

G51C-08 1205h INVITED

Inner Core Tilt and Polar Motion:
Probing the Dynamics Deep Inside
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A tilted inner core permits exchange of angular momentum between the core and the mantle through gravitational and pressure torques and, as a result, changes in the direction of Earth's axis of rotation with respect to the mantle. Some of the observed variations in the direction of Earth's rotation could then be caused by equatorial torques on the inner core which tilt the latter out of its alignment with the mantle. In this work, we investigate whether such a scenario could explain the decade polar motion known as the Markowitz wobble. We show that a decade polar motion of the same amplitude as the observed Markowitz wobble requires a torque of 10^{20} N m which tilts the inner core by 0.07 degrees. This result critically depends on the viscosity of the inner core; for a viscosity less than 5×10^{17} Pa s, larger torques are required. A torque of 10^{20} N m with decadal periodicity can perhaps be produced by electromagnetic coupling between the inner core and a component of the flow in the outer core known as torsional oscillations, provided that the radial magnetic field at the inner core boundary is on the order of 3 to 4 mT and satisfies certain geometrical constraints. The resulting polar motion thus produced is eccentric and polarized, in agreement with the observations. Our model suggests that equatorial torques at the inner core boundary might also excite the Chandler wobble, provided shorter wavelength torsional oscillations with higher natural frequencies have enough power or provided there exists another physical mechanism that can generate a large torque at a 14 month period.

G52A MCC: Level 1 Friday 1330h
High-Rate GPS: Infrastructure and
Applications Posters (joint with S)Presiding: M Caissy, NRCAN; G
Weber, BKG

G52A-0037 1330h POSTER

High-Rate GPS Data From the National
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The U. S. National Continuously Operating Reference Station (CORS) network contains 100+ stations that collect GPS data at a 1-hertz rate. Organizations that operate these high-rate CORS include the Federal Aviation Administration (FAA) and the States of Florida, Michigan, North Carolina, Ohio, Pennsylvania, and Vermont, as well as other organizations. The FAA-operated CORS comprise the Wide Area Augmentation System that serves primarily to enable safe and efficient air navigation. The remaining high-rate CORS serve primarily to enable highly accurate static and kinematic positioning, especially for postmission surveying and mapping applications. NOAA's National Geodetic Survey currently distributes GPS data from these high-rate CORS with a 1-hour latency. A significantly shorter latency is technically possible for many of these CORS.

URL: <http://www.ngs.noaa.gov/CORS/>

G52A-0038 1330h POSTER

A multipurpose high-rate GPS
observatory for northwestern Mexico[emil.robert.kursinski](mailto:emil.robert.kursinski@atmo.arizona.edu)¹ (kursinsk@atmo.arizona.edu)Richard A Bennett² (rbennett@cfa.harvard.edu)Andrea Hahmann¹ (hahmann@atmo.arizona.edu)¹University of Arizona, 1118 E. Fourth St, Tucson, AZ 85721, United States²Harvard-Smithsonian Center for Astrophysics, 60 Garden Street, MS 42, Cambridge, MA 02138, United States

We describe a proposed joint atmospheric and geophysical high-rate GPS observatory in northwestern Mexico complementing and extending analogous networks in the United States. The observatory would measure atmospheric water vapor during the North American Monsoon Experiment (NAME) as well as crustal velocities within and across the Gulf of California and the Mexican Basin and Range region for geodetic applications. The NOAA-sponsored NAME scheduled for several summers beginning in 2004 addresses the challenging issue of determining and improving the predictability of warm season precipitation in the mountainous region of the Northwestern Mexico and Southwestern US. Much of the rainfall in the region comes during the North American Monsoon each summer. Rainfall in the region is particularly difficult to model and predict because the orography and the complex land-sea geometry of the region with moisture sources in the Gulf of Mexico, Gulf of California and the eastern subtropical Pacific Ocean. The GPS provides accurate, near-continuous observations of water vapor in clear and cloudy air needed to sample the large diurnal variations in the dynamic and thermodynamic properties of the atmosphere. GPS in combination with wind and other measurements scattered in and around the region will provide much needed constraints to determine quantitatively the sources supplying moisture for precipitation within the NAME area. Tectonic applications of this continuous GPS network in Mexico include high-precision determinations of plate boundary deformation in and around the Gulf of California and possible diffuse deformation within the Mexican Basin and Range province. Because of the high sampling rate (1 Hz), the network will also provide data for seismological applications, including surface wave studies (e.g., Larson et al., SCIENCE, 2003) and potential near-field displacement records. Furthermore the network would complement the US-based Plate Boundary Observatory (PBO) facility by extending continuous GPS coverage into northern Mexico and other relatively smaller-scale continuous GPS networks in southern Mexico as well as provide important data for surveying and mapping applications. Several years of observations are required to capture the substantial year-to-year variations in the monsoon and yield accurate estimates of tectonic motion. Both objectives can be accomplished relatively inexpensively with the simple and robust GPS observations made in collaboration with investigators in Mexico.

G52A-0039 1330h POSTER

NTRIP: Networked Transport of RTCM
via Internet Protocol - Internet Radio
Technology for Real-Time GNSS
Purposes[Harald Gebhard](mailto:harald.gebhard@uni-dortmund.de)¹ (+49-2317552722;
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The massive worldwide growing of Internet capacity enables the introduction of new services such as Internet Radio or Internet Video-on-Demand, which transfer continuous data-streams by IP-packages. These services include the data transport via mobile IP-Networks like GSM, GPRS, EDGE, and UMTS where costs are nowadays rapidly decreasing. As a consequence, the global Internet can be used for the real-time collection and exchange of GNSS data, as well as for broadcasting derived differential products. Compared to Multimedia applications, the bandwidth required for streaming GNSS data is relatively small. The introduction of a real time streaming of GNSS data via Internet as a professional service is demanding with respect to network transparency, network security, program stability, access control, remote administration, scalability and client simplicity. This paper will discuss several possible technical/protocol solutions for streaming GNSS data over the Internet: Unicast vs. IP-Multicast, TCP vs. UDP, Client/Server vs. Client/Server/Splitter architecture. Based on this discussion, a novel HTTP-based technique for streaming GNSS data to mobile clients over the Internet is introduced. It allows simultaneous access of a large number of PDAs, Laptops, or GNSS receivers to a broadcasting host via Mobile IP-Networks. The technique establishes a format called "Networked Transport of RTCM via Internet Protocol" (NTRIP). NTRIP is designed for disseminating differential correction data (e.g. in the RTCM-104 format) or other kinds of GNSS streaming data.

G52A-0040 1330h POSTER

Large Scale GPS Processing at ESOC
for LEO, GNSS and Real-Time
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Most POD systems that are used in GPS data analysis, for instance in routine IGS processing, are large FORTRAN programs that have evolved from early generation systems over many years of use. These systems do not exploit the advantages of modern software engineering technology, and their limited processing efficiency constrains their application to emerging large-scale GPS processes, like real-time GPS, high-rate data processing or combined solutions for LEO + MEO constellations. In support of such high-performance applications, the ESOC IGS Analysis Centre is developing a new POD system based on the latest software engineering methods. This system is optimised in its use of both CPU and memory, following fundamental rules of minimum information containment that are more commonly found in internet search engines or artificial intelligence applications. Although this new system still has an experimental status it is expected to augment the GPS data processing capacity at ESOC by at least one order of magnitude. Some innovative concepts behind the system will be presented, together with first examples of GPS processes that until now were prohibitively large or slow.

G52B MCC: Level 1 Friday 1330h

Signal Versus Noise in GPS Height
Time Series II PostersPresiding: T van Dam, European
Center for Geodynamics and
Seismology; G Blewitt, Nevada
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G52B-0041 1330h POSTER

GPS observations of Ocean Tide
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Model predictions show that ocean tide loading (OTL) in the British Isles is particularly large (up to several cms in the S. W. of Britain). The primary cause of uncertainty in OTL models is the ocean tide models on which they depend. Interaction of the tides in the open oceans and the more restricted coastal regions, along with the intricate shape of the coastline, make accurate modelling of OTL in the British Isles difficult. Therefore an approach to directly measure these effects has been devised, using data gathered from a network of continuously operating GPS receivers (COGRs), in an attempt to validate or improve existing OTL models. We observe OTL at diurnal and semi-diurnal periods by directly estimating fixed-period harmonic motions within individual daily GIPSY/OASIS II GPS analyses. This approach enables us to solve separately for the tropospheric zenith wet delay (ZWD) as a random-walk parameter. An iterative Kalman Filter approach to combine the multiple daily solutions enables us to isolate the principal near-diurnal (K_1 , O_1 , P_1 , Q_1) and near-semi-diurnal (M_2 , S_2 , N_2 , K_2) OTL components. A preliminary test shows that data from six UK sites produce estimates which are in good agreement with OTL predicted by the FES99 model, where values vary from 3-43 mm in amplitude (M_2) at the six sites. Our final estimates are generated using approximately 1000 days of data in the solution, resulting in amplitude standard deviations of approximately 1 mm per component (compared with an RMS difference between OTL models of 2 mm per component). However, the phase estimates of the OTL components take much longer to

converge. Phase standard deviations for M_2 remain approximately around 10 degrees after 1000 days and 20-40 degrees for the remaining components (compared to the phase RMS between OTL models of 1-17 degrees for the larger amplitude signals). We also show that our estimates are stable for the majority of OTL components when data from at least 90 days are stacked, with an amplitude standard deviation of approximately 2 mm. Exceptionally, the K_1 component requires at least 200 days of data before similar confidence levels are achieved.

URL: http://www.staff.ncl.ac.uk/m.a.king/UK_otl.htm

G52B-0042 1330h POSTER

The Effect of SCIGN Domes on the Vertical Antenna Phase Centre Position in Routine Processing of GPS Data

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The question of phase centre shifts for GPS antennas introduced by the addition of domes is receiving more attention as the number of continuous GPS sites multiply and the precision of solutions continue to improve. Our earliest experiences with clear acrylic domes used in the Western Canada Deformation Array (WCDA) had shown that changes in the vertical position of the phase centre exceeding 1.5 cm could be caused by the introduction of a dome. More recently, our deployments of SCIGN domes at WCDA sites showed no discernable shifts in the horizontal components but apparent shifts of over 2 cm in the estimates of height. Such large shifts have also been observed in practice by others but have remained puzzling since calibration tests carried out by SCIGN and by NGS indicate maximum vertical shifts of only a few millimetres. Tests with the SCIGN short dome carried out at our GPS site at the Pacific Geoscience Centre (PGC5) demonstrate clearly that domes can introduce an elevation-dependent ($1/\cos Z$) delay and consequently, the nominal mounting of SCIGN domes biases the tropospheric zenith delay resulting in an apparent shift in the L3 estimate of station height. Since estimates of the tropospheric delay are strongly dependent on the elevation cut-off used in the analysis as well as local site horizons, it is not possible to provide an "absolute" calibration correction for this effect. However, mounting the SCIGN dome so that its centre of curvature coincides with the mean position of the L1/L2 phase centres of the Dorne Margolin element significantly reduces this bias and effectively eliminates the large spurious change in height. This "dome effect" can be explained in terms of "lensing" of incident plane waves inside the dome.

G52B-0043 1330h POSTER

Temporal Characteristics of GPS Coordinate Series Obtained From the Global IGS Tracking Network

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We have investigated continuous coordinate time series of more than 300 globally distributed IGS GPS-sites. The time series cover a 4 years period ranging from GPS week 1021 until GPS week 1230 (August 1999 till August 2003). The input data, which stems from the weekly SINEX solutions of eight different IGS Analysis Centres (ACs), has been analysed for signal, noise and outliers. Software has been developed which allows for the detection and proper filtering of position outliers prior to the spectral analysis. Moreover, robust interpolation methods were implemented to deal with gaps in the time series. Afterwards a spectral analysis has been performed for both the horizontal and the vertical component. Although all IGS ACs take into account solid Earth tide effects when processing station coordinate series we still have detected remaining power at the tidal frequencies, predominately in the annual and semi-annual band. Vertical movements, in the order of 5 mm, may stem from atmospheric and oceanic loading or are due to environmental effects like snow or the ground water cycle. In a worst case scenario, they reflect unreported changes of the stations hardware. The poster presents results of the spectral

analyses for a number of stations around the globe and gives reasonable estimates for the noise component in the time series. In addition, examples of "apparent" site-movements of a few cm that do not yet have a reasonable explanation are shown.

G52B-0044 1330h POSTER

Estimation of GPS Site Height by using Dynamic Hydrostatic and Wet Mapping Functions Based on Radiosonde Refractivity Profile

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GPS site height time series of GEONET (GPS Earth Observation Network which consists of about 1000 sites) of GSI (Geographical Survey Institute) in Japan show seasonal variations and several days variations of several ten mm. If some of the variations come from atmosphere, the one of the most plausible error sources in the atmosphere is "climatic" mapping function generally used in GPS analyses. We thus studied characteristics of site height time series of GEONET and "dynamic" mapping function (DMF) based on radiosonde profiles. We estimated GPS site heights by using the DMF and compared those with estimates by using climatic mapping function. Radiosonde data of 20 sites observed by JMA (Japan Meteorological Agency) and GEONET site coordinate time series based on GSI's routine analysis from 1997 to 2002 were used. After correction of offsets of height caused by earthquakes, periodic variations of the height time series were computed by fitting sinusoidal harmonic function to the time series. We analyzed four GEONET sites near radiosonde sites for two years in 2001 and 2002 by using Bernese GPS software. The reference site locates in the central Japan and mean distance of other three sites from the site is about 1000 km. DMF was computed by ray tracing, where isotropic distribution of refractivity in spherical layers was assumed. Because in-situ surface meteorological observation is not available in GEONET sites, we interpolated surface meteorological data observed at about 150 sites to the GEONET sites. The hydrostatic DMF was used to compute slant hydrostatic delays and the wet DMF and its derivative were used to estimate hourly zenith wet delay with daily coordinates. The estimates were compared with those by using Niell's mapping function (NMF) [1996]. The annual component of the height time-series of GSI's routine analysis have mean amplitude of about 10 mm and show extremum around day of year (DOY) 30 and 210. The hydrostatic DMF has significant annual variations from 0.2% to 0.5% of mapping factor, and it is about two times larger than those of NMF in the northern Japan while the mapping factors of DMF and NMF show almost similar in the southern Japan. Those in wet DMF are about 1% at the four sites. Mapping factors of hydrostatic and wet DMF show maxima around the end of January and the middle of January, respectively. The difference of two height time series of NMF and DMF shows seasonal variations of about 2-3 mm, where the magnitude is about two times larger than the difference of two height time series by using NMF and NMF but ignoring annual variation of its hydrostatic term. Several day variations of about 3 mm are also seen in the difference of two height time series of NMF and DMF. We have confirmed that most of the seasonal trend in the difference came from hydrostatic term of DMF, and that several day variations in the difference are contributed by both hydrostatic and wet DMFs, where the former is larger in winter season and the latter is larger in summer season, respectively. The facts suggest that hydrostatic DMF is important to remove systematic annual variations which can not be explained climatic mapping function. However, the magnitude of the seasonal variations in the difference of the two height time-series of DMF and NMF are too small to explain those in height time series of about 20mm.

URL: <http://www3.zero.ad.jp/ted>

G52B-0045 1330h POSTER

Precise Vertical Station Velocity Estimates in Regional GPS Networks: Monitoring UK Tide Gauge Sites

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Absolute vertical land/crustal motion rates derived from GPS are required by many geophysical research applications. However, due to the higher noise level in the vertical compared to the horizontal components, quantitative analyses are more difficult and require much longer observation time spans in order to arrive at significant vertical station velocity estimates. Through the analysis of the unfiltered and common mode filtered ITRF2000 coordinate time series of 17 stations in the UK and France, of which 8 are co-located with or close to tide gauge stations, the issues of noise in GPS height time series and the reference frame definition in regional networks are investigated and a strategy for routine analysis is formulated. Using Maximum Likelihood Estimation (MLE) and the empirical methods by Williams [2003] and Mao *et al.* [1999], the stochastic properties of the height time series are described. The MLE is carried out for several noise models identifying a white plus power-law noise model as the best stochastic model closely followed by a white plus flicker noise model. The results for the white plus flicker noise model suggest that it can be used in weekly or monthly analyses, whereas the currently time consuming white plus power-law model is recommended at, e.g. annual or inter-annual intervals. Both empirical methods are compared to the MLE with a white plus flicker noise model and their level of agreement to the MLE is evaluated. The vertical station velocity and uncertainty estimates obtained from these analyses are then compared with vertical land movement estimates from absolute gravimetry and tide gauge measurements, geological information, and to predicted vertical crustal motions computed for several glacial isostatic adjustment models. This comparison reveals an offset in the absolute GPS vertical station velocity estimates which is attributed to the reference frame definition. From this the authors conclude that GPS in the vertical component can currently only be used for relative vertical station velocities and that GPS at tide gauge sites offers the unique opportunity to test for this reference frame bias.

G52B-0046 1330h POSTER

Assessment of Noise in GPS Time Series for the Stations in mid and Southern Latitudes

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The noise characteristics in the time series of daily position estimates for 15 GPS stations from India to Antarctica through Indian Ocean were assessed with 4 years of data using the power spectrum analysis. The analysis reveals that the white noise whose spectral index is 0.4 in addition to flicker noise whose spectral index is between 0 and 1 constitute the total "fractal white" noise in the time series. Combination of white noise (time independent) and coloured or flicker noise (time correlated) enables to characterize the errors in the time series of coordinates. We followed the approach of Ailin Mao *et al.*, and used non-linear least squares to estimate the spectra and detected the signals buried in wide band noise. We present the results of how Fourier spectrum and least squares can be used to estimate the periodogram of time series, depending on whether the data are evenly spaced in time or not. The power spectra analysis of the stations from Hyderabad, India to Maitri, Antarctica shows significant variations (an increasing trend) in the Height component of the time series. The exact geodetic signals thus extracted after improved characterization of errors and noise resulted in improved accuracy of the estimated velocity vectors of the chosen GPS sites by a factor of 10-12, thereby enabling the Indian Plate Kinematics studies to be more reliable and consistent and also to reevaluate the existing Global Plate Motion Models.

G52B-0047 1330h POSTER

Towards a Realistic Uncertainty Budget for GPS Heights

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Precise GPS-determined heights play a key role in many geodetic and geophysical applications, in particular as input for studies on loading or rebound effects. For a meaningful interpretation of the heights and height changes their effective uncertainty has to be considered. It consists of stochasticity (reflecting the purely random component) and imprecision due to unknown systematic deviations between observations and model. Its assessment is indispensable for the distinction between signal and noise. In case of local GPS networks the entire uncertainty budget can sufficiently be described by normally distributed measurement errors since many disturbing effects are cancelled out by measurements methods or analysis strategies. In case of regional (or global) networks imprecision becomes the dominant component. In the common approach, both components are modeled by stochastic means. However, there are two main shortcomings yielding too optimistic uncertainty measures of the results. First, this strategy pretends a reduction of systematics. Second, since GPS permanent networks provide a sufficiently large number of observations, the total uncertainty of the results will decrease below any limit. As both effects massively contradict any practical experience, stochasticity and imprecision should be treated in a more adequate way. For this purpose, this contribution focuses on the description of imprecision by means of deterministic intervals without any stochastic properties. In a first part, the imprecision of GPS phase observations is quantified by intervals using a forward modelling approach based on a set of basic parameters. The different processing and correction steps which are applied to the original GPS observations in GPS data analysis (such as, e.g., due to tropospheric or ionospheric refraction, or antenna phase center variation) are studied in detail. As a result, typical imprecision intervals are composed which show the impact of standard correction models as well as of different baseline lengths and satellite constellations. In a second part, these intervals are transferred to the estimated point coordinates. It will be shown that the imprecision is maximum for the vertical coordinate component (height). This is similar to the random errors which are adequately represented by the variance-covariance matrix. The extended uncertainty is finally derived by superposing stochasticity and imprecision. Numerical examples are computed for a network of GPS permanent stations in Europe (EUREF) in order to illustrate the theoretical results.

G52C MCC: Level 1 Friday 1330h

Seasonal Signals in Space Geodetic Solutions Posters

Presiding: G Blewitt, Nevada Bureau of Mines and Geology and Seismological Laboratory; D Dong, Jet Propulsion Laboratory, California Institute of Technology

G52C-0048 1330h POSTER

The effect of the second order GPS ionospheric correction on receiver positions

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The Global Positioning System (GPS) transmits two frequencies, allowing users to correct for the first-order ionospheric signal group delay (or phase advance) of 1-50 m. The second-order ionospheric term, caused by the Faraday rotation effect induced by the Earth magnetic field, is about 1000 times smaller and usually ignored. In this study, we implement the 2nd-order correction suggested by Bassiri and Hajj [1993] and investigate its effect on GPS-inferred station positions. The correction causes a latitude dependent 0.1-0.5 cm

southward shift to the position which is roughly proportional to the integrated electron density above the receiver, and has strong diurnal, seasonal and decadal signatures. By analyzing a three-year time series of equatorial station positions obtained without the 2nd-order correction, a strong semi-annual north-south oscillation is observed, the origin of which has not been hitherto explained. We verify that this apparent oscillation can be largely removed once the 2nd-order correction is applied.

G52C-0049 1330h POSTER

Groundwater-Driven Vertical Movement in Tsukuba Detected by GPS

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Seasonal variations observed in the vertical coordinate timeseries of an IGS site TSKB (in Tsukuba, Japan) are investigated. First, we compared the GPS timeseries with the vertical displacements measured by a subsidence meter installed in a 190m-well near the site. It is found that the coherence between the two timeseries is as high as 0.7 and admittance is close to 1. Since the subsidence meter measures displacements occurred in the depth shallower than 190m, it suggests that the seasonal variations in the GPS timeseries are also caused in the corresponding depth. Here we focused on the ground-water as a possible cause of the displacements. A simple model is employed where strains caused by pore pressure changes in water tables are responsible for the vertical coordinate changes. Assuming the static pressure caused by the water column in wells are in equilibrium with the pore pressure in the corresponding water table, we simulate the vertical displacements using the water-level changes observed in the nearby wells, and estimate the volume compressibility of the rocks in the water tables by a least-square method. It is found that water tables between 40m and 190m are responsible for the displacements, and the model successfully explains 65% of the variances of the GPS timeseries. The volume compressibility of the rocks in the water tables is estimated to be $3 \times 10^{-9} N/m^2$, which is a reasonable value. Our hypothesis that the water tables deeper than 40m are responsible is consistent with the fact that TSKB station and the Tsukuba VLBI station, which has a basis on the top of the water table just below 40m, move coherently.

G52C-0050 1330h POSTER

Laser, GPS and absolute gravimetry vertical positioning time series comparison at the OCA observatory, France

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Time-dependent displacements of stations usually have magnitude close to the accuracy of each individual technique, and it still remains difficult to separate the true geophysical motion from possible artifacts inherent to each space geodetic technique. The Observatoire de la Côte d'Azur (OCA), located at Grasse, France benefits from the collocation of several geodetic instruments and techniques (3 laser ranging stations, and a permanent GPS) what allows us to do a direct comparison of the time series. Moreover, absolute gravimetry measurement campaigns have also been regularly performed since 1997, first by the "Ecole et Observatoire des Sciences de la Terre (EOST) of Strasbourg, France, and more recently by the Royal Observatory of Belgium. This study presents a comparison between the positioning time series of the vertical component derived from the SLR and GPS analysis with the gravimetric results from 1997 to 2003. The laser station coordinates are based on a LAGEOS -1 and -2 combined solution using reference 10-day arc orbits, the ITRF2000 reference

frame, and the IERS96 conventions. Different GPS weekly global solutions provided from several IGS are combined and compared to the SLR results. The absolute gravimetry measurements are converted into vertical displacements with a classical gradient. The laser time series indicate a strong annual signal at the level of about 3-4 cm peak to peak amplitude on the vertical component. Absolute gravimetry data agrees with the SLR results. GPS positioning solutions also indicate a significant annual term, but with a magnitude of only 50% of the one shown by the SLR solution and by the gravimetry measurements. Similar annual terms are also observed on other SLR sites we processed, but usually with lower and various amplitudes. These annual signals are also compared to vertical positioning variations corresponding to an atmospheric loading model. We present the level of agreement between the different techniques and we discuss possible explanations for the discrepancy noted between the signals. At last, we expose explanations for the large annual term at Grasse: These annual variations could be partly due to an hydrological loading effect on the karstic massif on which the observatory is located.

G52C-0051 1330h POSTER

Common-mode Signals Observed from the Korean GPS Network

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As of September 2003, there are more than 70 permanent Global Positioning System (GPS) stations in South Korea. We have been observing the three-dimensional velocity of each site for geodynamical studies in the northeast Asia. From the time series of the estimated site positions, most of which are longer than three years now, we found very interesting common-mode signals. Especially, in the vertical direction, the amplitude of the seasonal (annual) signal reaches up to a few centimeters. Other than the seasonal signal, we also could observe very intriguing dips and peaks occurring randomly. In this discussion, we will first introduce the current Korean GPS Network and will show two different ways to get the common-mode signals from a set of time series. By trying out many different data processing schemes, we will infer the best candidates for the real cause for those common-mode signals.

G52C-0052 1330h POSTER

Analysis of Site Position Time Series Derived From Space Geodetic Solutions

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This presentation deals with the analysis of station coordinate time series obtained from VLBI, SLR, GPS and DORIS solutions. We also present time series for the origin and scale derived from these solutions and discuss their contribution to the realization of the terrestrial reference frame. For these investigations we used SLR and VLBI solutions computed at DGFI with the software systems DOGS (SLR) and OCCAM (VLBI). The GPS and DORIS time series were obtained from weekly station coordinates solutions provided by the IGS, and from the joint DORIS analysis center (IGN-JPL). We analysed the time series with respect to various aspects, such as non-linear motions, periodic signals and systematic differences (biases). A major focus is on a comparison of the results at collocation sites in order to identify technique- and/or solution related problems. This may also help to separate and quantify possible effects, and to understand the origin of still existing discrepancies. Technique-related systematic effects (biases) should be reduced to the highest possible extent, before using the space geodetic solutions for a geophysical interpretation of seasonal signals in site position time series.