Terms of Reference for the IGS Ionosphere Working Group

Stefan Schaer and Joachim Feltens
on behalf of the GPS-IONO Group

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General Goals

The IGS Ionosphere Working Group is a long-term working group (WG). It should be active at least till the end of the next solar maximum. It exploits the permanent IGS network of stations and the IGS infrastructure to derive global IGS ionosphere maps and IGS ionosphere models.

The most important short-term goal (to be accomplished by an IGS Pilot Project of two years, see below) consists of the development of IGS Global Ionosphere Maps based on a combination of ionosphere maps regularly produced by IGS Ionosphere Associate Analysis Centers (IAACs) on which more information is provided below.

One of the important long-term goals consists of the validation of the IGS Ionosphere Maps. This validation may lead, in the collaboration with the ionosphere community, to an IGS Ionosphere Model.

This charter is based on first considerations provided by Gerhard Beutler and John Dow (e-mail from April 6, 1998).

Working Plan 1998–2000

The following goals should be achieved in the time period mid 1998 to mid 2000 (these goals were stated in the ionosphere position paper at the Darmstadt workshop):

- Global ionosphere maps (TEC maps) including satellite-specific differential code biases (DCBs) from contributing Analysis Centers are made available in IONEX format through the IGS Global Data Centers.

- Definition of minimum analysis and performance standards for IAACs:
  - minimum analysis standards, see recommendations of Darmstadt position paper,
  - ionosphere products are made available not later than the IGS final orbits and EOPs, i.e., 11 days after the observations.
- TEC maps and DCB values as produced by individual analysis centers are compared by the IGS Ionosphere Coordinating Center. A weekly report has to be produced.
- Individual TEC maps and DCB sets are combined into a preliminary IGS Combined Ionosphere Product. The weekly report contains also "rms-values" relative to the combined product.
- Validation of IGS Ionosphere Products using independent data and methods (ionosondes, TOPEX, future satellite missions, etc.). The WG has to define criteria and guidelines for the validation of TEC maps (absolute accuracy in comparison with independent ionospheric data, consistency between equivalent TEC maps).
- A comparison of TEC maps with TEC data derived from well-known models such as IRI will be useful to check both, the IONEX data as well as the model considered.
- Deadlines for ionosphere product delivery will be reviewed after at least one year of pilot service. Possibly, an IGS Rapid Ionosphere Product may be defined.
- Principles for the definition of an IGS Ionosphere Model are developed.

On the occasion of the solar eclipse on 11 August 1999 the WG will organize and coordinate a special observation campaign. This event is a unique opportunity to demonstrate the power of the GPS technique in monitoring the ionospheric ionization. As the zone of totality crosses Europe, the rather dense portion of the IGS network provides excellent conditions for monitoring the eclipse. Nevertheless, non-IGS stations should also be activated and included in the data analysis.

Structure of the Working Group and Initial Membership List

Representatives of those Analysis Centers which confirmed their willingness to contribute to an Pilot IGS Ionosphere Service, namely

Mihail Codrescu (SEC),
Joachim Feltens (ESOC),
Mariusz Figurski (WUT),
Manuel Hernandez-Pajares (UPC),
Pierre Heroux (NRCan),
Attila Komjathy (CCAR),
Steven Musman (NOAA),
Stefan Schaer (CODE),
Peter Stewart (UNB),
Rene Warnant (ROB),
Brian Wilson (JPL),

representatives from the ionosphere research community,

Dieter Bilitza (GSFC),
Norbert Jakowski (DLR),
Reinhard Leitinger (TU Graz, not confirmed),

as IGS Analysis Center Coordinator,

Jan Kouba (NRCan),

and as representative from the IGS CB,

Ruth Neilan (JPL).

Further participation will be called for through an IGS-mail message.

The IGS Ionosphere Working Group consists of

- Chairperson: Joachim Feltens (ESOC).
- IGS Ionosphere Associate Analysis Centers (IAACs) generating ionosphere maps in the IONEX format with the defined time resolution, namely

  CODE,
  ESOC,
  JPL,
  NOAA (not yet ready),
  NRCan,
  UPC.

  All these centers confirmed their participation.
- IGS Ionosphere Associate Combination Center(s) (IACC); interest indicated by ESOC.
- IGS Ionosphere Associate Validation Center(s) (IAVC).

Further participation for all categories of IAACs, IACCs, and IAVCs is fostered through IGS-Mail message.

The chairperson should be the representative of a TEC map producing center (IAAC/IACC). The IACC(s) must be associated with one of the IAACs. The IAVC(s) should have experience in the analysis of alternative (non-GPS) data. IAVC candidates are:

ESOC, using ERS data,
ROB, using ionosonde data,
UPC, making comparisons with IRI.

Schedule for Pilot Project

- Establishment of IGS Ionosphere Working Group (May 1998)
- Make IONEX files of IAACs available through IGS Global Data Centers (June 1998)
- Start of pilot project in August 1998 including comparisons (not yet combinations)
- Start of combinations, based on proposal from IACC(s)
- Start of validation, based on proposal from IAVC(s)
- First report to IGS GB (December 1998)
- Review of first year of operations (August 1999)

Acronyms

CB	Central Bureau
CCAR	Colorado Center for Astrodynamics Research, Boulder, Colorado, U.S.A.
CODE	Center for Orbit Determination in Europe, Astronomical Institute, University of Berne, Switzerland
DCB	Differential Code Bias
DLR	Deutsche Forschungsanstalt für Luft- und Raumfahrt, Fernerkundungsstation Neustrelitz, Germany
ESOC	European Space Operations Centre, Darmstadt, Germany
GB	Governing Board
GPS	Global Positioning System
GSFC	Goddard Space Flight Center, Greenbelt, Maryland, U.S.A.
IAAC	Ionosphere Associate Analysis Center
IACC	Ionosphere Associate Combination Center
IAVC	Ionosphere Associate Validation Center
IGS	International GPS Service
IONEX	IONosphere Map EXchange Format
IRI	International Reference Ionosphere
JPL	Jet Propulsion Laboratory, Pasadena, California, U.S.A.
NOAA	National Oceanic and Atmospheric Administration, Silver Spring, Maryland, U.S.A.
NRCan	National Resources Canada, Ottawa, Ontario, Canada
ROB	Royal Observatory of Belgium, Brussels, Belgium
SEC	Space Environment Center, Boulder, Colorado, U.S.A.
UNB	University of New Brunswick, Fredericton, New Brunswick, Canada
UPC	Polytechnical University of Catalonia, Barcelona, Spain
TEC	Total Electron Content
TU Graz	Technical University Graz, Graz, Austria
WUT	Warsaw University of Technology, Warsaw, Poland