

IGEX-98 Workshop Summary

Jim Slater Chair,
IGEX-98 Workshop Organizing Committee and Interim Chair, International GLONASS
Pilot Service Steering Committee

The IGEX-98 Workshop held on 13-14 September in Nashville, Tennessee was a great success. Approximately 80 people attended. I want to thank all the members of the Steering Committee and the Workshop Organizing Committee for their efforts in planning and coordinating the campaign, and the workshop that followed. Carey Noll was invaluable as the Co-chair of the Workshop as was Pascal Willis, Chair of the Steering Committee. The other members of the committees were Gerhard Beutler, Werner Gurtner, Guenter Hein, Wlodzimierz Lewandowski, Pratap Misra, Ruth Neilan, and Robert Weber. Thus far, only two-thirds of the papers have been submitted for publication in the workshop proceedings. If you are the author of one of those papers that has not been submitted yet, please submit it as soon as possible to the IGS Central Bureau web site <http://igs.cb.jpl.nasa.gov/submissions/index.html>.

IGEX-98 Highlights

The accomplishments of the experiment surpassed our expectations. Each individual and group that participated contributed directly to this success.

- A global network of over 60 GLONASS tracking stations and 30 Satellite Laser Ranging observatories in 25 countries participated in the campaign.
- Six months of continuous data were collected by these stations and archived at NASA Goddard Space Flight Center (GSFC) and the Institut Geographique National (IGN). This data set is a valuable asset that is available for use by anyone.
- Precise orbits were computed, from both the SLR and GLONASS receiver data, by 11 different groups, with resulting accuracies of 20-50 cm. A combined orbit was computed at the University of Technology, Vienna from the individual solutions provided on a regular basis by a subset of these groups. The precise orbits are also archived at NASA GSFC and IGN.
- Three commercial manufacturers and one university produced dual-frequency GLONASS receivers, which were operated and given their most thorough testing and evaluation as a result of IGEX.
- A number of different software packages (e.g., BAHN, Bernese, GIPSY) that were designed for GPS observations can now process GLONASS data and compute GLONASS orbits routinely.
- The RINEX and SP3 data exchange formats have been expanded to include GLONASS data.
- Datum transformations relating PZ-90 to WGS 84 and ITRF reference

frames were derived by several groups for the first time with a global distribution of data.

- By utilizing the precise orbits, the ability to perform inter-continental time transfer was improved significantly.

A summary of IGEX-98 and some of the results presented at the workshop are in a paper that was given at the Institute of Navigation GPS-99 conference that followed the IGEX-98 Workshop in Nashville. A copy of this paper, titled "The International GLONASS Experiment (IGEX-98): Organization, Preliminary Results and Future Plans", can be found in the IGEX web site under www.ion.org/workgroup.html. A list of workshop participants is also available at that web site.

Current Network Status and Potential Applications of GLONASS

As of today, there are 11 healthy GLONASS satellites. Thirty-one (31) stations continue to track these satellites and send the data to the Global Data Centers on a voluntary basis. Several groups continue to compute precise orbits using these data, and the timing community is applying these orbits in their time transfer work. Two of the manufacturers of dual-frequency GLONASS receivers confirmed at the workshop that they will continue to make receivers available and will support the ones that are already operational.

Now that we have overcome the major obstacles that limited the use of GLONASS in the past, there are a number of applications that could benefit from the availability of GLONASS observations and orbits. These include atmospheric studies, geodesy, definition of the ITRF, force modeling studies, time transfer and orbit prediction. The combined GPS and GLONASS constellations are also a good model for future Global Navigation Satellite Systems that may consist of several independent, integrated satellite systems. Many potential applications take advantage of GLONASS as an augmentation to GPS, not as a stand-alone system. Thus, the current number of usable GLONASS satellites and the lack of a full constellation are not critical at this time. This may become an issue if the number of usable satellites drops precipitously and no new launches take place.

Workshop Resolutions and Future Plans for a GLONASS Pilot Service

Gerhard Beutler presented a number of resolutions for a vote at the end of the workshop. Since many of the active participants in the experiment were present at the workshop (along with other individuals who had sufficient interest to pay the registration fee and attend the meeting), the Steering Committee felt that this group should decide (1) whether or not to continue IGEX, and (2) what form this activity should take. The workshop participants voted in favor of all the resolutions with the following results:

1. Global, internationally coordinated GLONASS tracking and orbit determination shall continue in the time interval 1999-2003.
2. The International Association of Geodesy's Committee for the Coordination of Space Techniques for Geodesy and Geodynamics (CSTG) and the International GPS Service (IGS) shall continue to collaborate in an International GLONASS "Pilot Service". This service will be organized according to the rules stated in the memorandum "IGS Policy for the Establishment of IGS Projects and Working Groups" (available through the IGS Central Bureau Information System at < <http://igsb.jpl.nasa.gov>>).
3. The International GLONASS "Pilot Service" will be proposed as an IGS Pilot Project, initially for the time period 1999-2003.

A new Steering Committee will be formed to (1) prepare a charter for the "Pilot Service", (2) define the duration of the "Pilot Service" as 1999-2003, (3) prepare and send out a new Call For Participation, including a Central Bureau function, and (4) draft an e-mail message that would officially announce the creation of the "Pilot Service". These documents together with a list of Steering Committee members and the proposed relationship between the Pilot Service and the IGS shall be sent to the Chairman of the IGS Governing Board with the request to put the proposal on the agenda of the December 1999 Governing Board meeting. Should the IGS Governing Board decide not to accept the Pilot Service as a pilot project, CSTG has offered to continue the GLONASS operations under its charter. The official Call for Participation will be issued in January 2000. After the resolutions were approved, I was asked to Chair the new Steering Committee, at least on an interim basis, and I have agreed to do so.

The International GLONASS Pilot Service (IGLOPS) will have the following goals and objectives:

1. Establish and maintain a global GLONASS tracking network
 - a. Apply IGS network operations standards
 - b. Calibrate and evaluate combined GPS/GLONASS receivers and antennas
2. Produce precise (10-cm level) orbits, satellite clock estimates, and station coordinates
 - a. Evaluate microwave-derived orbits using SLR observations and orbits
 - b. Incorporate SLR observations in routine orbit processing
 - c. Obtain initial operational capability of 20-50 cm orbits at Analysis Centers
 - d. Receive independent orbit/clock/station solutions from Analysis Centers within 3 weeks of observations
3. Monitor and assess GLONASS system performance
4. Investigate the use of GLONASS to improve Earth Orientation Parameters

5. Improve atmospheric products of the IGS
6. Fully integrate GLONASS into IGS products, operations and programs.

The Call for Participation will request recommitment from the existing GLONASS stations that continue to track and will invite new stations to join. Organizations will also be asked to participate as Analysis Centers, Data Centers and a Central Bureau. Requirements for all these activities will be given in the Call for Participation.