

## 3.3 Analysis Coordinator

**Introduction** This annual report of the IERS Analysis Coordinator (AC) focuses on the following topics involving active IERS Analysis Coordination:

- IERS Analysis Campaign to align EOPs to ITRF2000 / ICRF
- IERS SINEX Combination Campaign
- IERS Retreat 2003
- IERS Combination Pilot Project (CPP)
- IERS Working Groups
- IERS Workshop in Matera

Together with the IERS Central Bureau considerable effort was put into the preparation and organization of scientific meetings during 2003. These included the IERS Retreat in April 2003, the IERS CRC Meeting at the EGU Meeting 2003 in Nice and the IERS Workshop 2003 in Matera. Up-to-date information about the IERS Analysis Coordination activities may be found at <<http://tau.fesg.tu-muenchen.de/~iers/web/index.php>>.

### **IERS Analysis Campaign to Align EOPs to ITRF2000 / ICRF**

At the IERS Combination Workshop in Munich in November 2002 it was decided that the IERS Analysis Campaign to Align EOPs to ITRF2000/ICRF – with the goal to identify possible inconsistencies between the EOP series of various techniques correctly aligned to the ITRF2000/ICRF reference frames and the official C04-series – should be continued and finalized by the time of the EGS General Assembly, April 2003. At this meeting final results were shown by a few different groups (see, e.g., Annual Report 2003 of the CRC FESG, this volume, Section 3.6.2.4) clearly demonstrating that considerable biases do exist between official IERS products (e.g., between ITRF2000 and the C04 polar motion series). It was concluded that follow-up studies of these biases should be based on the SINEX files of the IERS SINEX Combination Campaign instead of the EOP time series alone, to allow for more detailed analyses and for rigorous combination approaches.

### **IERS SINEX Combination Campaign**

In May 2002 the IERS SINEX Combination Campaign was started with a Call for Participation (CfP). The goals of this activity were:

- Combination of “weekly” solutions from SINEX files of different space geodetic techniques (GPS, SLR, VLBI, DORIS,...) with station coordinates and EOPs
- Development of standards for common modeling and parameterization
- Assessment of systematic biases between the different techniques
- Combined weekly solutions as the basis for final routine EOP products

Eleven groups answered the CfP. The list of “weekly” SINEX series that were delivered to the IERS SINEX Combination Campaign is given in Table 1. All these series were archived in a SINEX data pool and are still available for combination tests. (see <http://tau.fesg.tu-muenchen.de/~iers/web/sinex/datapool.php>).

Table 1: “Weekly” SINEX Contributions to the IERS SINEX Combination Campaign

Solutions		Parameters contained in the solution							Normal equation	Constraints
		Coord.	Pole	Pole rates	UT1 - UTC	LOD	Nutation	Others		
GPS	CODE	X	X	X	X	X	-	-	-	NNR
	NRCan	X	X	X	-	X	-	Geocentre	-	inner constraints
	DGFI	X	-	-	-	-	-	-	-	1m for stations
SLR (monthly)	ASI	X	X	-	X	-	-	Biases	-	loose constraints
	DGFI	X	X	-	X	-	-	Biases	-	loose constraints
	JCET v1	X	X	X	X	X	-	Biases	-	1m for stations
	JCET v2	X	X	-	X	X	-	-	-	1m for stations
SLR (weekly)	ASI v1	X	X	-	X	-	-	-	-	loose constraints
	ASI v2	X	X	X	X	X	-	-	-	loose constraints
	JCET	X	X	-	-	LODR	-	-	-	1m for stations and ERP
VLBI	BKG	X	X	X	UT1	X	X	-	X	NNR + NNT
	DGFI	X	X	-	X	-	X	-	X	loose constraints
	GSFC (old)	X	X	-	UT1	X	X	-	-	loose constraints
	GSFC (new)	X	X	X	UT1	X	X	-	X	NNR + NNT
DORIS	IGN	X	X	X	X	LODR	-	-	-	
	INA	X	X	-	X	LODR	-	-	-	

First results of the campaign were presented at the IERS Workshop on Combination Research and Global Geophysical Fluids at the Bavarian Academy of Sciences, Munich, Germany, 18-21 November 2002 and published in the IERS Technical Note No. 30 (<http://www.iers.org/iers/publications/tn/tn30/>). In addition, major results were also presented in session G15 at the EGS-AGU-EGU Joint Assembly 2003 in Nice, April 6-11.

At the IERS Retreat in Paris (see below) it was decided that the IERS SINEX Combination Campaign should evolve into a pilot phase of routine product generation, i.e., into the IERS Combination Pilot Project (CPP).

For more information on the IERS SINEX Combination Campaign see <http://tau.fesg.tu-muenchen.de/~iers/web/sinex/campaign.php>.

### **IERS Retreat 2003**

Together with the IERS Central Bureau a considerable effort was put into the organization of the IERS Retreat 2003 in Paris. At this retreat, among others, the following important decisions were taken:

- the IERS Combination Pilot Project (CPP) should be initiated,
- an IERS Working Group on “Site Survey and Co-location”,
- an IERS Working Group on “Combination” to coordinate the IERS CPP and
- an IERS Working Group on “ITRF Datum” should be established.

These decisions are described in more details in the next two sections. For more information concerning the outcome of the IERS Retreat 2003 we refer to <http://www.iers.org/iers/meetings/IERS-Retreat-2003/>.

### **IERS Combination Pilot Project (CPP)**

Today the various products of the IERS, especially the International Terrestrial Reference Frame (ITRF), the International Celestial Reference Frame (ICRF) and the Earth Orientation Parameter (EOP) series, are still combined independently. With the exception of the ITRF and the IGS products neither intra-technique nor inter-technique combinations are correctly performed including the full variance-covariance information. In this way neither the consistency of the products can be guaranteed nor can the different strengths of the individual space geodetic techniques be exploited to improve the products. This means that there are clear deficiencies in the present IERS product generation. To achieve the highest accuracy and consistency, it is crucial to proceed towards a fully rigorous combination of all the parameters common to more than one space geodetic technique, especially in respect to the challenges the IERS is facing with the new satellite missions (gravity, altimetry, astrometry), with the Global Geodetic Observing System (GGOS) project of the International Association of Geodesy (IAG), and with many other applications.

At the IERS Retreat in Paris in April 2003 (see previous section above) it was therefore decided, that

- an IERS Working Group (WG) on Combination should be set up and that
- the IERS SINEX Combination Campaign should be converted into a pilot project, namely the IERS Combination Pilot Project (CPP), to be started in spring 2004.

To establish the IERS WG on Combination (IERS WG3) according to the IERS Terms of Reference a charter and a preliminary list of participants were drafted and discussed during the December 2003 IERS Directing Board meeting. The working group was set up in the beginning of 2004 and, as a first action, the Call for Participation (CfP) for the IERS Combination Pilot Project was launched.

The IERS CPP consists of three steps (see Figure 1):

1. The computation of combined “weekly” SINEX files by the Technique Centers starting from SINEX files of the individual Analysis Centers of the service (intra-technique combination).
2. The computation of combined weekly SINEX files by so-called IERS Combination Centers based on the “weekly” intra-technique SINEX files and local tie information.
3. The validation of the combined inter-technique solutions through comparisons, repeatability studies, and use of external information (geophysical fluids, models, ...).

More information about the CPP and the present status may be found at <<http://www.iers.org/iers/about/wg/wg3/cpp.html>>.

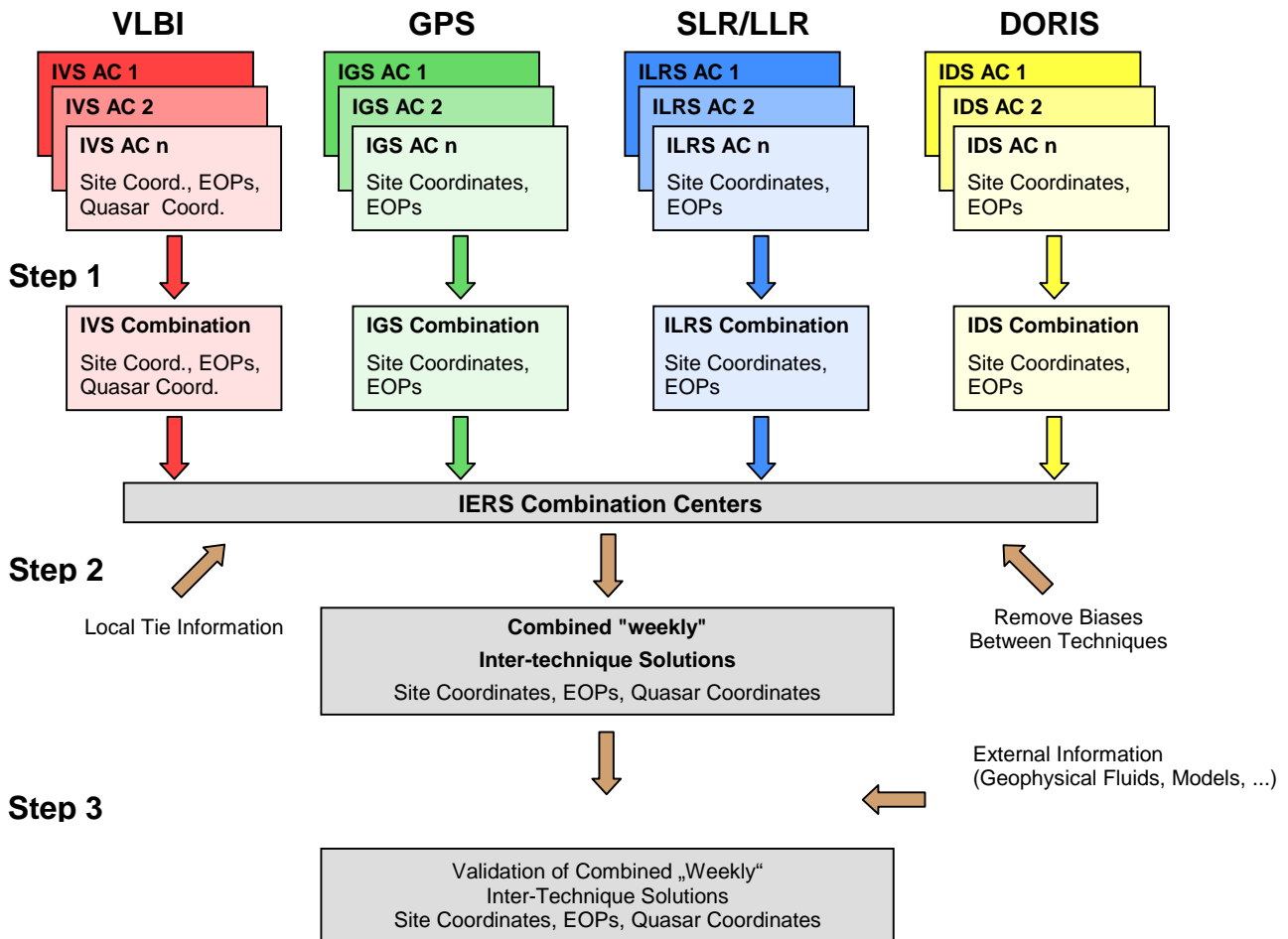


Fig. 1: Combination and validation of „weekly“ SINEX solutions in the framework of the IERS Combination Pilot Project (CPP).

### **IERS Working Groups**

At the IERS Retreat 2003, as mentioned above, it was also decided that two more IERS working groups should be established besides the IERS WG on Combination, namely the IERS WG1 on Datum Definition of Global Terrestrial Reference Frames, jointly with IAG Sub Commission 1.2 WG 1 (SC1.2-WG1) and IAG Inter-Commission Committee on Theory (ICCT), and the IERS WG2 on Site Survey and Co-locations, jointly with IAG Sub-Commission 1.2 WG 2 (SC1.2-WG2).

In the meantime two of the three working groups have been fully established (see <http://www.iers.org/iers/about/wg/>).

### **IERS Workshop on “Site Co-location” in Matera**

For the first time in the IERS history a workshop was organized solely concentrating on the topic of site surveying, site co-location and all issues related to the co-location of instruments at fundamental geodetic observatories. It was one of the major goals of this workshop to demonstrate that the topic of site surveying etc. should play a much more prominent role in space geodesy and especially in the combination of the space geodetic results into a consistent set of IERS products (see IERS CPP). The two most important recommendations resulting from the workshop are listed here:

- All local ties between co-located instruments should be determined with an accuracy of 1 mm or better in the ITRF (global, cartesian) and the full variance / covariance information should be made available in SINEX format (Recommendation 1).
- Local survey measurements should have the same importance as and should be treated like any of the space geodetic techniques (Recommendation 2).

The establishment of highly accurate local ties for all fundamental geodetic observatories should be considered a “conditio sine qua non” for a successful combination of the space geodetic techniques and a consistent set of IERS products (i.e., consistency between techniques as well as consistency between parameter groups like site coordinates, EOPs and quasar coordinates). A major effort should therefore be devoted to this task. For additional information and the presentations given at the workshop see [http://www.iers.org/workshop\\_2003\\_matera/](http://www.iers.org/workshop_2003_matera/).

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*Markus Rothacher, Robert Dill, Daniela Thaller*