

Station and AC Collaboration: Setting the stage

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Grasse

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- Proper analysis of tracking data needs
 - Accurate, timely and reliable station status and station configuration information
 - Accurate and reliable meta data
- Detection, identification, and quantification of various station-based error sources needs proper analysis
 - In the context of the global network or clusters of stations
 - Also through analysis of various time series (e.g., station heights)
- Feed-back to the stations needs to be timely, reliable, and coordinated
- Proper interpretation and use of such findings (both by stations and analysts) needs mutual discussions and decisions

Topics (1)



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- **Errors caused by stations**
 - Random errors
 - Outliers, gross errors
 - Systematic errors
 - Errors constant over a certain time
 - Satellite-dependent (e.g., range-dependent, target structure- and energy-dependent)
 - Configuration-dependent (e.g., different detectors in use)
 - Wrong meta data
 - Slowly varying errors
 - Aging of equipment???
 - Average ambient temperature, air pressure,...???
 - Errors mainly in range (including applied calibration values), sometimes in the epoch or in the surface met values

Topics (2)

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- Station-related analysis errors may be caused by
 - Wrong a priori coordinates
 - Wrong local ties
 - Wrong system corrections (e.g., target signatures)
 - Wrong wavelengths
 - Wrong weights
 - Wrong station constraints
 - Wrong a priori range corrections (e.g., Stanford!)
 - Wrong a priori range biases
 - ...

Levels of detection

- **By the stations**
 - e.g., gross errors, large random errors, non-plausible values
- **By operational centers**
 - e.g., format errors, non-plausible values
- **By quick look analysis centers**
 - All of above, larger range and time biases
- **By analysis and associate analysis centers**
 - All of above, smaller range and time biases
 - Time series analysis of station positions and other parameters
- **By combination centers**
 - Cross-examination of time series analyses → Detection and confirmation of smaller station problems

Information Flow: Station to Analysis

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- Basic station information
 - Station logs
 - Station configuration files
 - Station change files
- Actual station information
 - System change indicator
 - System configuration indicator
 - Data quality indicators: RMS, calib, # of obs in np, ...
 - SLR Mails
 - Data correction free format file at CDDIS Web
(*not updated anymore*)

Critical points:

- *Is this information sufficient, useful, up-to-date, and reliable?*
- *Which information is actually used by the analysts?*

- Quick-Look Analysis (SLReport)
 - Lageos 1+2: DGFI, MCC, HIT-U, SIO , Zwld Summary report
 - Etalon 1+2, Starlette, Stella, Ajisai: HIT-U
 - GNSS: CODE
- Short-Arc analysis (web-based)
 - Lageos 1+2, Stella, Ajisai: NERC
- Long-Arc analysis (web-based)
 - Lageos 1+2, Etalon 1+2: NERC
- Statistics based on Quick-Look Analysis (web-based)
 - Quarterly station report cards: ILRS CB

(Information mainly based on ILRS Analysis Report web page)

Quick-Look Analysis

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- Individual formats and procedures
- Difficult to interpret
- Significance level of range biases: 10 cm ?
- Fairly large discrepancies between centers
- Difficult to automatically and reliably detect range biases

→ Summary report (daily: web-based, weekly: SLReport)

→ Does not solve the major problems

Daily Summary Reports: Range biases? u^b

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7810 ZIML Zimmerwald						DGFI		MCC		HIT-U		SAO	
	sc	wl	rb	pr	rb	pr	rb	pr	rb	pr	rb	pr	
7810	2007-08-31	15:13	L1	423	-5	2	13	2	19	2			
7810	2007-09-01	07:07	L2	846	33	2	13	2	8	2			
7810	2007-09-01	07:09	L2	423	40	2	20	2	16	2			
7810	2007-09-01	13:35	L1	423	32	5	-2	2	5	1			
7810	2007-09-01	13:38	L1	846	218	22	-10	2	-4	2			
7810	2007-09-01	20:42	L1	846	41	5	-5	4	4	3			
7810	2007-09-01	20:42	L1	423	34	4	1	2	11	3			
7810	2007-09-01	20:52	L2	846	24	3	-11	4	3	3			

7840 HERL Herstmonceux						DGFI		MCC		HIT-U		SAO	
	sc	wl	rb	pr	rb	pr	rb	pr	rb	pr	rb	pr	
7840	2007-09-09	20:37	L1	532	-69	2			4	2			
7840	2007-09-09	23:51	L1	532	36	8			5	6			
7840	2007-09-10	06:00	L2	532	64	4			4	4			
7840	2007-09-10	18:55	L1	532	-14	1			-2170	211			
7840	2007-09-10	19:55	L2	532	39	2			2	1			
7840	2007-09-10	22:22	L1	532	4	2							

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Daily Summary Reports: Large differences between centers



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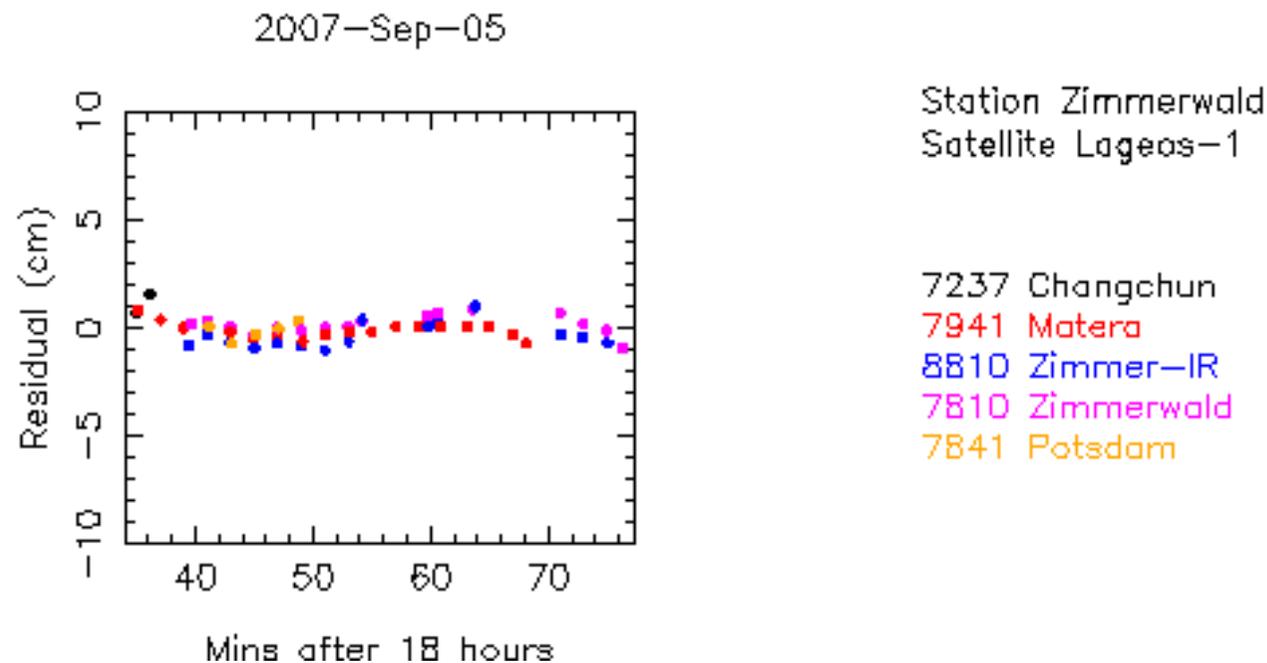
7090 YARL Yarragadee				DGFI		MCC		HIT-U		SAO		
			sc	wl	rb	pr	rb	pr	rb	pr	rb	pr
7090	2007-09-06	11:07	L2	532	-27	4	3	3	4	2		
7090	2007-09-06	16:03	L1	532	-3	2	8	2	3	2		
7090	2007-09-08	04:42	L1	532	-24	2	-14	2	-5	4		
7090	2007-09-08	07:56	L2	532	-55	1	3	1	1	1		
7090	2007-09-08	11:21	L2	532	8	3	-27	1	-3	2		
7090	2007-09-08	16:50	L1	532	2	2	12	2	12	1		
7090	2007-09-08	20:29	L1	532	162	6	13	3	7	2		
7090	2007-09-08	23:50	L1	532	107	6	1	2	0	1		
7090	2007-09-09	00:59	L2	532	17	7	-3	1	3	3		
7090	2007-09-09	03:32	L1	532	-39	4	7	1	7	2		
7090	2007-09-09	05:17	L2	532	-15	3	16	2	5	2		
7090	2007-09-09	06:43	L1	532	24	5	-9	4	-1	2		
7090	2007-09-09	09:24	L2	532	8	2	-2	2	2	1		
7090	2007-09-09	13:46	L2	532	-6	3	-4	3	-7	2		
7090	2007-09-09	15:29	L1	532	19	3	14	2	5	2		
7090	2007-09-09	19:07	L1	532	-51	6	16	0	22	1		
7090	2007-09-09	22:31	L1	532	-118	3	0	2	-8	1		
7090	2007-09-09	23:04	L2	532	48	5	-10	4	12	2		

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Web-Based Analysis Reports

- NERC reports
 - Graphics of np residuals for simultaneous passes
 - In the differences between stations: Fairly sensitive!
 - *Are the alert mails to stations still generated?*
 - *Who is routinely checking the plots?*



Further Analysis Feed Back



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- Presentations at Analysis Center meetings, Workshops and Symposia
 - Sometimes very surprising and not very flattering (example: Jumps in the height of Zimmerwald)
 - Large time lag
 - Not reliable: Station may not be represented at these events
- Occasional direct contacts

Further Information



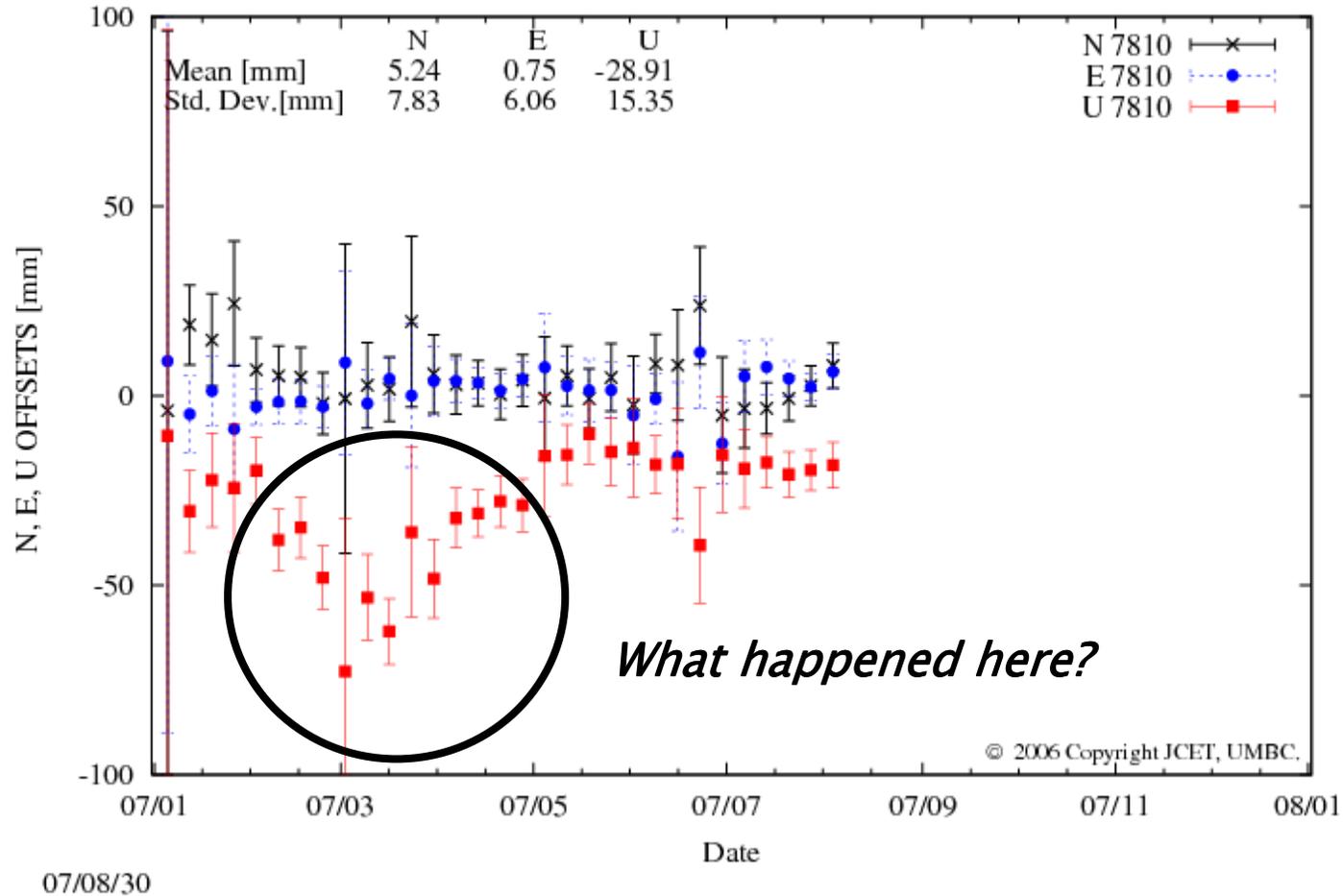
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- Plots and tables from official weekly analysis
 - Example: JCET web-based summaries for all ACs and stations (e.g., time series of station positions)
 - Difficult to find: ILRS Home → Data & Products → Official ILRS Products → Inconspicuous link to JCET in the header of a table
 - http://geodesy.jcet.umbc.edu/ILRS_QCQA/index.html
- Are there other such places to go?
 - Example: Range bias data base at http://maestro.obs-azur.fr/cgi-bin/query_mrb.pl, not active anymore?

Example: ASI, 7810 ZIML: 423 or 846? u^b

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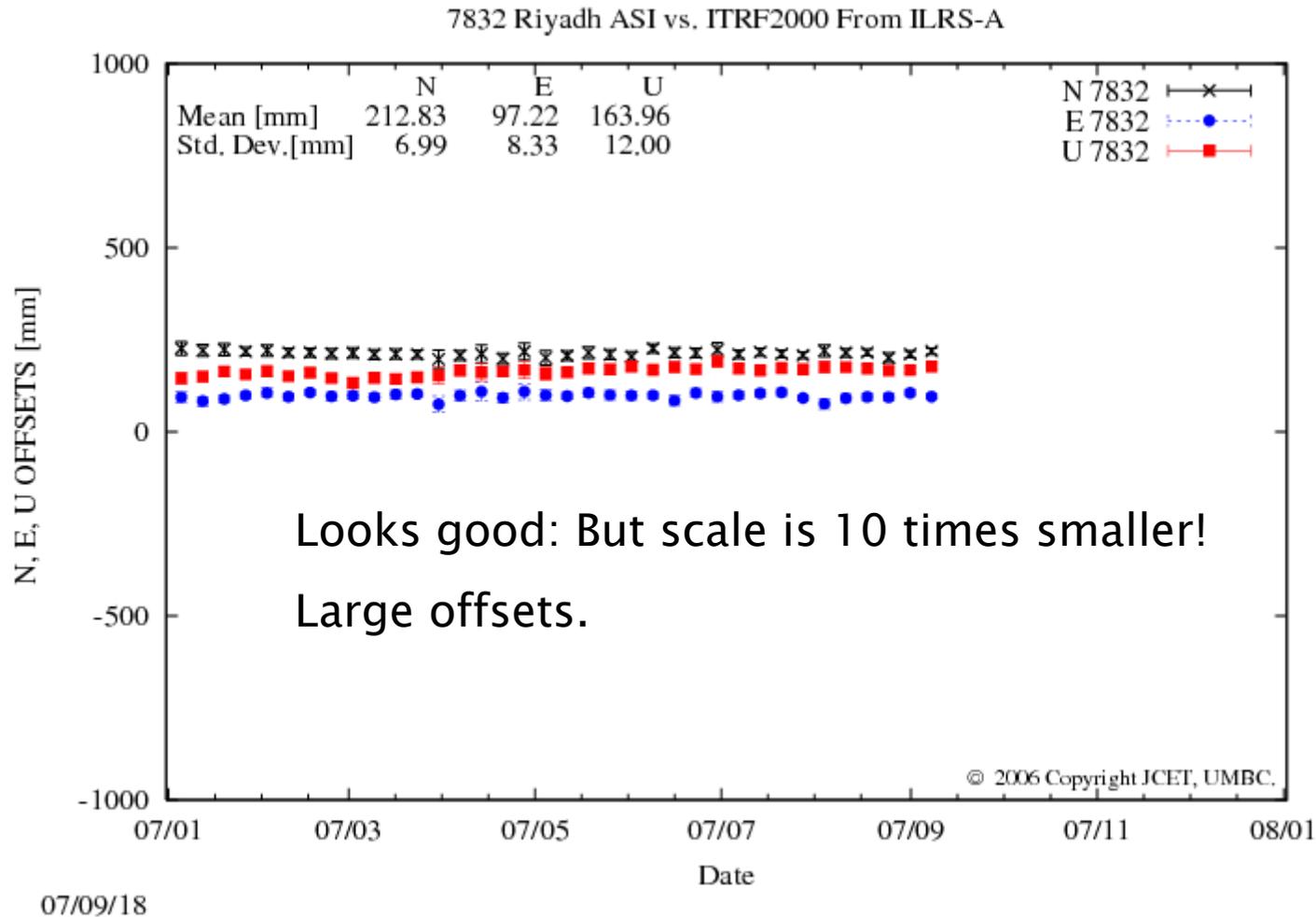
7810 Zimmerwald ASI vs. ITRF2000 From ILRS-A



Example: 7832 RIYL: Scale, offset?

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Problem areas

- Station → Analysis Centers
 - Reliability and completeness of status information
 - Is the current procedure appropriate?
 - Too complicated?
 - **Is it properly used by the analysts?**
- Analysis Centers → Stations
 - Quick-look analysis: Complicated, difficult to interpret
 - High-end analysis: Does not actually flow back to the stations, difficult to interpret, difficult to find
 - **No "digested" and coordinated feed-back available**
- Analysis Centers ←?→ Combination Centers
 - Exchange of station status information
 - **Coordinated maintenance and use of such information**

Items to address

- What

- Outliers, gross errors pass-per-pass
- Short-term range and time biases pass-per-pass
- Medium-term range biases weeks to months
- Long-term range biases years
- Slowly varying systematic errors any
- Intervals of malfunction any

- How

- Historic and routine check for biases → feed back
- **Correlation of biases/problems with system changes** → mutual consent
- Historic and routine determination of biases → verification
- Routine use of pre-determined biases

What do we need?

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- **Institutionalized information exchange** between station responsables and analysis centers
 - Human information exchange
 - Mainly E-Mail based
 - On a rather "confidential" level, i.e., controlled distribution list
 - Phone calls
 - Meta data exchange, coordination, use
 - Station logs, configuration, system changes ??
 - **Station system configuration file (exists!). Do we need a global file?**
- **Institutionalized control of the station performance**, mainly regarding data quality = systematic errors. (regarding random errors and data quantity see e.g., quarterly performance charts)
- **Institutionalized determination of station biases and their coordinated introduction into ILRS (and other!) product generation**
 - **Station data problem file (biases, data to exclude, ...)**

Recommendation



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- The Network and Engineering WG, the Analysis WG, and the Formats and Procedures WG form a small task force to prepare, define, and install concrete procedures and processes