be responsible for research and data service activities pertaining to mass transports and related geophysical processes in specific components of the Earth system, or "global geophysical fluids," including the atmosphere, oceans, solid Earth, core, and geophysical processes of gravity, loading, tides and hydrological cycles. GGFC and the SBs have the responsibility of supporting, facilitating, and providing services to the worldwide research community, in areas related to the variations in Earth rotation, gravity field and geocenter that are caused by mass transport in the global geophysical fluids. These minute variations have been observed by various space geodetic techniques, as effective remote sensing tools, with ever increasing precision/accuracy and temporal/spatial resolution. The GGFC and SBs have organized dedicated workshops and special sessions at international conferences, published articles, and held regular business meetings. The SBs maintain individual website for data services and information exchanges. See URL bowie.gsfc.nasa.gov/ggfc/. In particular, the SB for Mantle focuses on large-scale mass redistributions that occur in the mantle in association with various dynamic processes, including seismic activities, the post-glacial rebound, and mantle convections.

G12A-1044 1330h INVITED POSTER

Activities of the Special Bureau for the Atmosphere of the IERS

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As a component of the Global Geophysical Fluids Center of the International Earth Rotation Service, we collect, archive, make available, and advise on atmospheric information related to global geodetic studies. Due to exchanges of angular momentum between solid Earth and atmosphere, records of atmospheric angular momentum possess most of the variance in that of the solid Earth on timescales between several days and years. Thus the axial and equatorial components of Earth momentum related to length of day and polar motion, respectively, are strongly tied to the signature of winds and atmospheric mass. We have records up to several times per day from several of the worlds large weather centers in which we have studied the angular momentum covering over 99 percent of atmospheric mass. When angular momentum from such a domain is considered, it captures many of the climate related signatures associated with intraseasonal and interannual variability, such as Madden-Julian oscillations, the El Nino/Southern Oscillation, and the North Atlantic Oscillation. Such angular momentum associations also exist at very high (daily and subdaily) and very low (decadal and longer) frequencies. Models of the atmosphere also reproduce the signatures necessary to determine the angular momentum, though less perfectly. The torques that dynamically relate the atmosphere to the Earth through its lower interface, including transfer