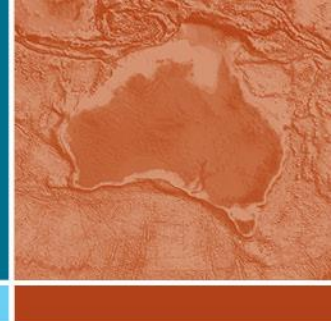




Australian Government  
Geoscience Australia



# Recent IGS Analysis Centres Coordinator Activities

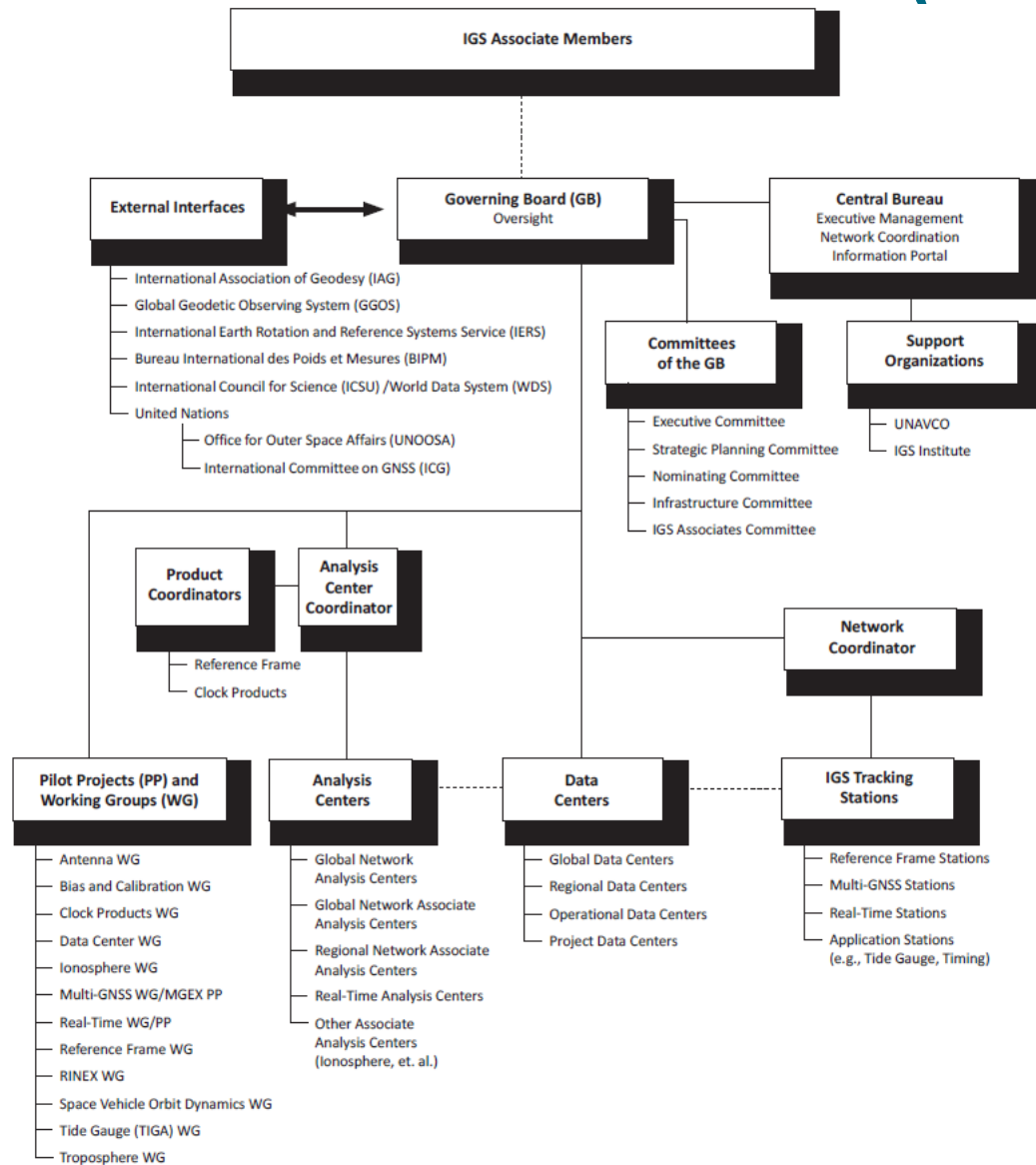
Guorong Hu & Michael Moore

*Geodesy Section, Geoscience Australia*



***IGNSS 2016, Sydney, 6 – 8 December 2016***

# The International GNSS Service (IGS)



# History of IGS ACC

- Feb 2016 – present: joint role between Geoscience Australia (Canberra, Australia) and MIT (Cambridge, USA)
- 2008 – 2015: National Geodetic Survey (NGS, Maryland, USA)
- 2003 – 2008: GeoForschungsZentrum (GFZ, Potsdam, Germany)
- 1999 – 2003: Centre for Orbit Determination in Europe (CODE, Bern, Switzerland and Vienna, Austria)
- 1994 – 1998: Natural Resources Canada (NRC, Ottawa, Canada)

# What's the role of IGS ACC

- Overall responsibility of generating official IGS combined products (**7/24 service**)
- IGS products combination
  - GPS: Ultra-rapid, rapid and final products
  - GLONASS: Ultra-rapid and final products
- Monitoring the quality of IGS products
  - The statistical tables and figures for the final products updated weekly
  - Others shortly updated after combinations

# Major changes of IGS ACC during transition

- Sharing responsibilities between GA and MIT
- The ACC email is switched from [igs.acc@noaa.gov](mailto:igs.acc@noaa.gov) to [acc@igs.org](mailto:acc@igs.org)
- Moving the combination server to the Cloud (Amazon EC2 service)
- Allowing easy transition to other agencies in the future

# Current status of IGS products

## ➤ IGS products include:

- ✓ GPS/GLONASS satellite orbit
- ✓ GPS/GLONASS satellite clock
- ✓ ERP (Earth rotation parameters: X-pole, Y-pole, X-pole rate, Y-pole rate and LOD (Length of Day))

Series	ID	Latency	Issue times(UTC)	Data spans(UTC)	Remarks
<b>Ultra-Rapid</b> (observed half)	IGA	3–9 hr	@ 03:00, 09:00, 15:00, 21:00	–24 hr @ 00:00, 06:00, 12:00, 18:00	<ul style="list-style-type: none"> <li>• for near real-time apps</li> <li>• GPS &amp; GLONASS</li> <li>• issued with following IGU</li> </ul>
<b>Ultra-Rapid</b> (predicted half)	IGU	real-time	@ 03:00, 09:00, 15:00, 21:00	+24 hr @ 00:00, 06:00, 12:00, 18:00	<ul style="list-style-type: none"> <li>• for real-time apps</li> <li>• GPS &amp; GLONASS</li> <li>• issued with prior IGA</li> </ul>
<b>Rapid</b>	IGR	17 – 41 hr	@ 17:00 daily	±12 hr @ 12:00	<ul style="list-style-type: none"> <li>• for near-definitive, rapid apps</li> <li>• GPS only</li> </ul>
<b>Final</b>	IGS	12 – 19 d	weekly each Thursday/Friday	±12 hr @ 12:00 for 7 d	<ul style="list-style-type: none"> <li>• for definitive apps</li> <li>• GPS &amp; GLONASS</li> </ul>

# Current status of IGS products

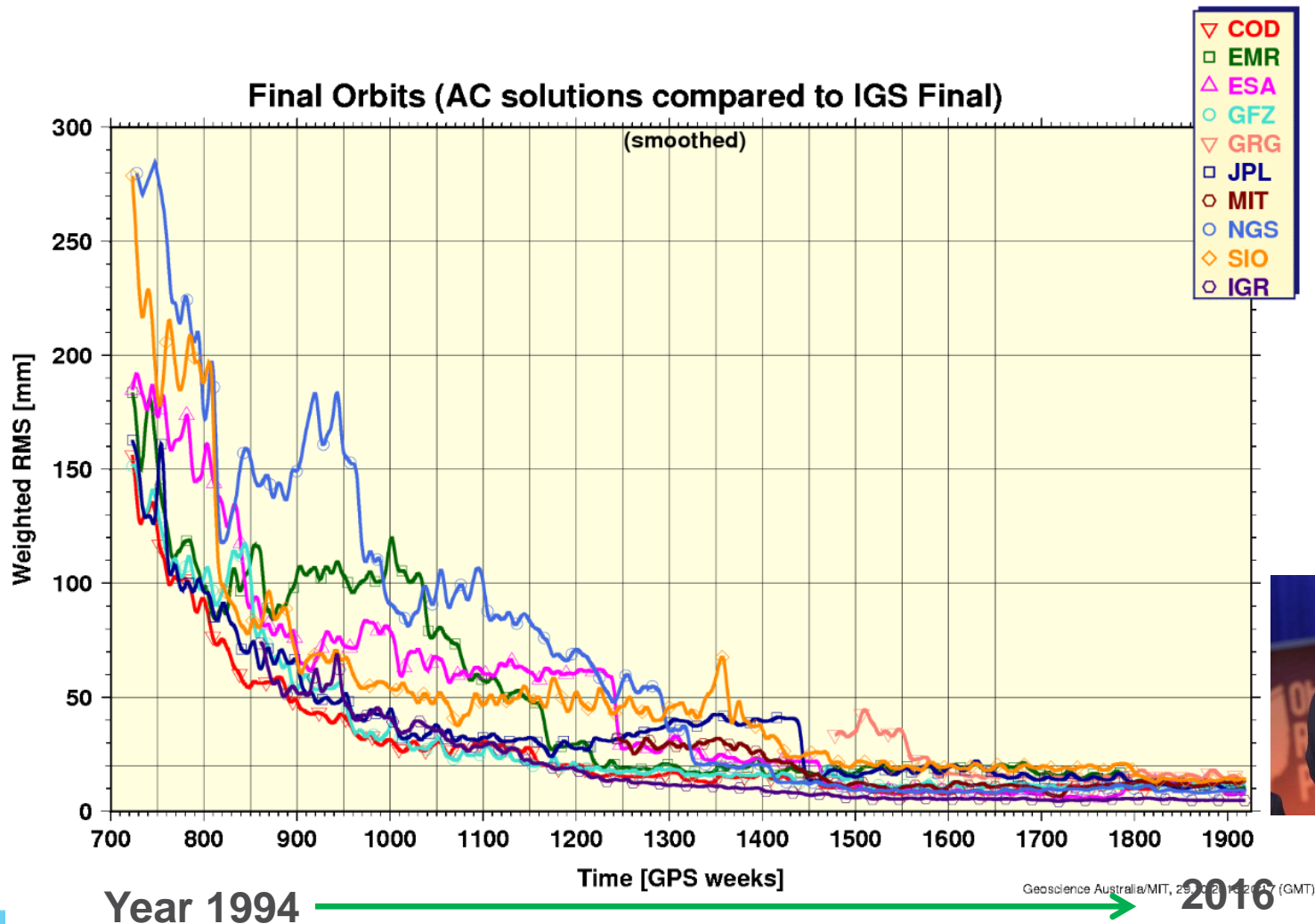
		Accuracy	Latency	Updates	Sample Interval	Archive locations
GPS Satellite Ephemerides/ Satellite & Station Clocks						
Broadcast	orbits	~100 cm	real time	--	daily	<a href="#">CDDIS</a> (US-MD) <a href="#">SOPAC</a> (US-CA) <a href="#">IGN</a> (FR)
	Sat. clocks	~5 ns RMS ~2.5 ns SDev				
Ultra-Rapid (predicted half)	orbits	~5 cm	real time	at 03, 09, 15, 21 UTC	15 min	<a href="#">CDDIS</a> (US-MD) <a href="#">IGS CB</a> (US-CA) <a href="#">SOPAC</a> (US-CA) <a href="#">IGN</a> (FR) <a href="#">KASI</a> (KOREA)
	Sat. clocks	~3 ns RMS ~1.5 ns SDev				
Ultra-Rapid (observed half)	orbits	~3 cm	3 - 9 hours	at 03, 09, 15, 21 UTC	15 min	<a href="#">CDDIS</a> (US-MD) <a href="#">IGS CB</a> (US-CA) <a href="#">SOPAC</a> (US-CA) <a href="#">IGN</a> (FR) <a href="#">KASI</a> (KOREA)
	Sat. clocks	~150 ps RMS ~50 ps SDev				
Rapid	orbits	~2.5 cm	17 - 41 hours	at 17 UTC daily	15 min	<a href="#">CDDIS</a> (US-MD) <a href="#">IGS CB</a> (US-CA) <a href="#">SOPAC</a> (US-CA) <a href="#">IGN</a> (FR) <a href="#">KASI</a> (KOREA)
	Sat. & Stn. clocks	~75 ps RMS ~25 ps SDev			5 min	
Final	orbits	~2.5 cm	12 - 18 days	every Thursday	15 min	<a href="#">CDDIS</a> (US-MD) <a href="#">IGS CB</a> (US-CA) <a href="#">SOPAC</a> (US-CA) <a href="#">IGN</a> (FR) <a href="#">KASI</a> (KOREA)
	Sat. & Stn. clocks	~75 ps RMS ~20 ps SDev			Sat.: 30s Stn.: 5 min	

# A list of ACs

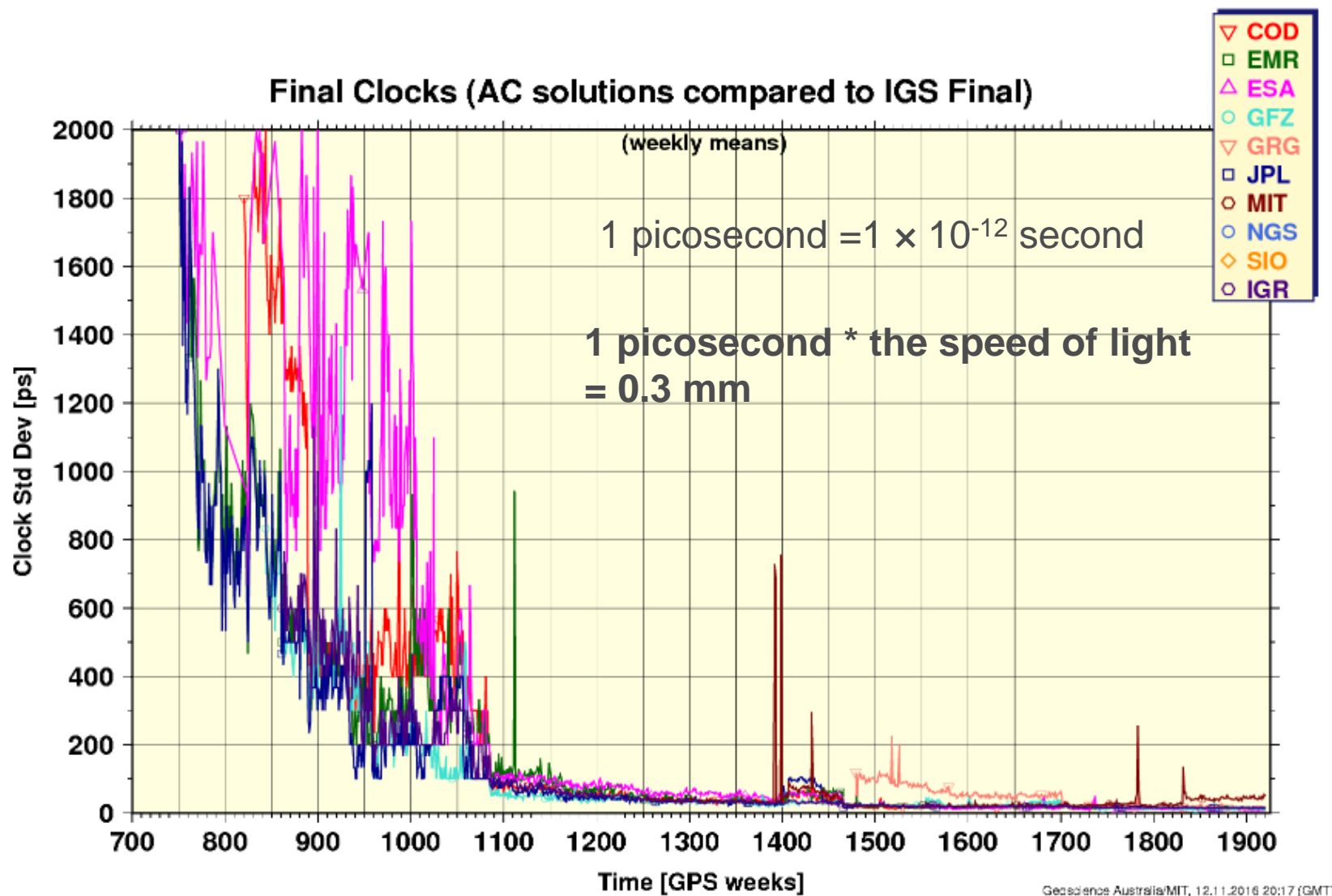
- Final products: COD, EMR, ESA, GFZ, **GRG**, JPL, **MIT**, NGS, SIO (9 ACs)
  - Rapid products: COD, EMR, ESA, GFZ, JPL, NGS, SIO, **USN**, **WHU** (9 ACs)
  - Ultra rapid products: COU, EMU, ESU, GFU, GOU, JPU, NGU, SIU, USU, WHU (10 ACs)
- 
- ❖ COD: the Center for Orbit Determination in Europe, Switzerland and Germany
  - ❖ EMR: Natural Resources Canada
  - ❖ ESA: the European Space Agency, Germany
  - ❖ GFZ: Deutsches GeoForschungsZentrum, Germany
  - ❖ GRG: CNES-CLS Analysis Centre (Centre National d'Etudes Spatiales, Collecte Localisation Satellites, France)
  - ❖ JPL: Jet Propulsion Laboratory, USA
  - ❖ NGS: National Geodetic Survey, USA
  - ❖ SIO: Scripps Institute of Oceanography, USA
  - ❖ USN: United States Naval Observatory (USNO), USA
  - ❖ WHU: Wuhan University, China; MIT: Massachusetts Institute of Technology, USA



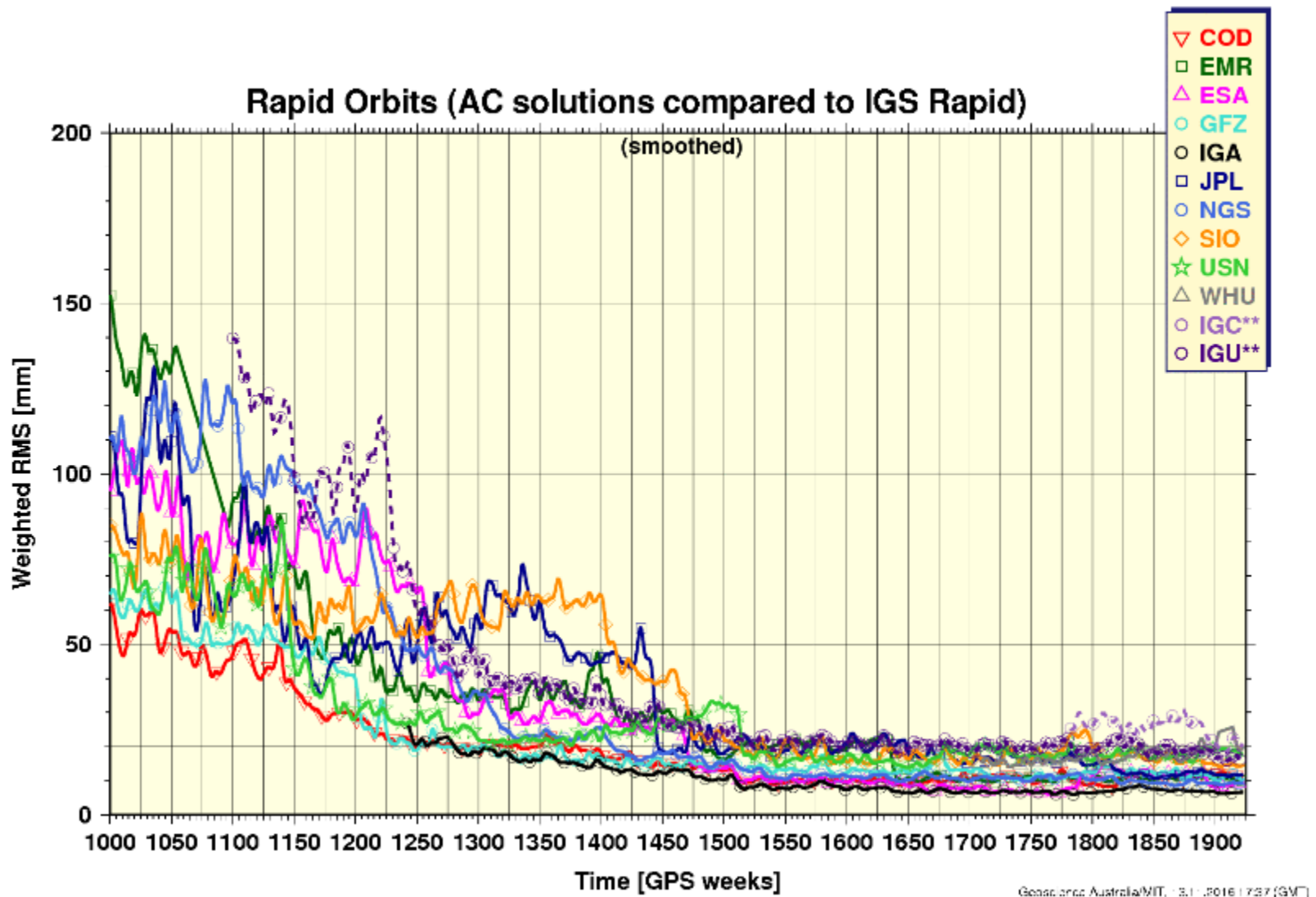
# Quality control of IGS products – Final orbits



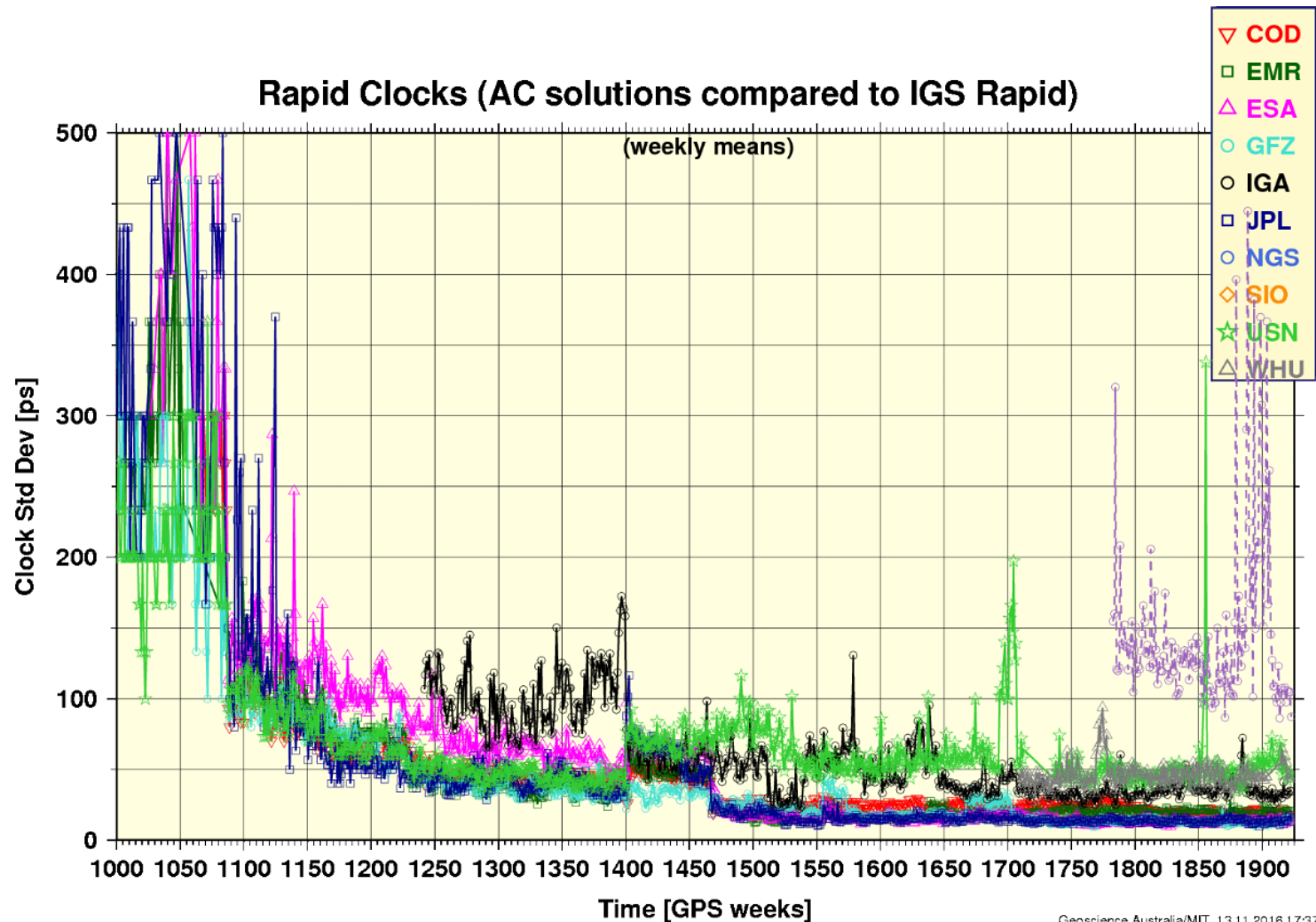
# Quality control of IGS products – Final clocks



# Quality control of IGS products – Rapid orbits



# Quality control of IGS products – Rapid clocks

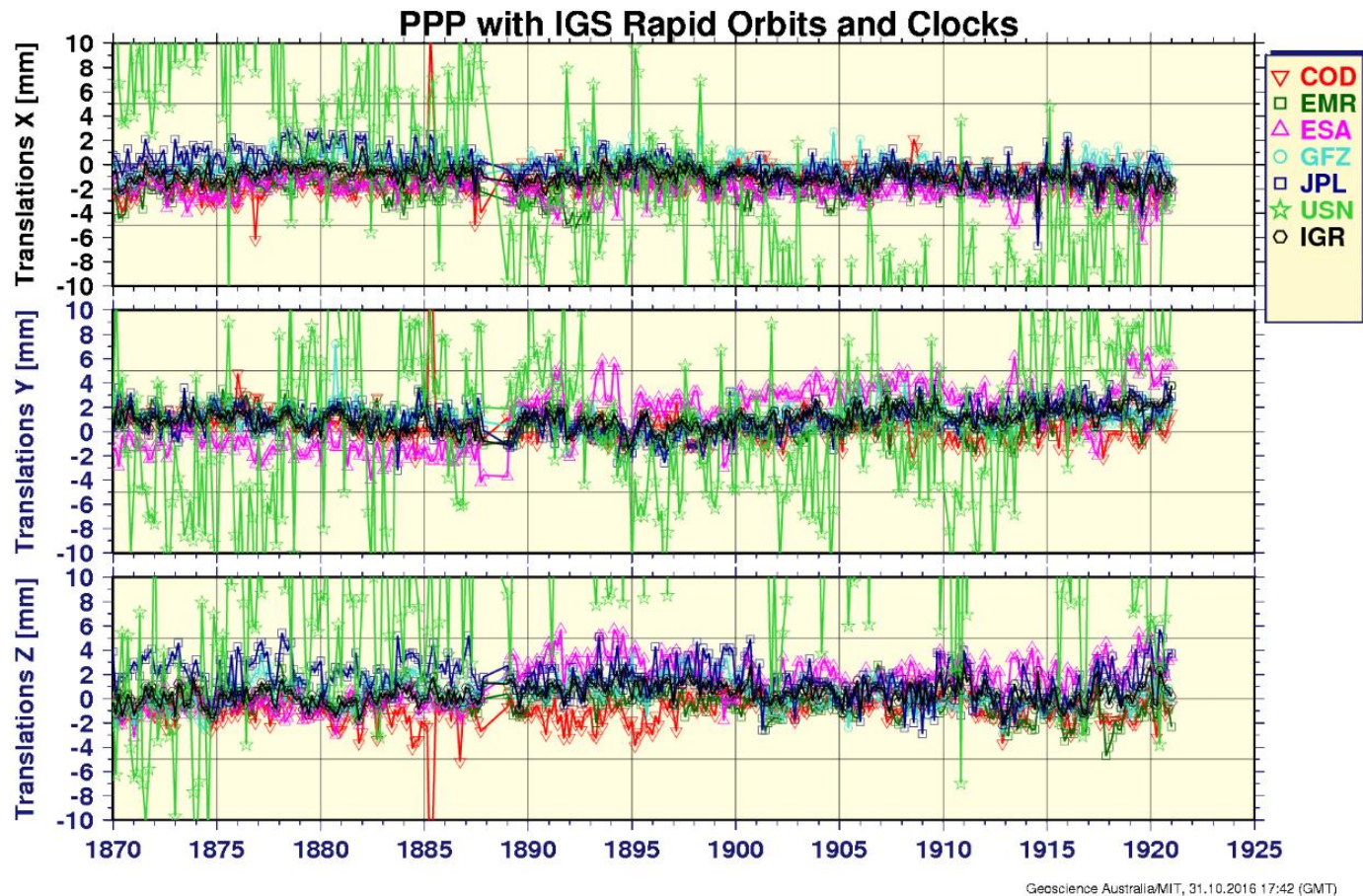


Geoscience Australia/MIT, 13.11.2016 17:37 (GMT)



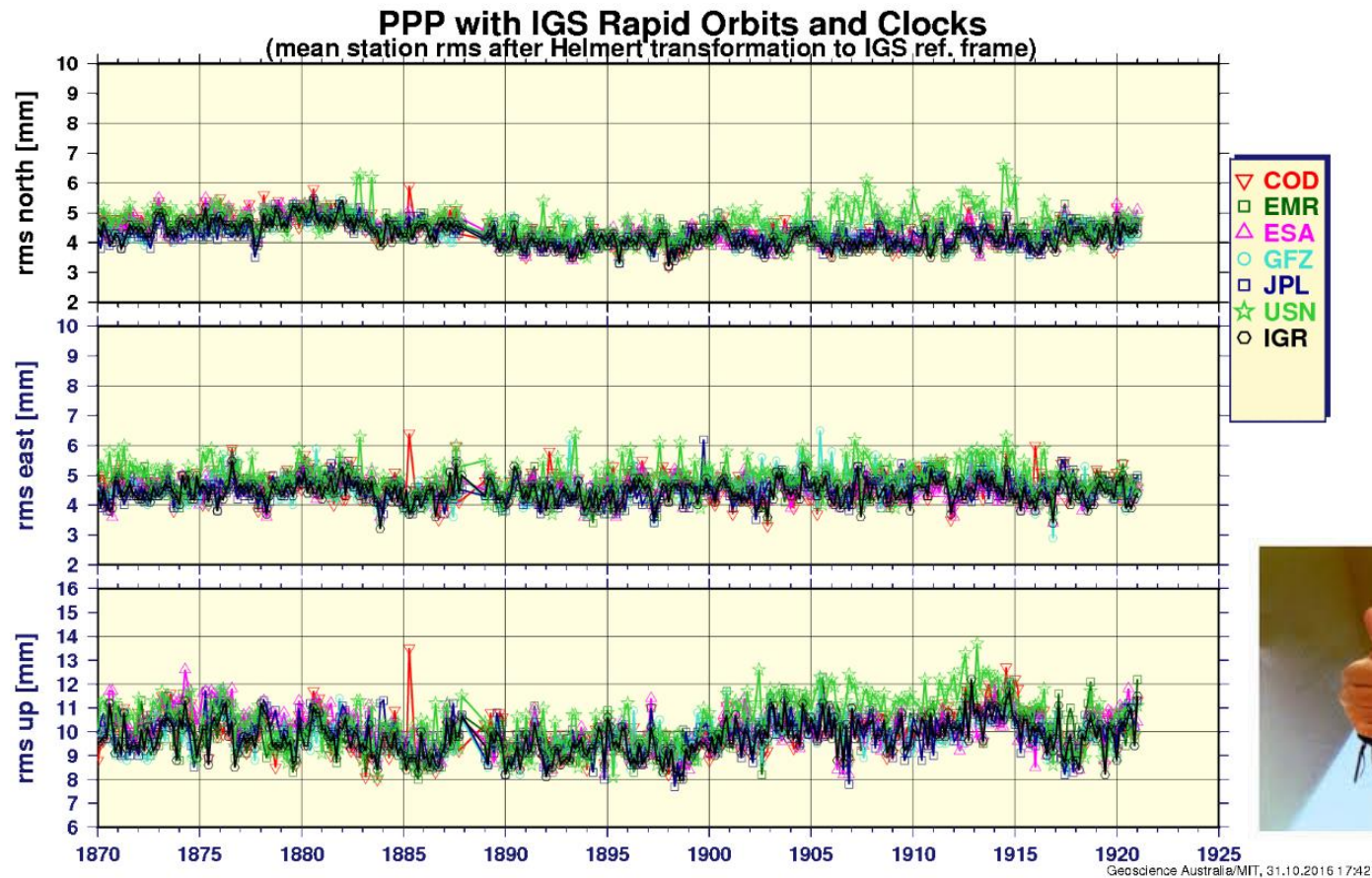
# Quality control of IGS products

- Rapid PPP (near real-time, Bernese software v5.2)



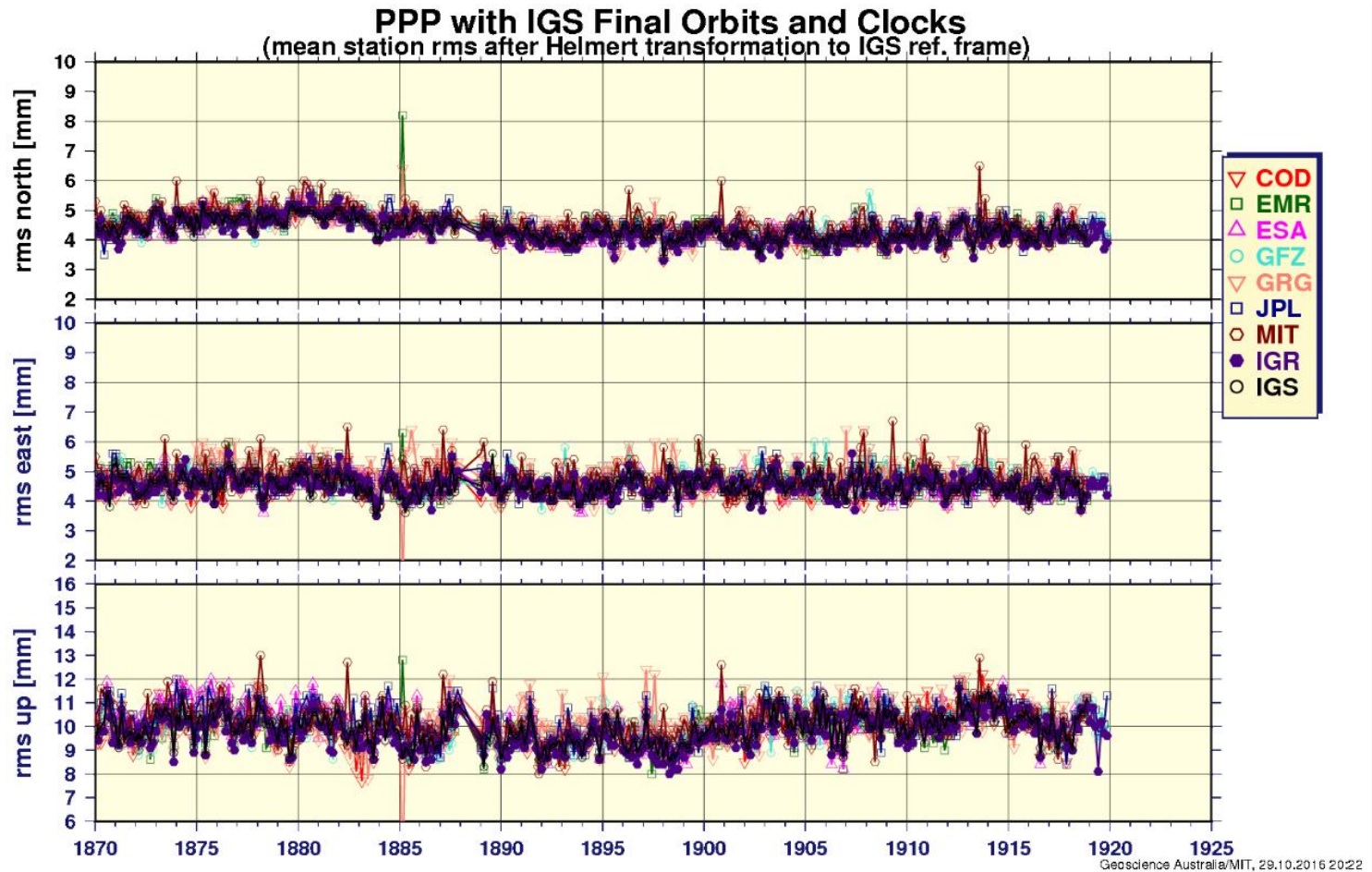
# Quality control of IGS products

- Rapid PPP (near real-time, Bernese software 5.2)



# Quality control of IGS products

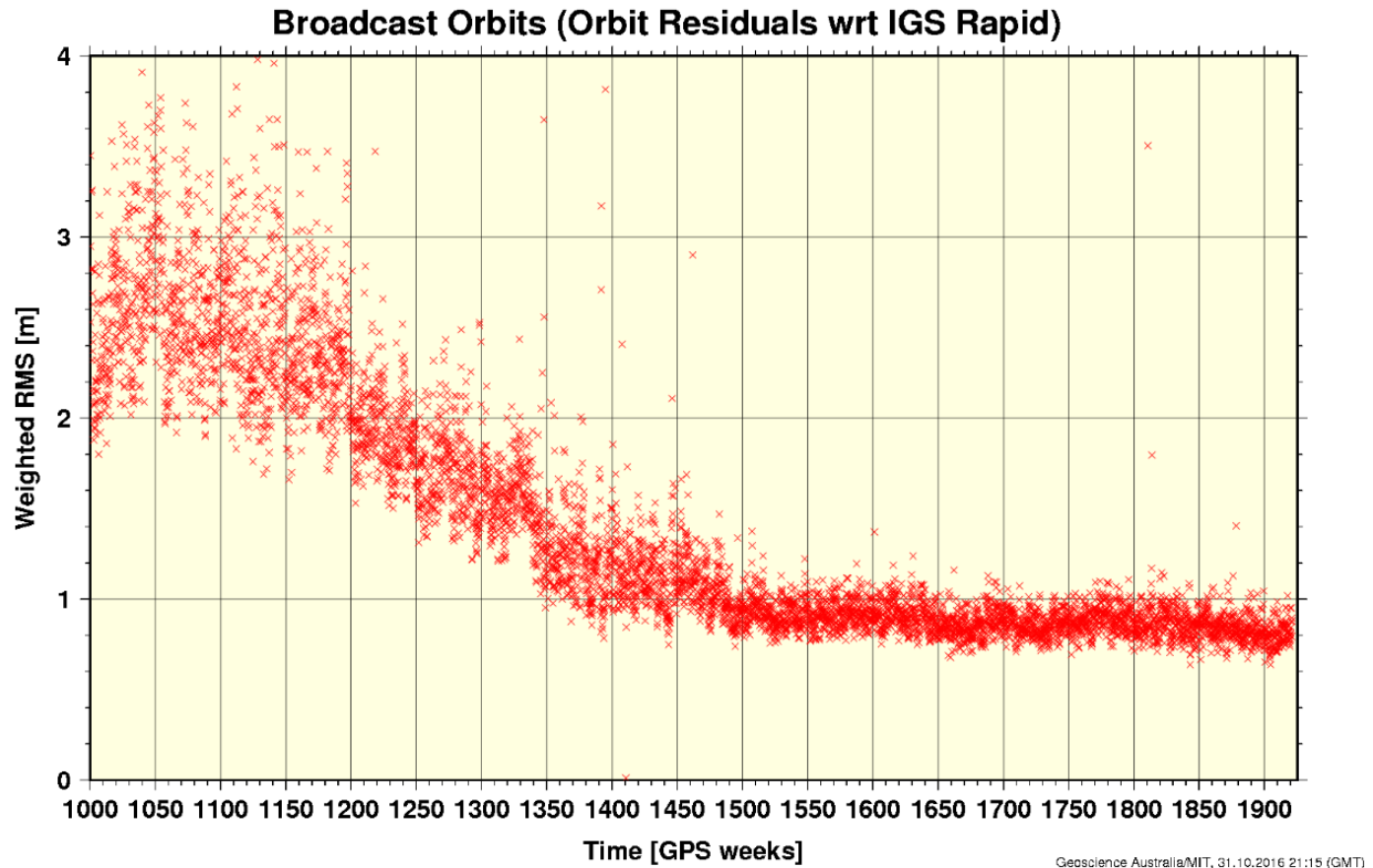
- Final PPP (Bernese software v5.2)





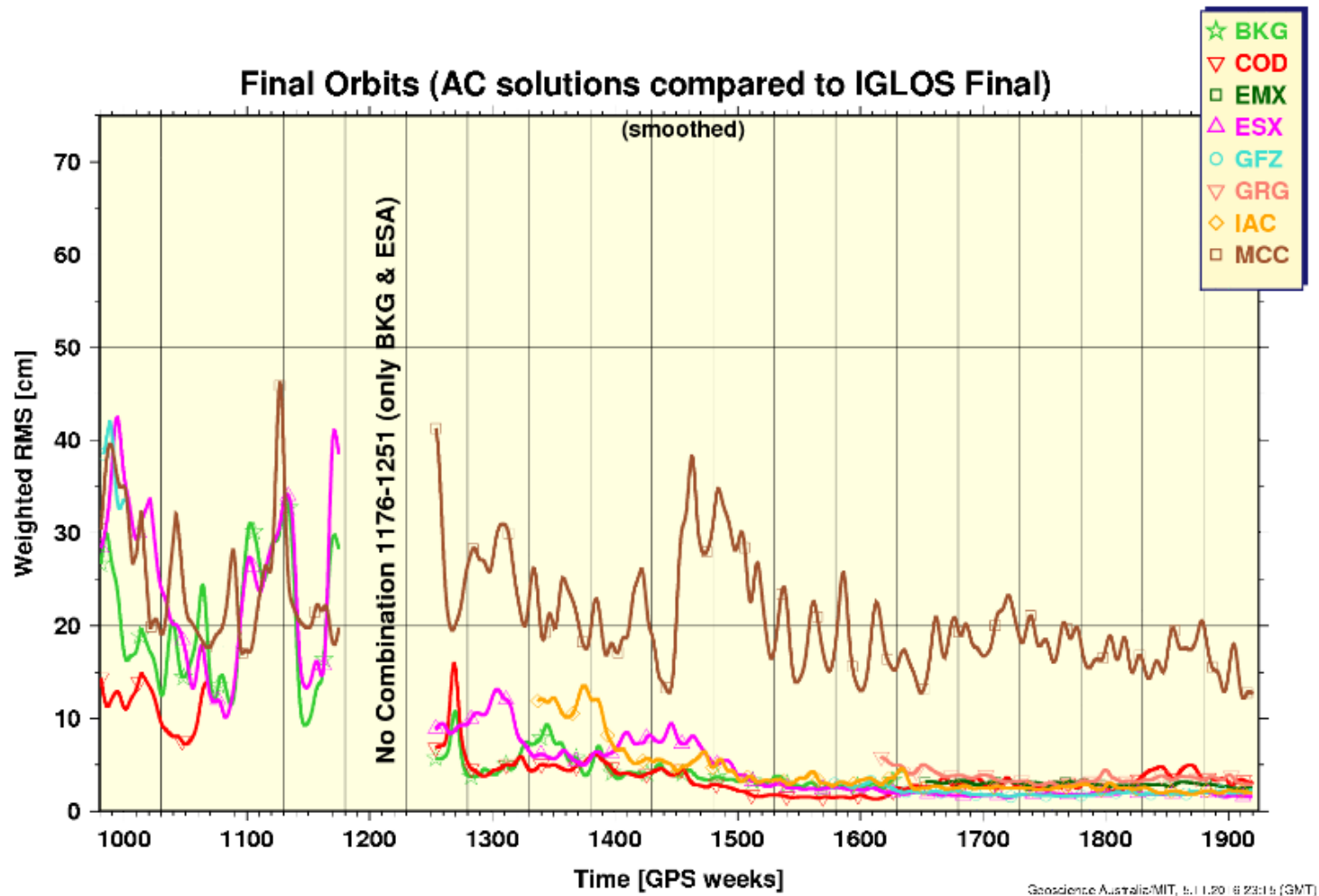
# Quality control of IGS products

- Broadcast orbits



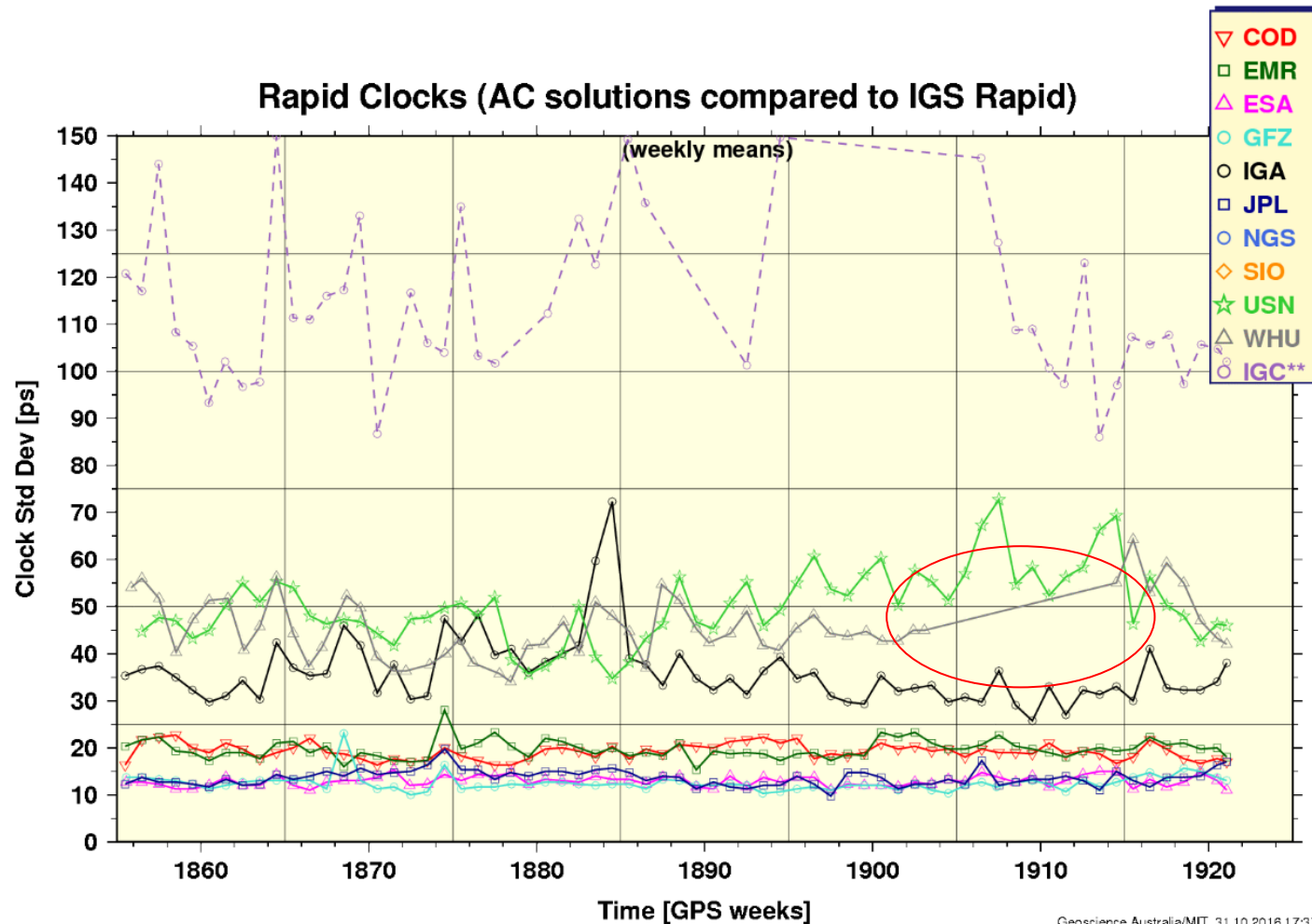


# Quality control of IGS products - GLONASS



# Minor events

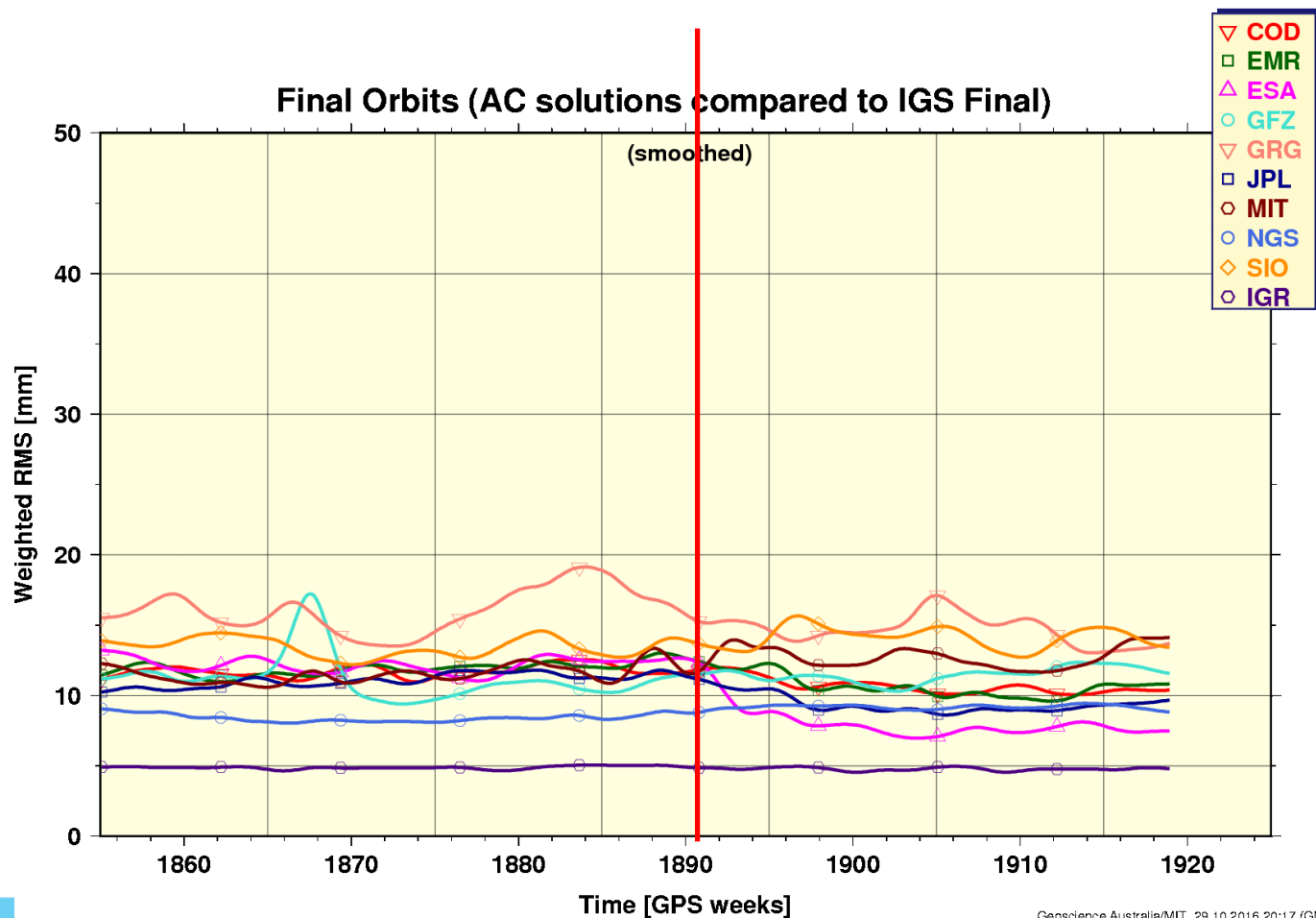
Missing rapid products from WHU



Geoscience Australia/MIT, 31.10.2016 17:37 (GMT)

# Minor events












Inter-consistency of the Final Orbit WRMS has decreased (more scatter) since wk1891



Geoscience Australia/MIT, 29.10.2016 20:17 (GMT)

# Minor events

- Delay in delivery of IGS final products for weeks 1907 and 1909 because of a delay the arrival of the IGS SINEX combination from IGN
- SIO did not appear in the orbit combination for wk1909 because of SIO final products did not reach CDDIS, caused by the testing of CDDIS new upload procedure
- More recently, IGU failure of 1924-5\_12 (unforeseen reason, still not solved)
- AC submission errors

Date: Yesterday			
	acc@igs.org	*** ERROR in AC SUBMISSION cou19260_00.sp3	Sun 4/12/2016 2:01 PM 35 KB
	acc@igs.org	*** ERROR in AC SUBMISSION cou19260_00.sp3	Sun 4/12/2016 1:57 PM 35 KB
	acc@igs.org	*** ERROR in AC SUBMISSION cou19260_00.sp3	Sun 4/12/2016 1:41 PM 35 KB
	acc@igs.org	*** ERROR in AC SUBMISSION cou19260_00.sp3	Sun 4/12/2016 1:26 PM 35 KB
	acc@igs.org	*** ERROR in AC SUBMISSION cou19260_00.sp3	Sun 4/12/2016 1:11 PM 35 KB
	acc@igs.org	*** ERROR in AC SUBMISSION cou19260_00.sp3	Sun 4/12/2016 12:57 ... 35 KB
	acc@igs.org	*** ERROR in AC SUBMISSION whu19256_12.sp3	Sun 4/12/2016 2:05 AM 35 KB
	acc@igs.org	*** ERROR in AC SUBMISSION whu19256_12.sp3	Sun 4/12/2016 2:01 AM 35 KB
Date: Last Week			
	acc@igs.org	*** ERROR in AC SUBMISSION whu19256_06.erp	Sat 3/12/2016 8:05 PM 36 KB
	acc@igs.org	*** ERROR in AC SUBMISSION whu19256_06.erp	Sat 3/12/2016 8:01 PM 35 KB
	acc@igs.org	*** ERROR in AC SUBMISSION whu19255_12.erp	Sat 3/12/2016 2:05 AM 36 KB

# Moving forward to IGS14/ITRF2014

- Completing Repro2 Orbit and Clock combination
- Implementation of ITRF2014 (IGS14)
- Call for testing IGS14P sent to IGS ACs on 18/10/2016
- Decision will be made at AGU IGS GB meeting for the transition plan
- Transition from IGB08 to ITRF2014 via IGS14 expected to happen in early Jan 2017

# Open discussion

- IGS products file naming conventions

IGS0IGSRAP_20162500000_01D_30S_CLK.clk	igr19132.clk
IGS0IGSRAP_20162500000_01D_01D_ERP.erp	igr19132.erp
IGS0IGSRAP_20162500000_01D_15M_ORB.sp3	igr19132.sp3
IGS0IGSRAP_20162500000_01D_00U_SUM.txt	igr19132.sum



## Questions?

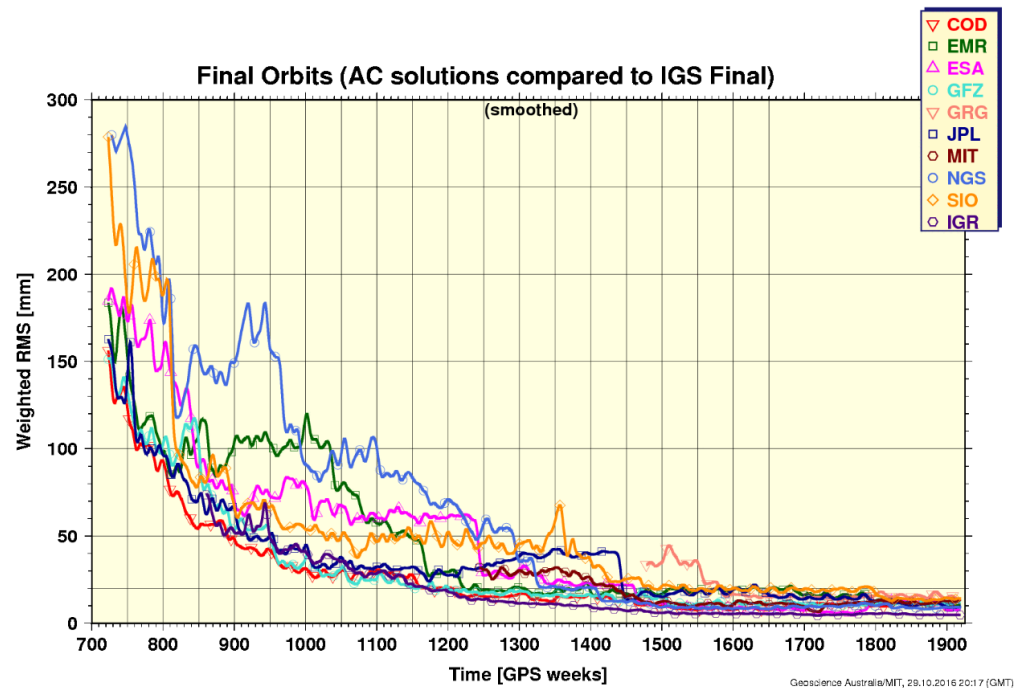
**Phone:** +61 2 6249 9884

**Web:** [www.ga.gov.au](http://www.ga.gov.au)

**Email:** [guorong.hu@ga.gov.au](mailto:guorong.hu@ga.gov.au)

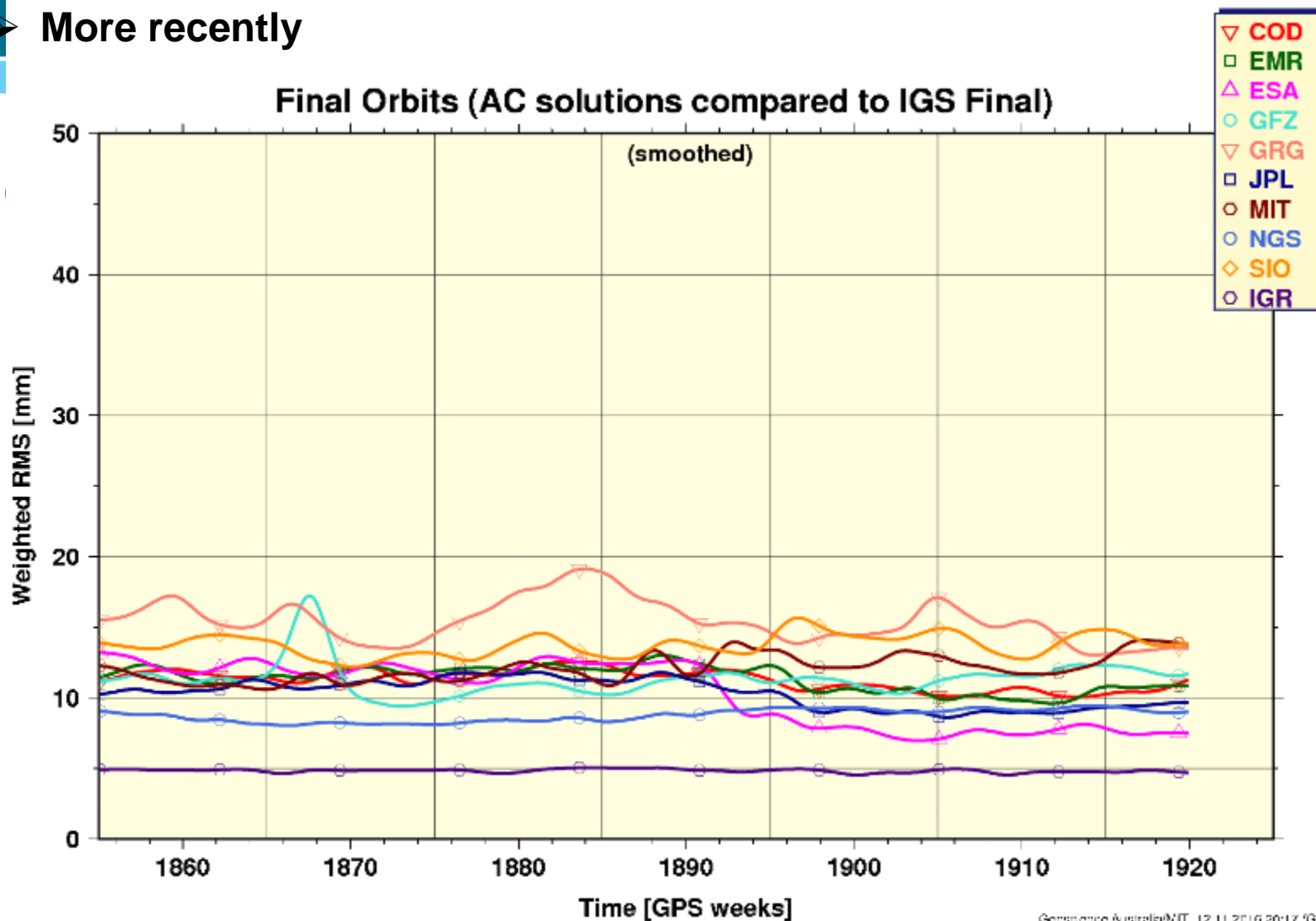
**Address:** Cnr Jerrabomberra Avenue and Hindmarsh Drive, Symonston ACT 2609

**Postal Address:** GPO Box 378, Canberra ACT 2601





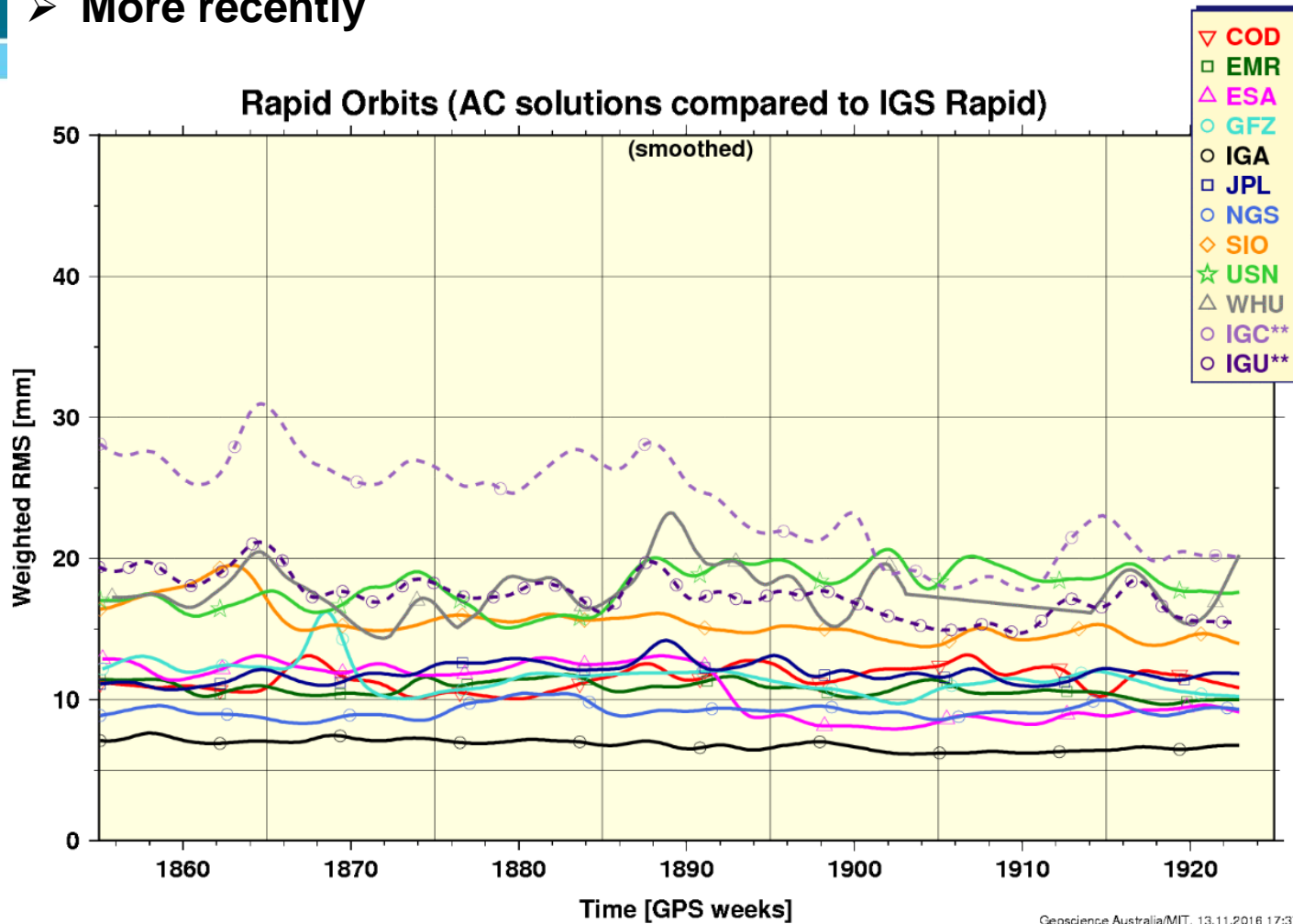
➤ More recently







➤ More recently

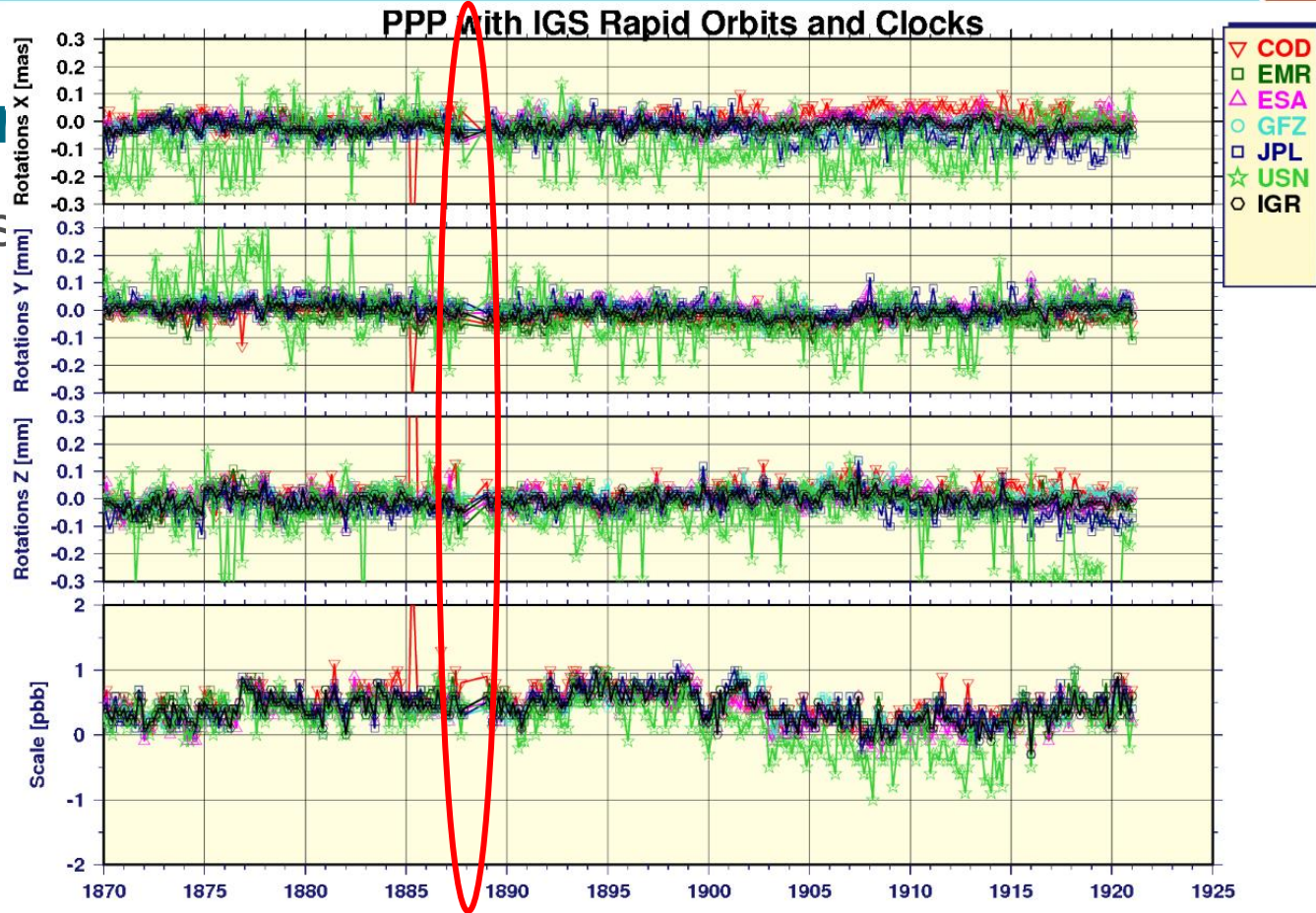


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## OUTLINE

- History of IGS ACC (Analysis Centres Coordinator)
- What's the role of IGS ACC
- Major changes of IGS products combination
- Current status of the IGS products
- Quality control of the IGS products
- Minor events during the past few months
- Moving forward to IGS14/ITRF2014