G14A-06 - Analysis of the DORIS, GNSS, SLR, VLBI and gravimetric time series at the GGOS core sites

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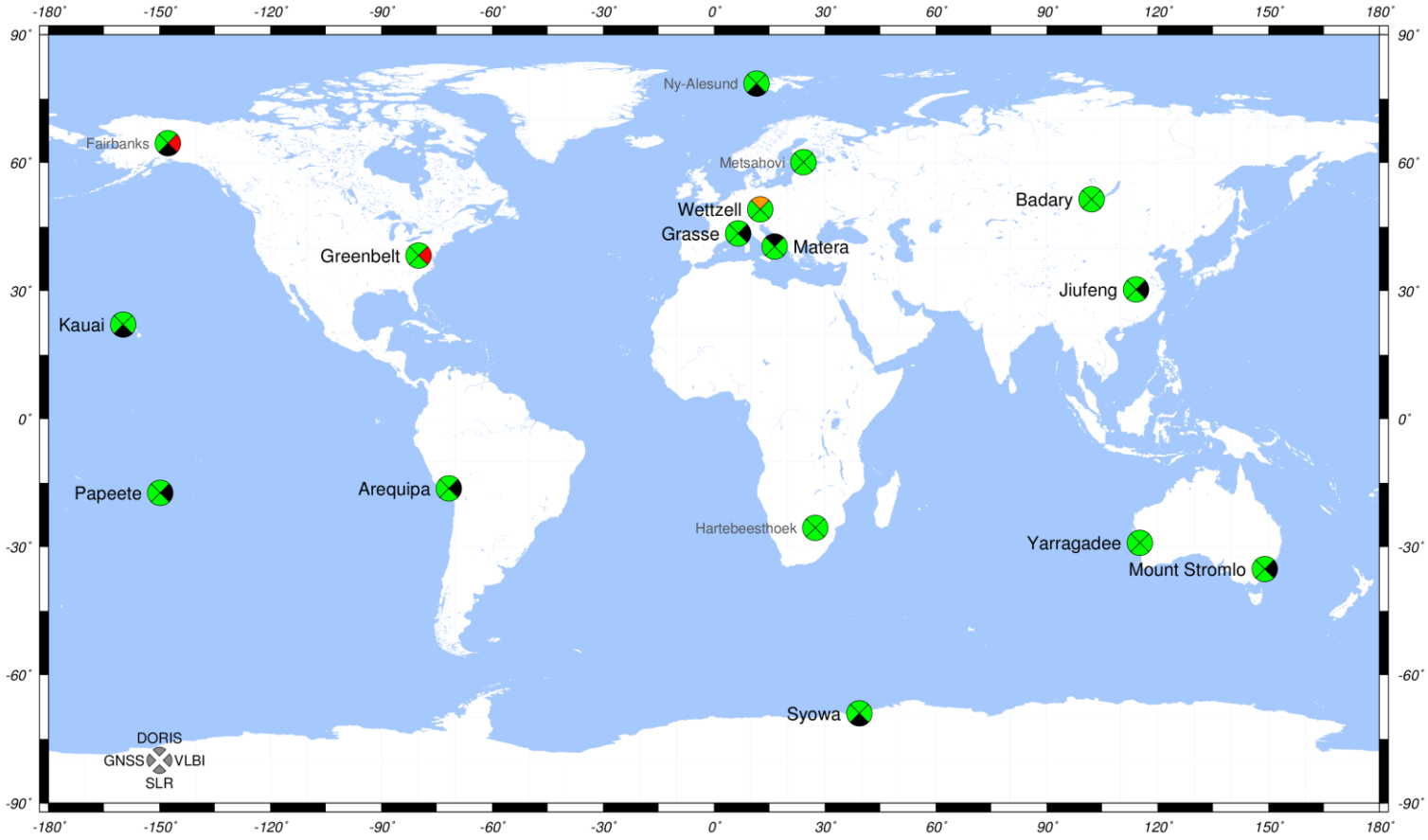
Motivation & Goals

- **Motivation & Goals:** **analysis of the time series at the 3-5 multi-technique GGOS sites to**
  - **Analyze and compare the spectral content of the space geodetic and gravity time series.**
  - **Evaluate the level of agreement between the space geodesy measurements and the physical tie vectors.**
- **Data sources:**
  - **DORIS: coordinate time series from the latest IDS combined series (ids 12).**
  - **GNSS : coordinate time series from the IGS Combination Center (ftp://igs-rf.ign.fr/).**
  - **Laser : coordinate time series from the operational ILRS combination.**
  - **VLBI : coordinate time series from GSFC.**
  - **Gravity: BGI.**

Source: GGAO/BKG

http://ids-doris.org

Multi technique sites

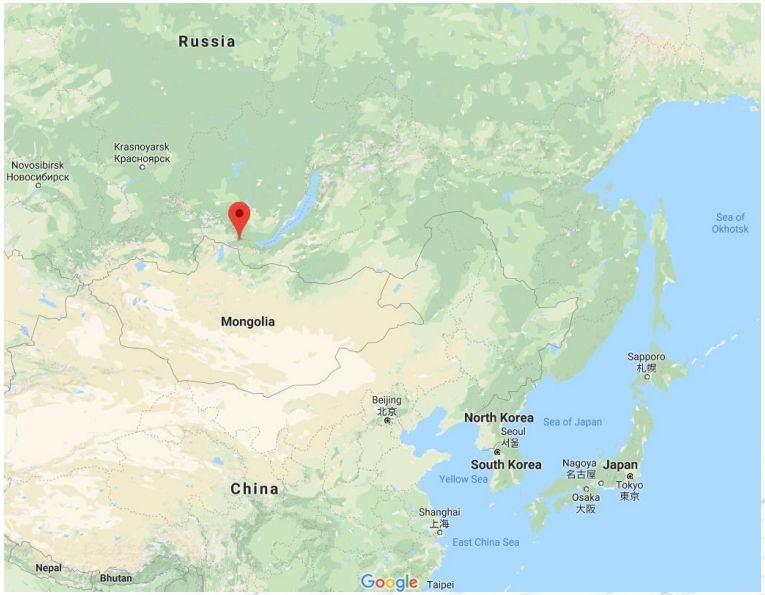


# techniques	# sites
4	6
3	10

- Fairbanks, Hartebeesthoek, Metsahovi, Ny-Alesund: co-location > 1km.
- Wettzell: DORIS started recently (2016/09/27).

Badary (Russia)

- **Host agency: Institute of Applied Astronomy (of the Russian Academy of Sciences)**
- **4 techniques**
- **DORIS:**
  - **Since 1991/12/11.**
  - **BADA, BADB.**
- **GNSS:**
  - **Since 2005/04/01.**
  - **BADG.**
- **SLR:**
  - **Since 2011/07/10.**
  - **1890 (BADL).**
- **VLBI:**
  - **Since 2007/03/01.**
  - **7382.**
- **Tie vectors:**
  - **BADB/BADG/7382.**



Badary (Russia) - Sitelog

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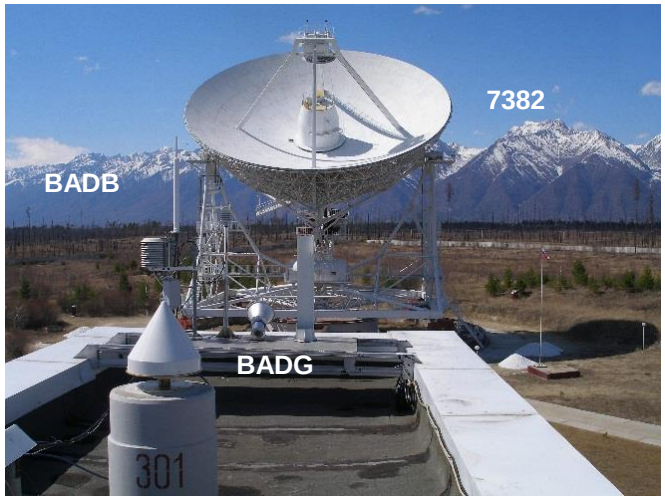

Technique	Monument Description (from sitelogs)
DORIS (BADB)	Ant. support: 30cm sided very rigid metal tower 1m high Installed on: Thick aluminium plate fixed on the terrace roof of a 3 storied building.
GNSS (BADG)	Stainless plate on concrete pillar on flat roof of 2-storied laboratory buidling (16m above the ground).
SLR (BADL)	Concrete pillar.

Unit: m	DORIS	GNSS	SLR	VLBI
DORIS		4.285	46.324	92.457
GNSS	4.285		45.562	96.619
SLR	46.324	45,562		104.208
VLBI	92.457	96.619	104.208	

Date	Technique	Event
2004/08/10	DORIS	Station change (BADA → BADB)
2006/09/25	Ties	BADB vs BADG, BADB vs 1890
2007/04/02	GNSS	Antenna change
2010/03/15	GNSS	Antenna change
2011/06/06	Ties	1890 vs 7382

Badary (Russia) – Time series

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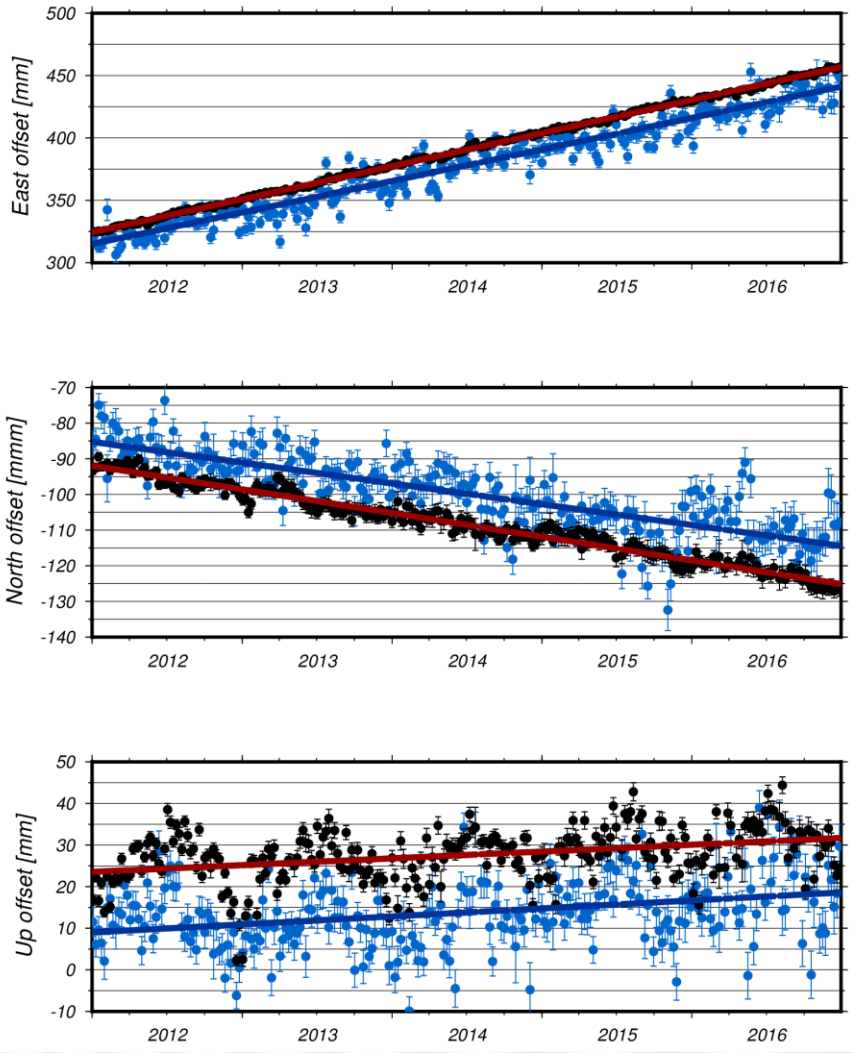
DORIS - GNSS



Time Span: 2012.0-2017.0

Mean Velocity

Unit: mm/yr	DORIS	GNSS	VLBI
Vel – East	25.3 ± 0.6	26.5 ± 0.1	26.1 ± 0.4
Vel – North	-5.9 ± 0.4	-6.6 ± 0.1	-6.2 ± 0.3
Vel - Up	1.9 ± 0.5	1.6 ± 0.3	1.1 ± 0.9

➔ **ENU velocities all agree to w/in their respective std dev**

Annual Signal Content

Units: mm & deg	DORIS	GNSS	VLBI
East	-	-	-
North	-	1.0 ± 0.2 (126.2)	-
Up	4.3 ± 0.7 (32.9)	5.2 ± 0.5 (28.0)	-

➔ **Very good agreement between DORIS and GNSS in the up.**

Yarragadee (Australia)

- **Host agency: Geoscience Australia**
- **4 techniques**
- **DORIS:**
  - **YARA, YARB, YASB - Since 1992/09/14.**
- **GNSS:**
  - **YAR2, YAR3, YARR - Since 1990/12/03.**
- **SLR:**
  - **7090 (YARL, Moblas-5) - Since 1979/07/01.**
- **VLBI:**
  - **7376 - Since 2011/05/18.**

Yarragadee (Australia) - Sitelog

Unit: m	DORIS	GNSS	SLR	VLBI
DORIS		48.080	36.690	155.779
GNSS	48.080		23.152	147.451
SLR	36.690	23.152		131.615
VLBI	155.779	147.451	131.615	

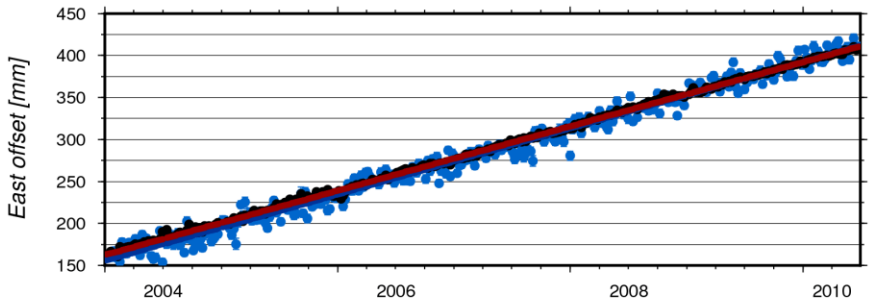
Technique	Monument Description (from sitelogs)
DORIS (YASB)	0.3m stainless steel tripod on 1.5m high concrete pillar.
GNSS (YAR2)	Stainless plate on concrete pillar on flat roof of 2-storied laboratory buidling (16m above the ground).
SLR (7090)	Concrete block.

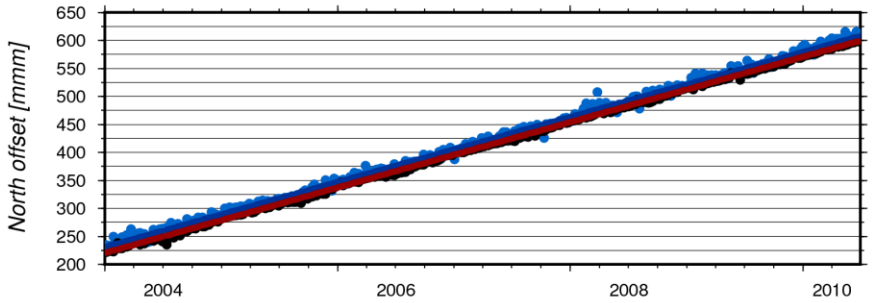
Date	Technique	Event
1997/08/18	GNSS	Antenna change
1998/08/01	Ties	YARA vs YAR2, YARA vs 7090
1999/10/01	Ties	YARB vs YAR2
1999/10/04	DORIS	Station change (YARA → YARB)
2002/05/13	GNSS	Antenna change
2003/11/01	Ties	YASB vs YAR2, YARB/YASB vs 7090
2003/11/27	DORIS	Station change (YARB → YASB)
2010/06/12	Ties	7090 vs 7376
2013/06/17	GNSS	Antenna change

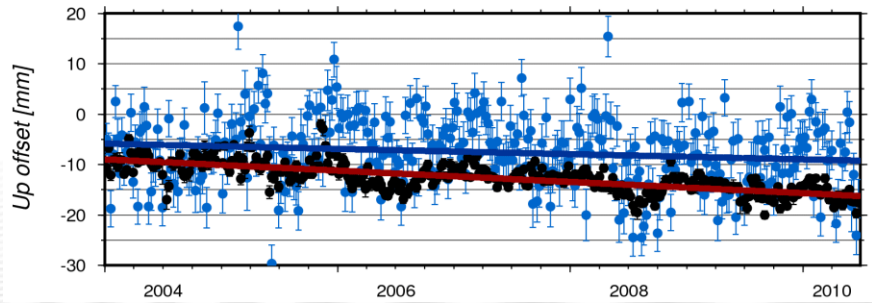
Yarragadee (Australia) - Time series

http://ids-doris.org

DORIS –SLR







Time Span: 2004.0-2010.5

Mean Velocity

Unit: mm/yr	DORIS	GNSS	SLR
Vel – East	39.4 ± 0.3	38.7 ± 0.1	38.3 ± 0.1
Vel – North	58.1 ± 0.2	58.1 ± 0.1	58.4 ± 0.1
Vel - Up	-0.5 ± 0.2	0.2 ± 0.1	-1.1 ± 0.1

➔ **EN velocities all agree to w/in their respective std dev**

➔ **Up velocity must be analyzed**

Summary and Next

- **Summary**
  - **List of 3-4-5 technique sites.**
  - **List of stations, time periods, station events, monument types, ties from the technique sitelog files.**
  - **Badary: good agreement for the ENU velocities and annual amplitude for DORIS and GNSS. This signal may result from the hydrologic and atmospheric loading.**
  - **Yarragadee: up velocity differences must be investigated.**

- **Next**
  - **More detailed analysis of the periodic signals and tie discrepancies.**
  - **Comparisons with ITRF2014, DTRF2014 output.**
  - **Adding of gravimetric data.**
  - **More sites.**