IVS Newsletter

Issue 29, April 2011

Hasta Pronto en Madrid – IGN Hosts GM2012

– Francisco Colomer, IGN Spain and Dirk Behrend, NVI, Inc./GSFC

The 7th IVS General Meeting (GM2012) will be hosted by the National Geographical Institute of Spain (IGN) in Madrid. The meeting will take place from 5 to 9 March 2012; a reception is anticipated to be held at the Royal Observatory of Madrid on 4 March 2012.

Royal Observatory of Madrid, venue of the 7th IVS General Meeting.

The meeting will include three full days of oral and poster contributions, an Analysis Workshop, and an IVS Directing Board meeting. Under the theme "Launching the Next-Generation IVS Network", GM2012 will focus, among other things, on the VLBI2010 implementation and its implications for the Global Geodetic Observing System (GGOS).

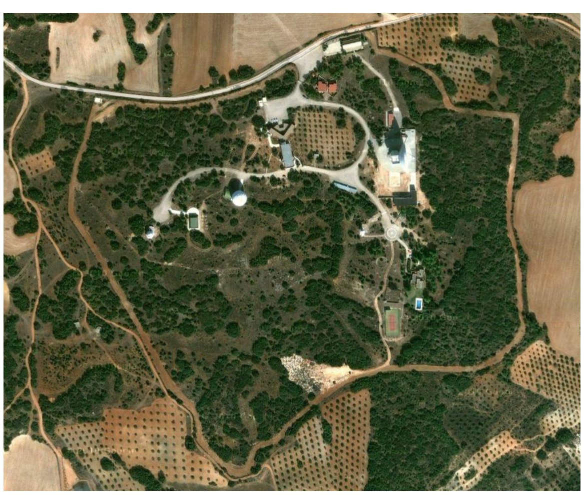
We are confident that the content of the general meeting will be of interest to the broad spectrum of IVS members as well as to the wider VLBI and Earth science communities. All IVS Members and individuals who have interests in the various applications and research fields of VLBI such as geodesy, astrometry, Earth sciences, and related fields are encouraged to attend the meeting and to make an oral or poster presentation. Non-IVS members are cordially invited to attend the meeting and to make a presentation.

The main sessions will be held at the facilities of the Royal Observatory of Madrid, which was founded in 1790 and is located in the very heart of the city next to the Atocha train station. The Observatory is in walking distance to famous landmarks and museums such as the "Retiro" park, the Prado and Thyssen-Bornemisza museums.

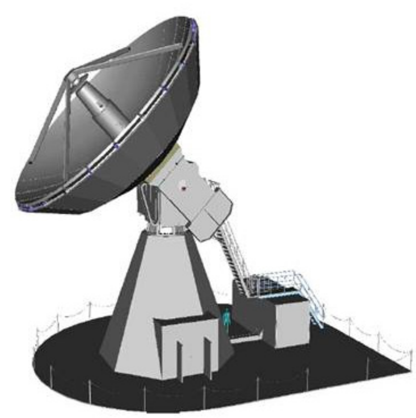
We plan on arranging a visit to the facilities of Yebes Observatory, including the construction site of the new VLBI2010 antenna of the RAEGE project, the 40-meter radio telescope which takes part regularly in the IVS observing program, the older 14-meter antenna with which IGN started geodetic VLBI activities in 1995, and the gravity station.

The atmosphere and flair of Madrid, a very attractive city thanks to its history, culture, and gastronomy, will be conducive to a very successful meeting... All in all, ingredients for an unforgettable experience!

More information will be made available on the meeting Web page at http://www.oan.es/gm2012/



Aerial view of the Yebes Observatory.



Artist's rendition of the new RAEGE VLBI2010 antenna design.

KASI Combination Center

– Younghee Kwak and Jungho Cho, Korea Astronomy and Space Science Institute

KASI is one of the two Combination Centers of the IVS. Newsletter editor Hayo Hase interviewed Younghee Kwak and Jungho Cho remotely to get a better picture about this young group and the situation in Korea. Read what he learned.

How did the geodetic VLBI get started in Korea?

Prof. Tuhwan Kim, Younghee Kwak, and Jungho Cho at the IVS General Meeting 2006 in Concepcion, Chile. (Photo: Volkmar Thorandt)

In 1995, the first VLBI observation was conducted by National Geographic Information Institute (NGII, South Korea) and Geospatial Information Authority of Japan (GSI, former Geographical Survey Institute). At that time, a 3.8-m mobile VLBI antenna was temporarily transported to NGII and our Japanese colleagues arranged the observation. Using this observation, the Korean Geodetic Datum could be connected to the International Terrestrial Reference Frame. With the observation, the necessity of a permanent VLBI station and continuous observing was raised. However, there was no person who could drive such an effort at that time.

A few years later, two VLBI groups emerged. The first one is the space geodesy research group at Korea Astronomy and Space Science Institute (KASI; hereafter KASI SG group), the place where we are working. The KASI SG group started positional astronomy introducing space geodesy for the first time in Korea with GPS in 1989. Several years later, the KASI SG group became aware of the necessity of geodetic VLBI. In the early 2000s, KASI undertook the construction project of the Korean VLBI Network (KVN). KVN consists of three 21-m radio telescopes, which are located in Seoul (Yonsei University), Ulsan (University of Ulsan), and Jeju Island (Tamna University). Although the main purpose of KVN is radio astronomy, KASI also contemplates how to make use of the KVN facility for geodesy. In 2004, KASI decided to receive overseas training in geodetic VLBI and Jungho Cho was dispatched to the Institute of Geodesy and Geoinformation (IGG) of the University of Bonn as a guest scientist.

The other group is Ajou University where Younghee Kwak studied geodetic VLBI. In 2003, Professor Tuhwan Kim founded the Department of Space Survey and Information Technology at Ajou University. Dr. Tetsuo Sasao, who was the former director of VLBI Exploration of Radio Astrometry (VERA), also joined the department. They persuaded NGII to construct a geodetic VLBI station in Korea. In 2005, Younghee started her Ph.D. course at Ajou University, joined the KASI SG group, and finally met Jungho. We investigated the geodetic applications with KVN. At the same time, the consortium of Ajou University and several companies started a project for the conceptual design of a geodetic VLBI station of NGII. In short, we could say that Korea started geodetic VLBI in 1995, but it took ten years to actually implement it.

Which role does the geodetic VLBI group of KASI play in Korea?

There are three independent institutes regarding VLBI. KASI is a government-funded research institute and operates KVN for radio astronomy. NGII is a government agency that constructs a dedicated geodetic VLBI facility at Sejong which is located in the middle of South Korea. Ajou University collaborates on the construction of the Sejong VLBI station. The main purpose of the Sejong VLBI station is to establish and maintain the national geodetic datum by participating in IVS regular sessions.

The KASI KVN group is in charge of R&D, operation, and maintenance of the KVN. The observing frequencies of the KVN system are 22, 43, 86, and 129 GHz. The main purpose of the KVN is mm-wave VLBI observation to study Active Galactic Nuclei, evolved stars, and star formation. The KVN group is doing test measurements of the antennas now.

The KASI SG group is responsible for space geodesy using global and/or local space geodetic data, while the KASI KVN group is in charge of radio astronomy using the KVN. Jungho and Younghee are working on geodetic VLBI in the KASI SG group. The main goals of the KASI SG group are to produce our own TRF and EOP solutions with high quality and to contribute to the international services such as IVS, IGS, ILRS, IERS, and GGOS, and the general public. In support of these goals, the KASI SG group carried out, until last year, a project to combine the major space geodetic techniques of GNSS, geodetic VLBI, and SLR— the so-called GVS project. We analyzed the data of each technique for ourselves, combined the products, and produced combined TRF and EOP. That kind of combination can be useful when we want to connect the domestic or new geodetic stations to the ITRF. Jungho directed the project; Younghee analyzed the VLBI data and combined the products of three techniques in the project.

Who is doing what in your group? What are your tasks?

Jungho Cho is responsible for geodetic VLBI research at KASI. His long-term goal is generating KASI's own solutions for TRF and EOP. At the moment, his research is focused on a water vapor-induced error correction, which is one of the most critical issues in space geodesy, in terms of improving the positioning accuracy. When he started with GPS in 1994, he included VLBI and water vapor radiometers (WVR) in his research tool lists for tropospheric studies.

Younghee's tasks consist of all kinds of combinations. At the moment, she is doing IVS combination. She is also doing combination of VLBI and GPS techniques at the observation level, so-called GPS-VLBI Hybrid Observations. As already mentioned before, she was responsible for the data analysis of geodetic VLBI and the combination of three techniques in the GVS project.

What is your commitment of your group to the IVS?

KASI was accepted as an IVS Combination Center in October 2008. We are now preparing for regular operation. The combination is carried out at the normal equation level, as does the BKG/DGFI Combination Center. However, we decided to use different software: we use Bernese, which was originally developed for GPS data processing, to give reliability to the combination results through cross-checking. In the last two years, we have studied normal equation level combination and modified the Bernese software to handle VLBI products.

What are your plans for the near and far future concerning geodetic VLBI?

We will concentrate on IVS combination center work in the near future. Our long-term goals are to produce our own TRF and EOP solutions with high quality and to contribute to the international services and the public. Therefore our main task will be to improve the precision and accuracy of the solution.

Do you know about Korean contributions to the Global Geodetic Observing System (GGOS)?

Yes, we do. Dr. Jonguk Park, who is the director of the Space Science Division, is a member of the GGOS Steering Committee and KASI is one of the participating institutions of the GGOS Inter-Agency Committee (GIAC). Our group has the plan to construct a GGOS core site which will include a VLBI2010 system in the long run. The site will contain a VLBI2010 system, Multi-GNSS, SLR, gravimeter, and, if possible, DORIS. The construction project of the GGOS core site is included in the National Large Facilities and Equipment Roadmap of Korea. This shows that the Korean government understands the importance of GGOS in the future.

What are your personal research interests?

Jungho is interested in continuous monitoring of natural hazards based on the space geodetic network, especially on a global scale. He hopes that it would be possible to get some clues for causing the natural hazards in terms of space geodetic solutions.

Younghee is interested in observation level combination of space geodetic techniques. She is also interested in plate tectonic motion, especially Amurian plate motion, and earth rotation.

If you do not work, what do you like to do in your leisure time?

Jungho is a wine fanatic. He tastes wine regularly and has his own wine tasting notes. For several years now, he has organized the wine club of KASI. According to his opinion, the IVS network is a reasonable fit for tasting wines all around the world.

When Younghee was staying in Suwon, where her university is located, she used to go break dancing with her friends. In Daejeon, however, there is no place to do this and her body has a hard time keeping up with her mind ☹. So, these days she usually goes for a walk or hiking, does Yoga, watches TV shows, and enjoys checking Google maps for the location of the next VLBI meeting in her leisure time. ☺

A "wine tasting" in an Italian restaurant in Daejeon in 2008. From left: Markus Vennebusch (visitor), Jungho Cho, Jungho Baek (GPS group), and Younghee Kwak. (Photo: Volkmar Thorandt)

2010 Directing Board Elections

– Kerry Kingham, USNO

As directed by the IVS Terms of Reference, elections are held every two years to fill the expiring seats of representatives to the IVS Directing Board. At the same time, the at-large positions are also filled. This year, one Networks Representative and the Representative for Correlators and Operations Centers were up for election. The elections were overseen by an Election Committee consisting of Dirk Behrend (NVI, Inc./GSFC, USA), Oleg Titov (Geoscience Australia, Australia) and Kerry Kingham (USNO, USA; Committee Chair).

The elections ended up with an excellent set of candidates for the two representative positions and the three at-large positions. In addition, 52% of the eligible Associate Members voted, one of the highest turnouts in the last four IVS elections. This is a tribute to the IVS' success in coordinating and promoting geodetic and astrometric VLBI.

Hayo Hase (TIGO, Chile) was re-elected as Networks Representative, and Alessandra Bertarini (Bonn Correlator, Germany) will be the new Correlators and Operations Center Representative, taking over from Kerry Kingham (USNO, USA), who was term limited.

Subsequent to the election, the Directing Board, under the leadership of chair Harald Schuh, selected

Shinobu Kurihara (Geospatial Information Authority, Japan), Fengchun Shu (Shanghai Astronomical Observatory, China), and Jesús Gómez-González (National Geographical Institute, Spain) as the new at-large members.

The Election Committee would like to thank all of the candidates, and their IVS components, for their interest and investment in the IVS. This is encouraging for the future of our organization as we undertake the challenging new programs planned for the next few years.

New Board Elects Schuh as IVS Chair for Second Four-Year Term

– Dirk Behrend, NVI, Inc./GSFC

Following the European VLBI meeting in Bonn, the newly elected Directing Board came together for its first meeting on April Fool's Day (1 April 2011). But the Board did not fool around long and quickly determined who should be the foo.., uh, chair of the IVS for the next four years. Harald Schuh was so foolhardy to run for a second term and the Board unanimously elected Harald for the period of 2011−2014. And Harald was so foolish to accept his election. All joking aside, we are glad to have Harald again at the helm of the IVS.

In this context, I would like to mention that Harald received the Vening Meinesz Medal 2011 from the European Geosciences Union (EGU), which is the highest medal the EGU bestows for geodesy. The VM Medal was awarded to Harald "for his work in the field of Very Long Baseline Interferometry (VLBI) and his important contribution to space geodetic research." This is excellent news as the award put VLBI into the spotlight in the international Earth science community. The interested reader can find more information at the URL http://www.egu.eu/awards-medals/awards-and-medals/award/vening-meinesz/harald-schuh.html (take notice of the elegant naming convention). Congratulations Harald!

A clever man commits no minor blunders.
- Johann Wolfgang von Goethe

Upcoming Meetings...

IUGG General Assembly
Melbourne, Australia
June 28 - 7 July, 2011

Journées 2011
Vienna, Austria
September 19-21, 2011

AOGS 2011
Taipei, Taiwan
August 8-12, 2011

10th Intl e-VLBI Wkshp
Broederstroom, South Africa
November 13-16, 2011

URSI General Assembly
Istanbul, Turkey
August 13-20, 2011

AGU Fall Meeting
San Francisco, CA
December 5-9, 2011

http://ivscc.gsfc.nasa.gov/meetings

Met Sensors – Vital for High-Accurate VLBI

– Karine Le Bail, NVI, Inc./GSFC

Meteorological data ('met data') taken at VLBI stations has a significant impact in the processing of VLBI data. We need local pressure and temperature data to accurately model the atmosphere. We would like accurate, complete, and reliable met data from all stations. In reality, however, we know that some stations do not have met sensors, and some met sensors are neither accurate nor reliable. Furthermore some stations are known to have gaps in their met data. We cannot stress enough the importance of precise meteorological sensors operating at all stations providing a continuous, homogeneous recording of pressure/temperature.

But how bad is it really? At Goddard we were interested in seeing what the met data situation was in the Mark-III databases. We investigated the situation considering various periods: (1) the CONT05 and CONT08 campaigns and (2) the R1 and R4 sessions between 2002 and 2010. We compiled time series of pressure and temperature from the values in the databases and then compared these internally for consistency and with external sources such as ECMWF (using the VMF values) and independent met sensor recordings of SuomiNet. In this analysis, we found examples of:

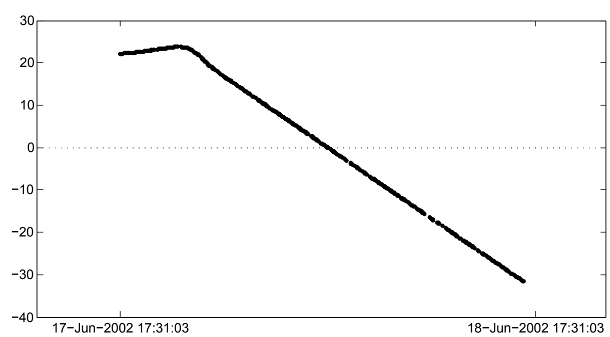
- Abnormal behavior of the temperature (e.g., a little ice-age at Westford in June 2002; see figure);
- Jumps in the pressure time series;
- Systematic differences between the pressure time series of the database with ECMWF data (e.g., about a 10-hPA bias at Svetloe during CONT08; see figure);
- Missing data over long periods of time (e.g. Westford and Fortaleza for several years, Zelenchukskaya for a year).

In some cases, existing gaps were filled manually with met data from a different source, which was not necessarily consistent with the data used in other databases. In summary, the databases' met data are clearly not homogeneous as they contain missing, biased, and inaccurate data.

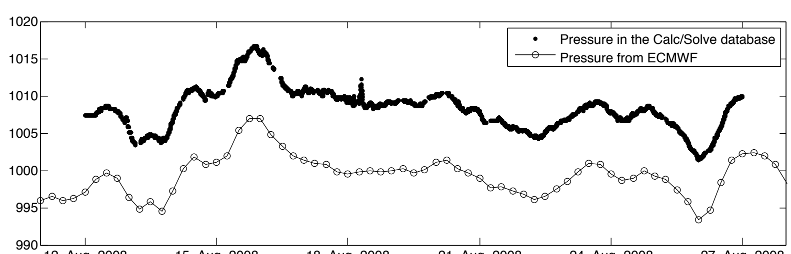
The next question is: What is the impact of the non-homogeneity of the met data on the VLBI data analysis? We did several Calc/Solve runs: (a) For the 10-hPa bias at Svetloe during CONT08, for instance, we determined that the pressure offset directly propagates into the Up-component at the level of 8.9 hPa/mm. (b) In the case of missing data, say Zelenchukskaya over the period of CONT08, Calc/Solve defaults to using a constant value over the time period, affecting the WRMS at the level of 0.12 mm over 2 weeks. (c) For Westford the effect was 1 mm WRMS for the 8.5 years of missing data. (d) The impact on the determination of the Up-component is 0.31 mm in the case of Zelenchukskaya. As we aim at 1-mm accuracy with the VLBI2010 system, these errors cannot be neglected, because the accumulative effect can easily reach the 1 mm.

We can think of two actions to be taken in order to obtain a homogenous database for the meteorological data. First, for the existing databases, the stored pressure and temperature values need to be validated and, if needed, corrected. This is a long and meticulous undertaking currently underway at GSFC for our existing data. By doing statistics on what is in the database as well as comparisons with other meteorological data, we will detect bad data and correct them with appropriate data. In the case of data gaps, we will search for accurate meteorological data to fill in.

Second, we need a homogeneous network of meteorological sensors located at the VLBI stations, observing and recording pressure and temperature continuously. Of course, this does not help with the existing data and the databases we already have. But we need to be aware of the importance of these parameters. Met sensors must be part of the station specifications of a VLBI2010 site. Without accurate meteorological data, we will never reach the 1-mm accuracy goal. With the implementation of VLBI2010, we have the opportunity to reach a new level of accuracy. Let's grab this chance!



Little ice-age at Westford on 17/18 June 2002 according to the Calc/Solve databases. Temperature in °C.



Pressure curves in hPa for Svetloe during the CONT08 campaign as obtained from the Calc/Solve databases and ECMWF data.

Fortaleza's 14.2-m Antenna Has a New Lease on Life

– Pierre Kaufmann, A. Macílio Pereira de Lucena, Adeildo Sombra da Silva, Mackenzie - INPE/CRAAM

During the verification of the antenna pointing model before the IVS-RD0909 session on 6 October 2009, the operator heard a loud noise coming from the antenna positioner structure. He immediately found that the loud noise was associated with the antenna azimuth movement. The noise did not occur for all positions of the azimuth axis; rather it was heard at some angles only. Similar noises, but only sporadically, had already been noticed in the past. But this time, the symptoms were different, because for each rotation of the antenna the noise was repeated. Further, an instantaneous increase of the azimuth motor driver current was observed at the exact moment when the noise was heard.

(top) Last fasteners are being taken off before lifting up. (bottom) Moving the antenna closer to the ground to have the bearing replaced.

It was not easy to diagnose the problem as a damage of the antenna azimuth bearing. There was no way to remove the bearing without disassembling the antenna. And the disassembly of the antenna was not a trivial operation. A visual inspection of the grease that came out from the seals of the bearing revealed small pieces of metal and a large quantity of iron filings. A chemical analysis then confirmed that the grease contained a large amount of steel and plastic. All this clearly hinted at a problem with the antenna azimuth bearing.

The companies that were asked to look into and propose a possible antenna repair scheme were divided into those who thought that the damaged bearing could be restored and those who stated that the bearing was unrecoverable. Considering the costs involved, it was decided to have a new bearing manufactured; however; we held open the option of refurbishing the damaged bearing until after the antenna was disassembled.

When searching for companies to provide the repair services, we received four proposals from different companies, each one offering different solutions. The repair job was eventually awarded to and performed by the Brazilian company Robrasa and their installation company partner Peyrani. These companies had presented the best and technically consistent bid for the job. Their offer exhibited the best solution in terms of risk, cost, and benefit. The repair consisted in the fabrication of a new bearing, which was performed at the Robrasa factory in Diadema, near São Paulo, and accomplished in six months, shipment of the new bearing to the Eusébio site (the Fortaleza VLBI facility) followed by the actual replacement. For this, the antenna was lifted up and displaced, the old bearing was removed, the new bearing was put into place, the antenna was relocated, and checks and tests as well as azimuth movements were done for final acceptance. The installation was performed over a period of twelve days. All phases were performed successfully and on schedule. A pictorial of the various work steps can be viewed on the Web site http://200.129.55.1.

A rather unique methodology was used by Robrasa and their Peyrani partner to replace the azimuth bearing. The entire antenna structure, without removal of any pieces, was separated from the tower using hydraulic jacks running on rails, leaving the azimuth area free for bearing replacement. The figures illustrate the entire repair procedure and are mostly self-explanatory.

The VLBI geodetic activities at Fortaleza (Eusébio) are supported by an agreement between Brazil Space Agency and NASA, and a contract between NASA and Mackenzie Presbyterian University, within a collaboration with National Institute for Space Research (INPE). The repair job received technical advice from Mackenzie's Engineering School Department of Mechanics and was carried out with emergency funds provided by NASA.

(top) Removing the damaged 2-meter diameter bearing. (left) New bearing installed.

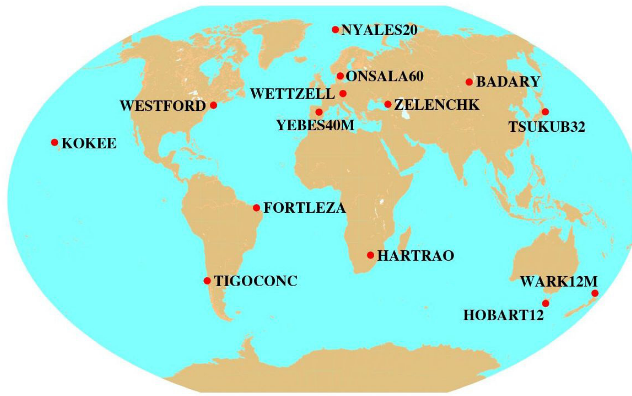
CONT Cont'd... CONT11 Comes

– Dirk Behrend, NVI, Inc./GSFC

Some three years have passed since the observation of the very successful CONT08 campaign. Come September, we will see another CONT campaign. CONT11 will be a campaign of fifteen continuous VLBI sessions, scheduled to be observed in the second half of September 2011 (15-SEP-2011 00:00 UT through 29-SEP-2011 24:00 UT). With a planned network size of fourteen stations, CONT11 will have the largest number of stations participating in a CONT campaign yet. The planned network consists of nine stations in the northern hemisphere and five stations in the southern hemisphere, constituting an excellent geographical distribution and global coverage. As was done in previous CONT campaigns, the participating stations will conduct extensive testing of their equipment under the direction of Brian Corey and Ed Himwich. The test results are to be examined by the stations themselves as well as by Brian and Ed. The tests will be done in order to ensure that the stations will be at their peak performance for CONT11.

The general setup of the session days will be similar to CONT08. The sessions will be observed on the basis of UT days (from 0 UT to 24 UT), station checks will be staggered between the participating stations to avoid observational data gaps, and the recording rate will be 512 Mbps. Also, it is anticipated that the other space-geodetic techniques (GPS, SLR, DORIS) will ensure that the best possible observations be taken so that optimal comparison and combination work becomes possible.

Name	*Code*	*Observatory name and location*
BADARY	Bd	Badary Radio Astronomical Observatory, Russia
FORTLEZA	Ft	Space Radio Observatory of the Northeast (ROEN), Fortaleza, Brazil
HARTRAO	Hh	Hartebeesthoek Radio Astronomy Observatory, South Africa
HOBART12	Hb	Mt. Pleasant Radio Astronomy Observatory, Hobart, TAS, Australia
KOKEE	Kk	Kokee Park Geophysical Observatory, Kauai, HI, USA
NYALES20	Ny	Ny Ålesund Geodetic Observatory, Spitsbergen, Norway
ONSALA60	On	Onsala Space Observatory, Sweden
TIGOCONC	Tc	Transportable Integrated Geodetic Observatory (TIGO), Concepción, Chile
TSUKUB32	Ts	Tsukuba VLBI Station, Japan
WARK12M	Ww	Warkworth VLBI Station, New Zealand
WESTFORD	Wf	Westford Antenna, Haystack Observatory, MA, USA
WETTZELL	Wz	Geodetic Observatory Wettzell, Germany
YEBES40M	Ys	Astronomical Center at Yebes, Spain
ZELENCHK	Zc	Radioastronomical Observatory Zelenchukskaya, Russia



With a network size of fourteen stations, the CONT11 campaign can be viewed as a precursor of the observing mode of the next generation VLBI system (VLBI2010). In "VLBI2010 mode" networks of sixteen or more stations will observe continuously and transfer their data to a correlator facility for immediate correlation so that results become available within 24 hours of the end of observation. CONT11, of course, will have a lower data rate and a less stringent completion requirement than VLBI2010. It is expected that recording modules will store several campaign days of a given station in order to optimize the usage of media. Hence, for logistical ease, consistency of results, and to gain experience in VLBI2010-type load, correlation will be performed at a single correlator: the Washington Correlator will take on the large task of correlating the CONT11 data.

Further information about the campaign is compiled on the CONT11 Web page at the URL http://ivscc.gsfc.nasa.gov/program/cont11.

The IVS Newsletter is published three times annually, in April, August, and December. Contributed articles, pictures, cartoons, and feedback are welcome at any time.

Please send contributions to
ivs-news@ivscc.gsfc.nasa.gov.
The editors reserve the right to edit contributions. The deadline for contributions is one month before the publication date.

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The newsletter is published in color with live links on the IVS web site at

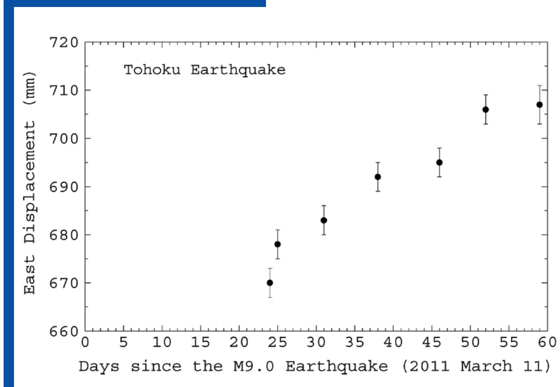
http://ivscc.gsfc.nasa.gov/.

NEWS...

Major Earthquake Rattles Japan and the IVS Observing Plan

– Dirk Behrend, NVI, Inc./GSFC

On March 11, 2011 a magnitude 9.0 earthquake shook the Earth near the northeast coast of Honshu, Japan. The shaking also triggered a major tsunami that hit the coast shortly after the quake. Many of you have followed the events and seen images in the media. The aftermath of the tsunami is still unfolding. We are glad that none of our Japanese colleagues came to harm in this event.



Eastward displacement of Tsukuba after the Tohoku earthquake.

The IVS has several network stations in relative proximity to the affected area. Depending on the distance to the epicenter these stations (e.g., Tsukuba, Kashima, Mizusawa) experienced a co-seismic displacement of several decimeters to meters, and currently the process of post-seismic relaxation is still ongoing. While these stations dropped out of the IVS observing plan immediately following the quake, every effort was undertaken to re-establish observing as soon as possible. This is particularly important in order to precisely determine the new position and velocity. Tsukuba commenced observing in 24-hour sessions about 3−4 weeks after the event.

Tsukuba plays a special role in the observing plan, as it constitutes a non-redundant endpoint of the baselines of the weekend Intensives (Int2 and Int3). Given the primarily Eastward displacement and the continuing relaxation caused by the earthquake, the Tsukuba pre-Earthquake position and velocity are no longer valid. Based on the estimated displacements (from pre-Earthquake positions) for the sessions shown in the figure, the current Eastward rate is at most 1 cm/week and some curvature (relaxation) is apparent. As the position is held fixed in the dUT1 determination, any error in the position at the epoch of the Intensive session will propagate directly into the dUT1 estimate. The sensitivity of dUT1 estimates to East displacements of Tsukuba is about −15 µsec/cm. Due to the latency of the R1 sessions (about 2 weeks), using the latest available R1 position would lead to an error of about −30 µsec. For the Int2 Intensives, Kokee Park is available to fill in and a program is being established to ensure proper validation for the turnover of the operational dUT1 determination from the Kokee–Wettzell baseline back to the Tsukuba–Wettzell baseline. For the Int3 Intensives, Seshan is available to co-observe with Tsukuba in most of the sessions. Many thanks to Kokee Park and Seshan for taking this on!

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