

The Challenges of a Multi-GNSS Future for IGS

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The Mission ...

“The International GNSS Service provides the highest quality GNSS data, products, and services in support of the terrestrial reference frame; Earth observations and research; positioning, navigation, and timing (PNT); and other applications that benefit the scientific community and society.”

... and the Challenge

“Keep this promise in a rapidly changing world of GNSS”

Which Changes?

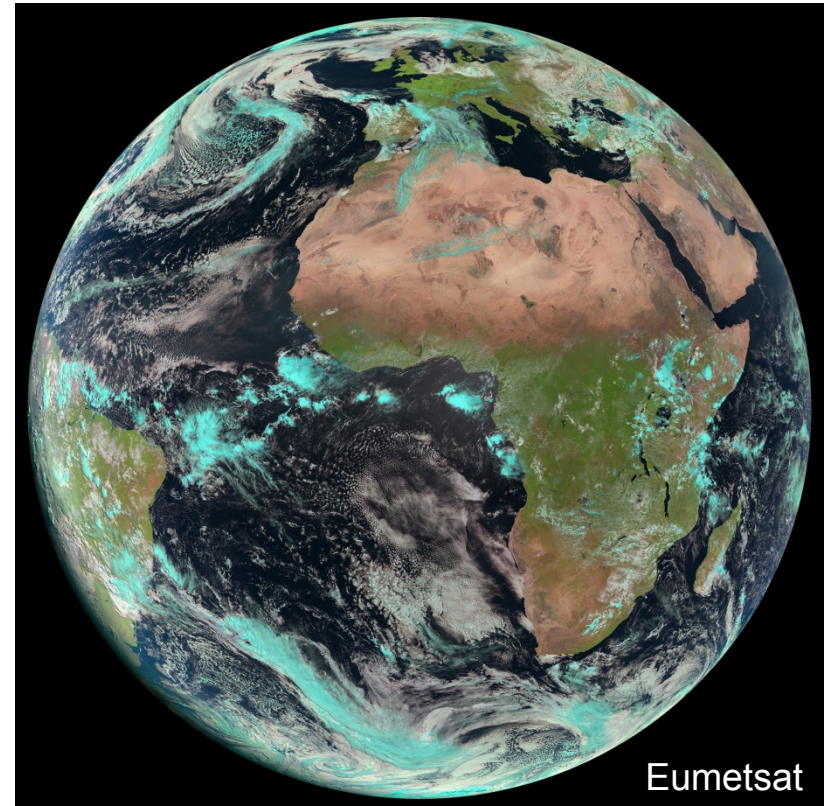
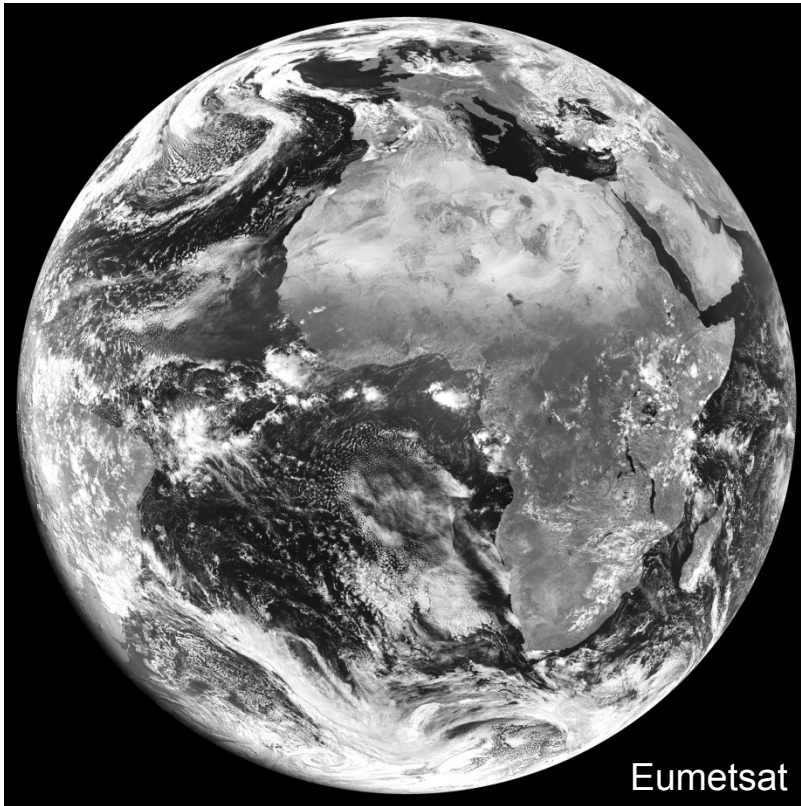
Real-Time
GNSS

Assured PNT

New Signals and
Constellations




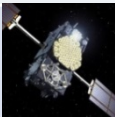

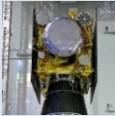
Commercial
Providers

The Earth: A Multi-GNSS Perspective



- First “new” satellites launched a decade ago
 - GPS IIR-M (Sep 2005)
 - GIOVE-A (Dec. 2005)
 - COMPASS-M1 (Apr. 2007)
- CONGO Network
 - 8 globally distributed Galileo stations in 2009
- IGS Multi-GNSS Experiment
 - Call for participation in 2011, active since 2012
 - Platform for early familiarization
 - Data and products

GNSS Status

System		Blocks	Signals	Sats ^{*)}
GPS		HA	L1 C/A, L1/L2 P(Y)	4
		IIR	L1 C/A, L1/L2 P(Y)	12
		IIR-M	+L2C	7
		IIF	+L5	11
GLONASS		M	L1/L2 C/A+P	21
		M+	L1/L2 C/A+P, L3 (CDMA)	1
		K1	L1/L2 C/A+P, L3 (CDMA)	1+(1)
BeiDou		GEO	B1, B2, B3	5
		IGSO	B1, B2, B3	5
		MEO	B1, B2, B3	3
		3 rd generation	(B1,B3)	(4)
Galileo		IOV	E1, (E6), E5a/b/ab	3+(1)
		FOC	E1, (E6), E5a/b/ab	4+(4)
QZSS		IGSO	L1 C/A, L1C, SAIF L2C, E6 LEX, L5	1
IRNSS		IGSO	L5, S	4+(1)

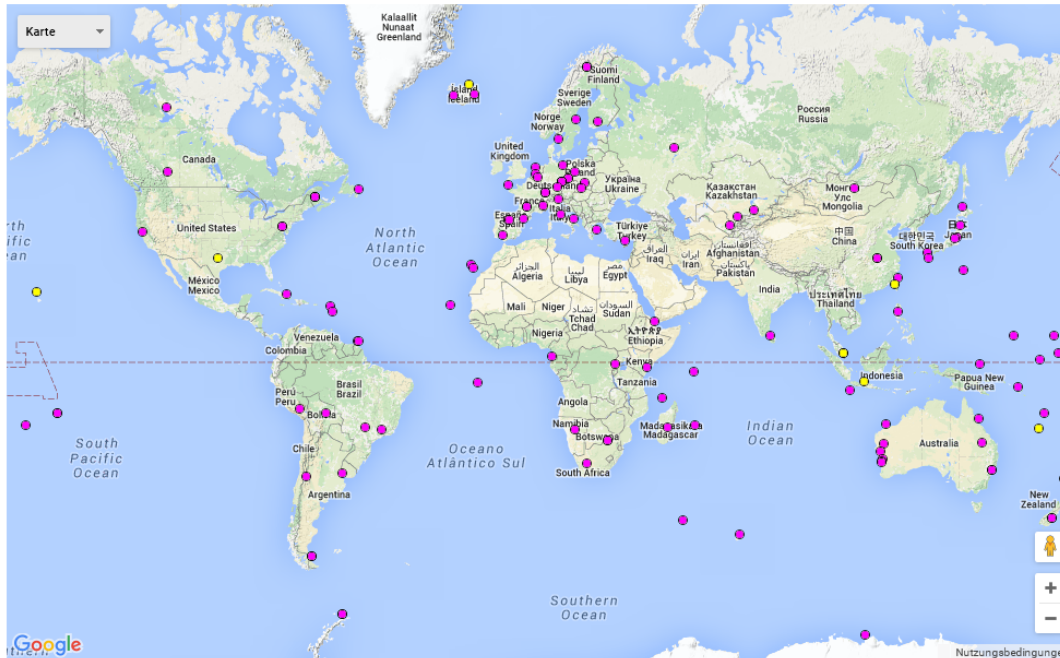
^{*)} Status Jan 2016; brackets indicate satellites not declared healthy/operational

IGS Multi-GNSS Stations

<http://www.igs.org/network?network=multi-GNSS>

Network

Information



- ~130 stations with GAL, BDS, or QZSS tracking
- Includes ~70 real-time stations

Options >>>

Site	Location	Receiver	Antenna	Other	Network Filter
<input checked="" type="checkbox"/> Site	<input checked="" type="checkbox"/> City	<input checked="" type="checkbox"/> Receiver	<input checked="" type="checkbox"/> Antenna	<input checked="" type="checkbox"/> Last Data Available	<input type="checkbox"/> IGS08 Core
<input type="checkbox"/> Changes Pending?	<input checked="" type="checkbox"/> Country	<input type="checkbox"/> Receiver SN	<input checked="" type="checkbox"/> Radome	<input checked="" type="checkbox"/> Satellite System	<input checked="" type="checkbox"/> MGEX Experimental
<input checked="" type="checkbox"/> Network(s)	<input checked="" type="checkbox"/> Agency	<input type="checkbox"/> Firmware	<input checked="" type="checkbox"/> Calibration	<input type="checkbox"/> Data Center	<input type="checkbox"/> IGS
<input type="checkbox"/> Long Name	<input type="checkbox"/> Agency Name		<input type="checkbox"/> Clock	<input checked="" type="checkbox"/> Site	<input checked="" type="checkbox"/> IGS Multi-GNSS
<input type="checkbox"/> Domes #	<input checked="" type="checkbox"/> Latitude				<input type="checkbox"/> IGS08
<input type="checkbox"/> SiteID	<input checked="" type="checkbox"/> Longitude				<input type="checkbox"/> RTS
	<input checked="" type="checkbox"/> Height				<input type="checkbox"/> Former IGS
	<input checked="" type="checkbox"/> Site				<input type="checkbox"/> IGS Proposed
					<input type="checkbox"/> Former MGEX

Apply Network Filter

Orbit & Clock Products

Agency	ID	GNSS	Sampling (O/C)	Notes
CNES/CLS	grm	GRE	15m/30s	+snx for 120 stations
CODE	com	GRECJ	15m/5m	New ECOM-2 model
GFZ	gbm	GRECJ	5m/30s	Replaces previous gfm product
JAXA	qzf	GJ	5m/(5m)	SP3-only, no CLK
TUM	tum	EJ	5m/(5m)	SP3-only, no CLK
WU	wum	GRECJ	15m/5m	

Status Jan. 2016

GNSS	Consistency (3D RMS)	SLR	Notes
Galileo	10-20 cm	10 cm	
BeiDou	20-40 cm few m	10 cm 50 cm	MEO/IGSO GEO
QZSS	20-40 cm	20 cm	

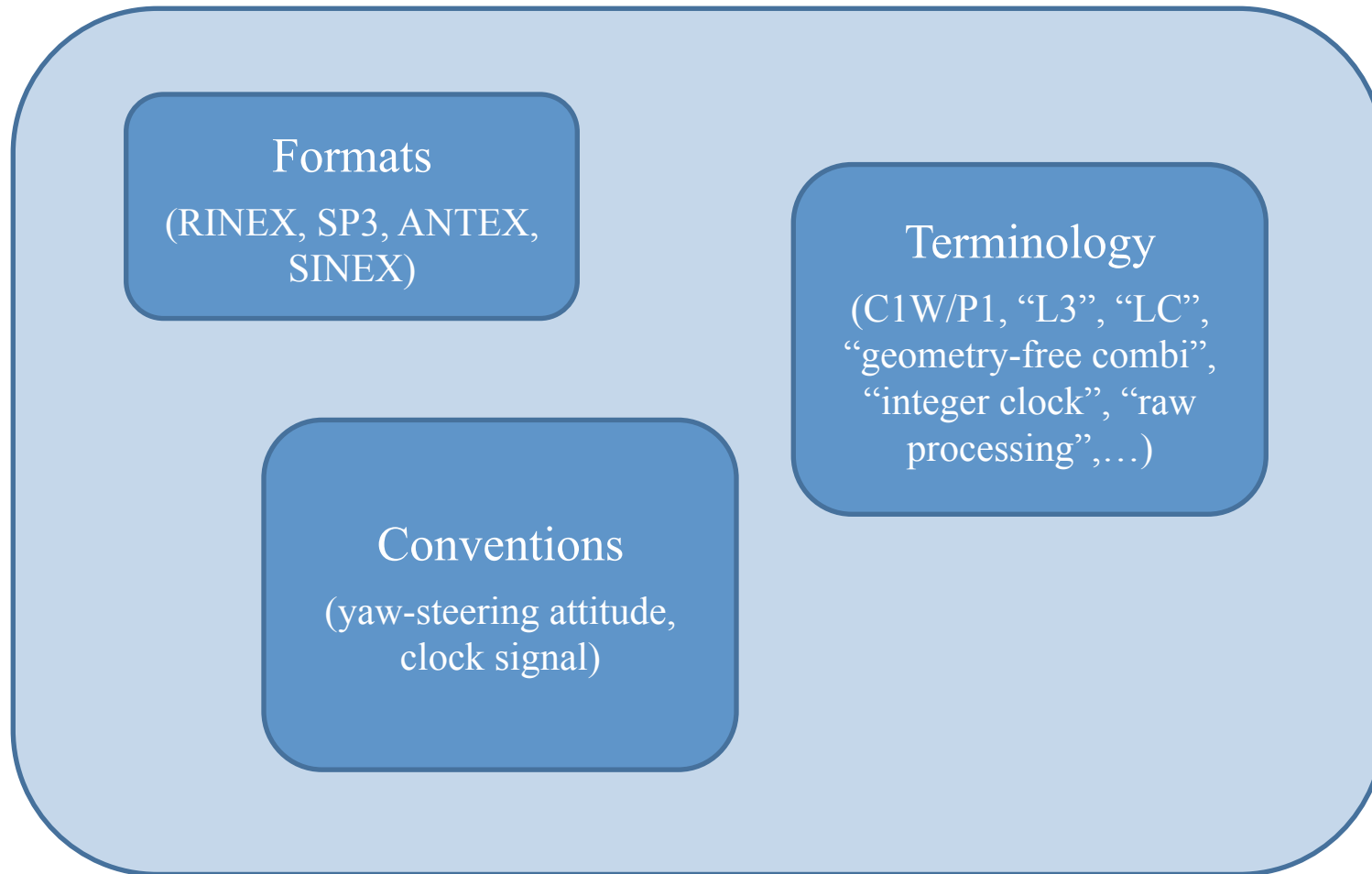
MultiGNSS – The Challenges

Habits

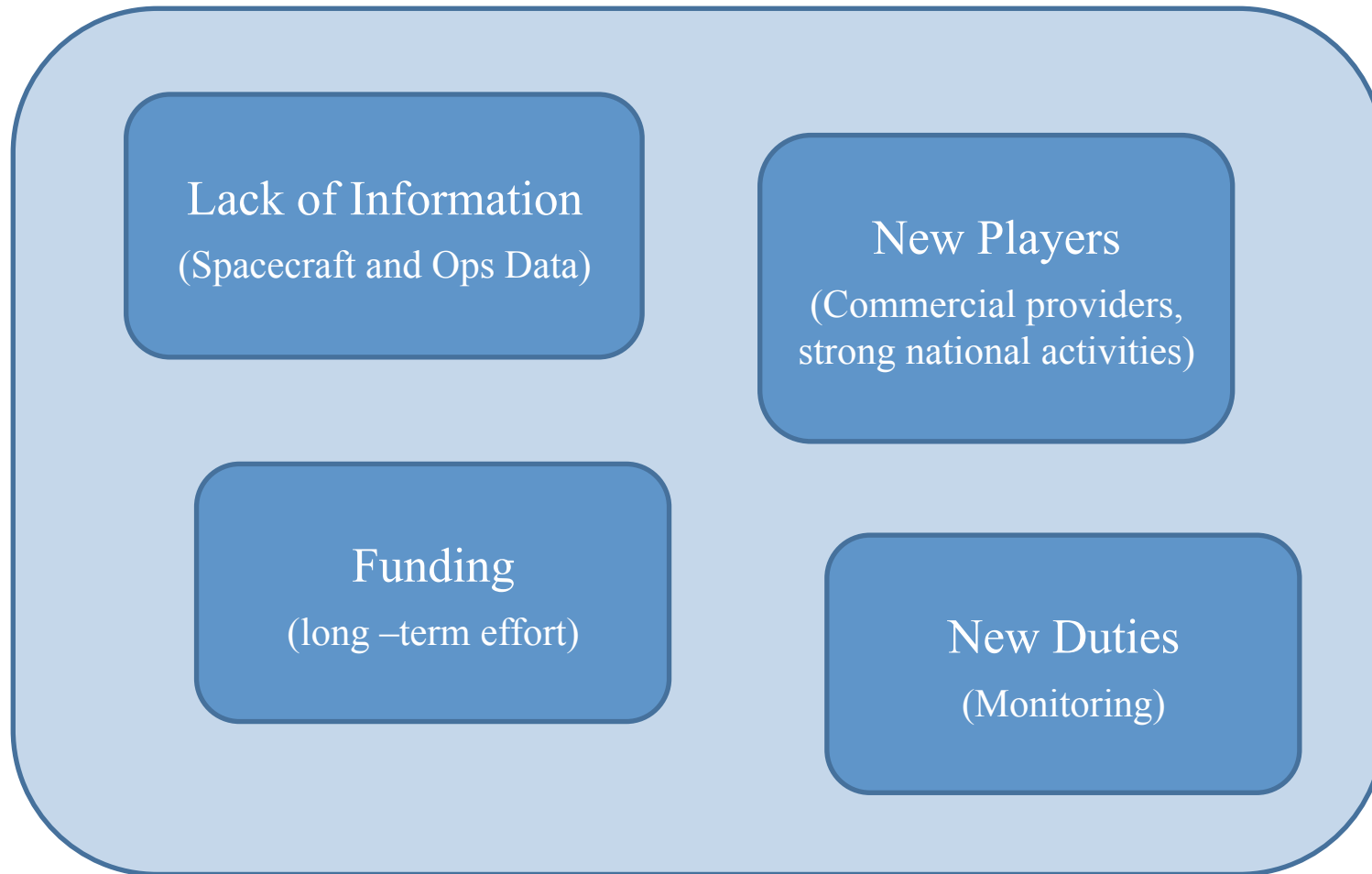
Technical

Political

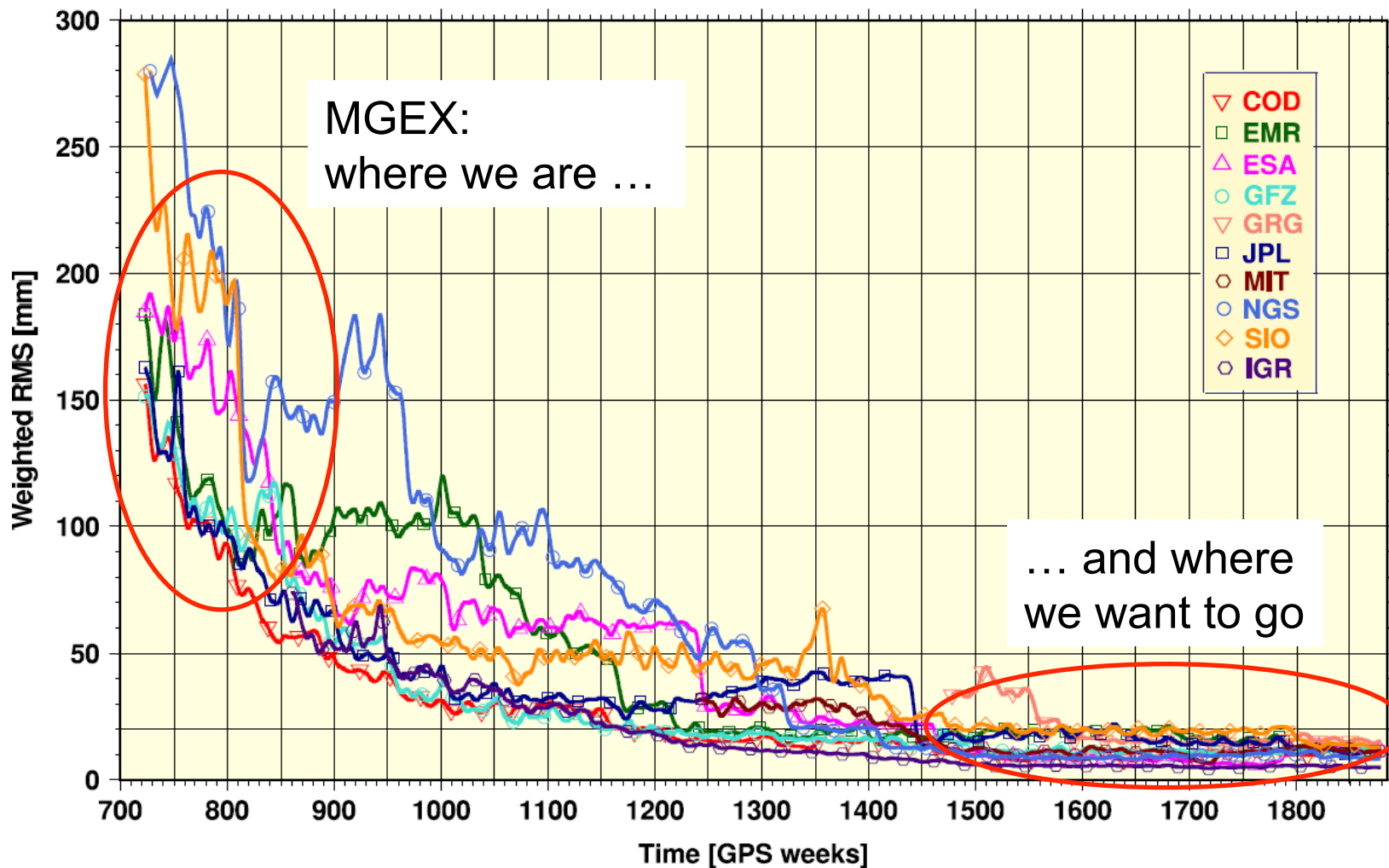
Performance

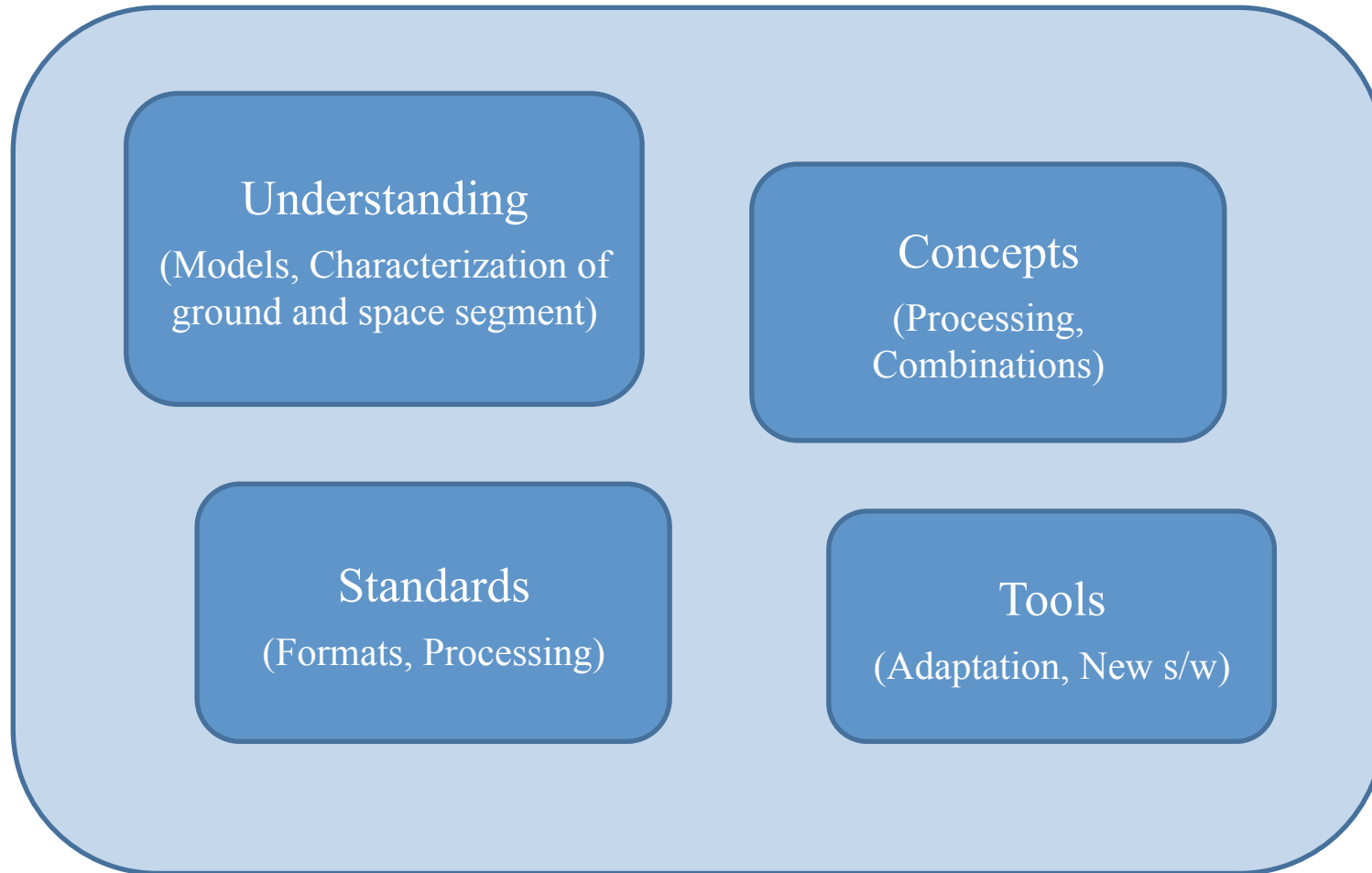


MultiGNSS Challenges – Political



MultiGNSS Challenges – Performance







Yes, we can.”

“... with a little bit of help
from my friends ...”

“Wir schaffen das.”