

The Asia Pacific Reference Frame (APREF)

John Dawson, Geoscience Australia
Andrick Lal, Pacific Community



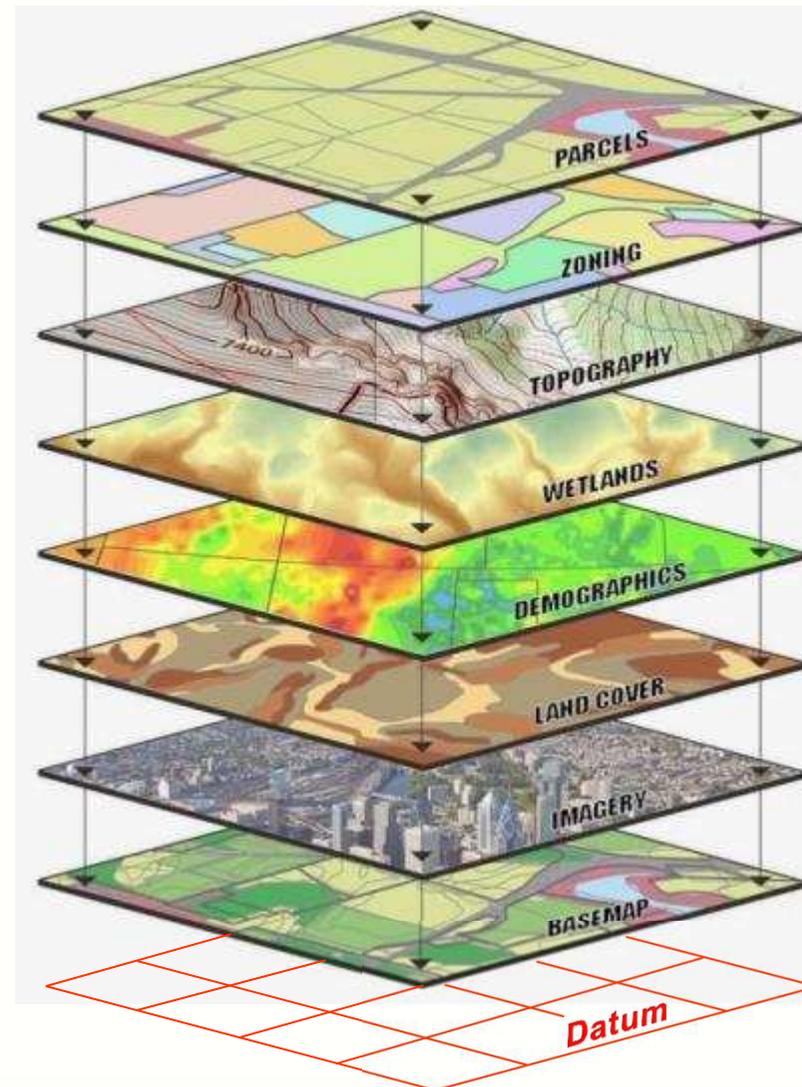
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Importance of Datum



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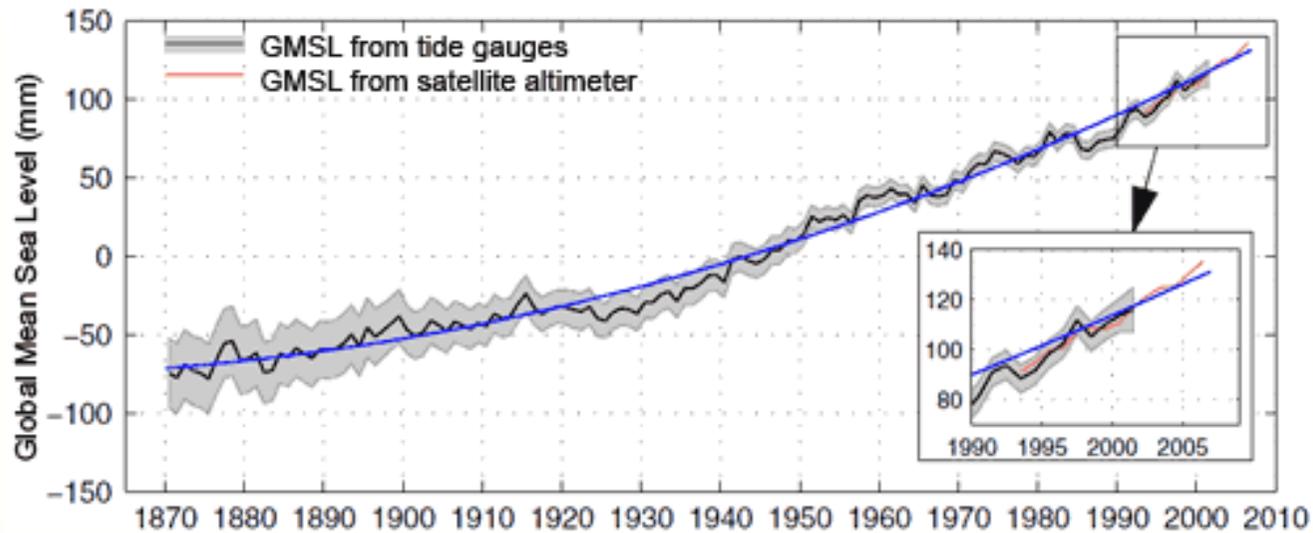
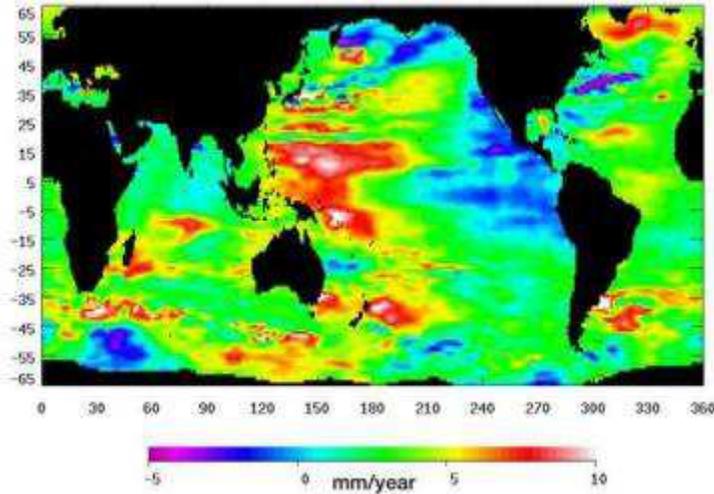
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Understanding the Earth System

Trend of Sea Level Change (1993-2008)



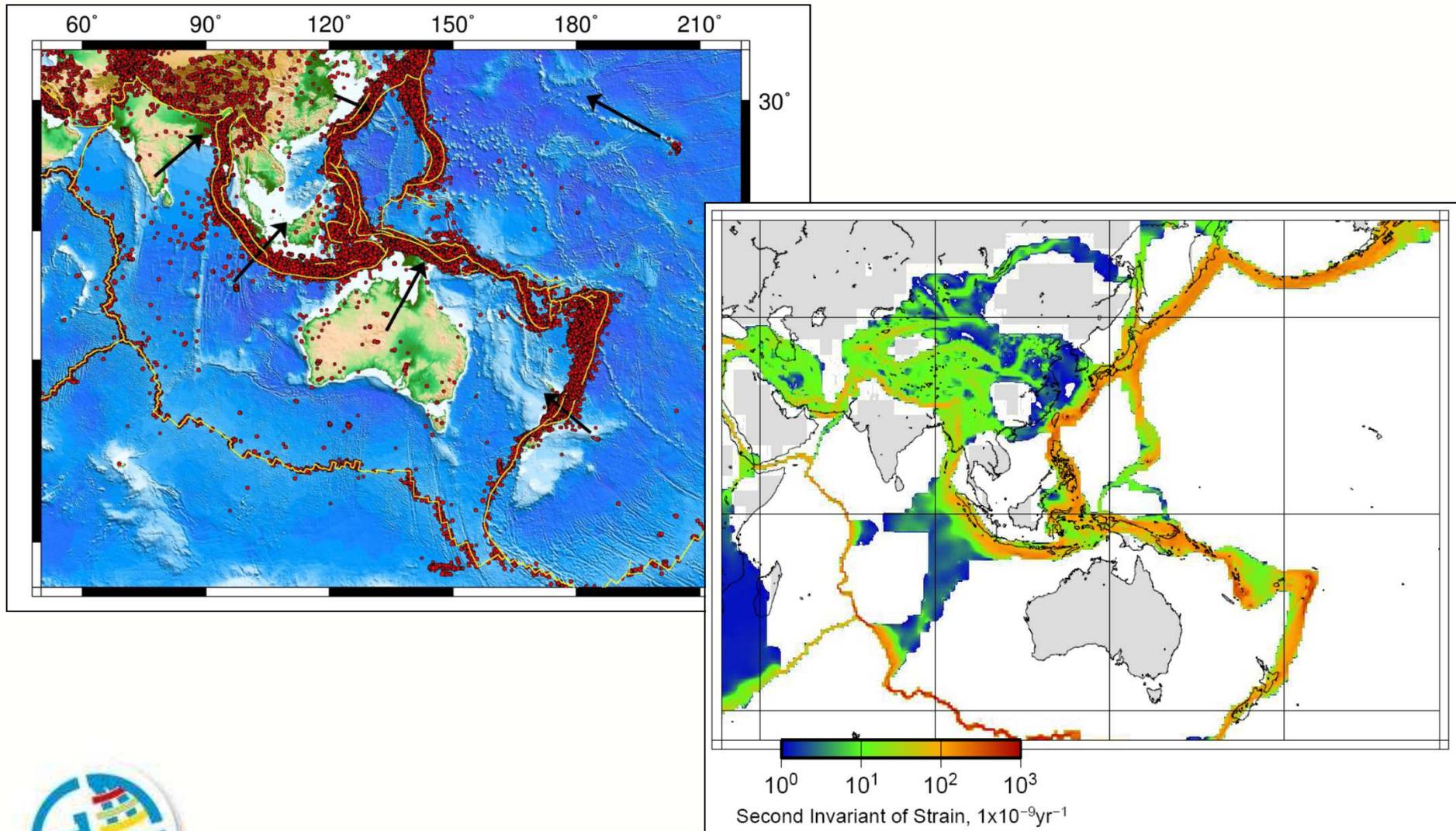
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Crustal Strain and Earthquakes: Asia Pacific



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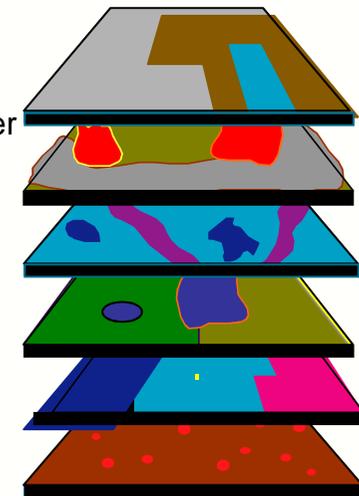
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United Nations – Sustainable Development Goals



High quality, timely and reliable data

Geodetic
Elevation
Water/Ocean
Land use/cover
Transport
Cadastral
Population
Infrastructure
Settlements
Admin. Bdys.
Imagery
Geology/soils
Observations
etc.



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Asia Pacific Reference Frame

- **Asia Pacific Reference Frame – APREF**
- Analogous to other ITRF based regional reference frames EUREF, SIRGAS, NAREF, AFREF, etc.
- Joint initiative of the UN-GGIM Asia Pacific and the International Association of Geodesy (IAG) supported by **FIG**



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Asia Pacific Reference Frame: Objectives

- Create and maintain an accurate and densely realised geodetic framework, based on continuous observation and analysis of GNSS data
- Densification of the ITRF in the Asia-Pacific
- Encourage regional data sharing of GNSS CORS data and its analysis



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Asia Pacific Reference Frame: Participants

- Data from 28 countries
- 16 national agencies participating
- Approximately 420 Asia Pacific stations
- Approximately 600 stations routinely analysed
- Four independent analysis centres
 - Geoscience Australia
 - Curtin University
 - Department of Sustainability and Environment in Victoria, Australia
 - Institute of Geodesy and Geophysics, Chinese Academy of Sciences



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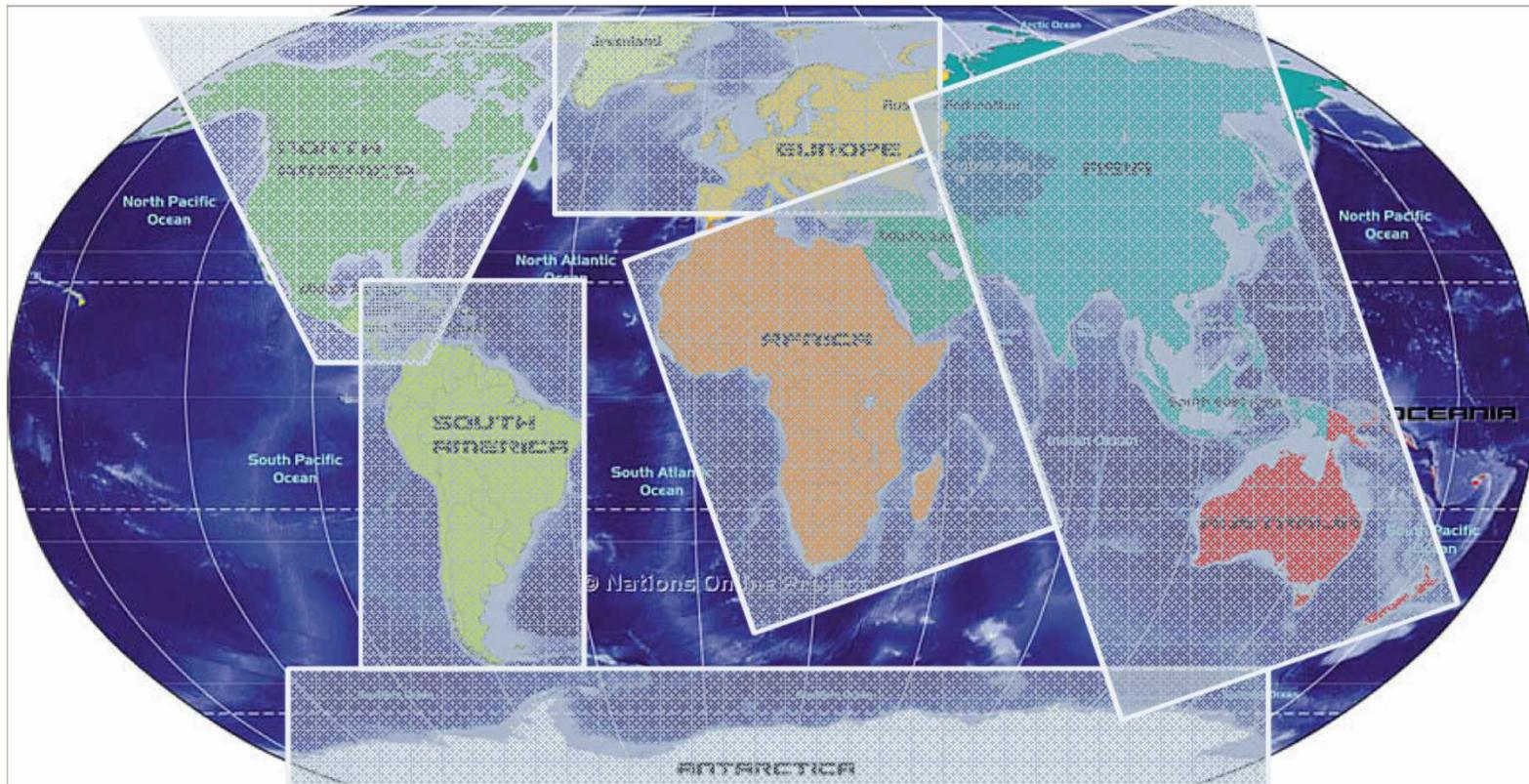
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Regional Reference Frame Densification

ITRF = APREF, AFREF, EUREF, NAREF SIRGAS,...



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Asia Pacific Reference Frame

- Open to all organisations (government, research, private) involved with CORS data collection and/or analysis
- APREF encourages those organizations who are prepared to participate on an ongoing basis (at least two years)
 - GNSS CORS stations data;
 - Provide access and on-line archiving of APREF data and products for users; and/or
 - Routinely analyse some, or all, of the APREF GNSS CORS data



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Benefits of APREF Participation

- Improved and continuous link between national datums and CORS networks to the ITRF
- Contribute to a open and dense ITRF network in Asia and the Pacific
- Independent quality monitoring
- Improved access to GNSS data
- Providing an opportunity and a forum towards improving the regional geodetic infrastructure



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APREF website for more information

- <http://www.ga.gov.au/earth-monitoring/geodesy/asia-pacific-reference-frame.html>



FOMO,
Macau, China



KUAL, Malaysia



PTAG, Philippines



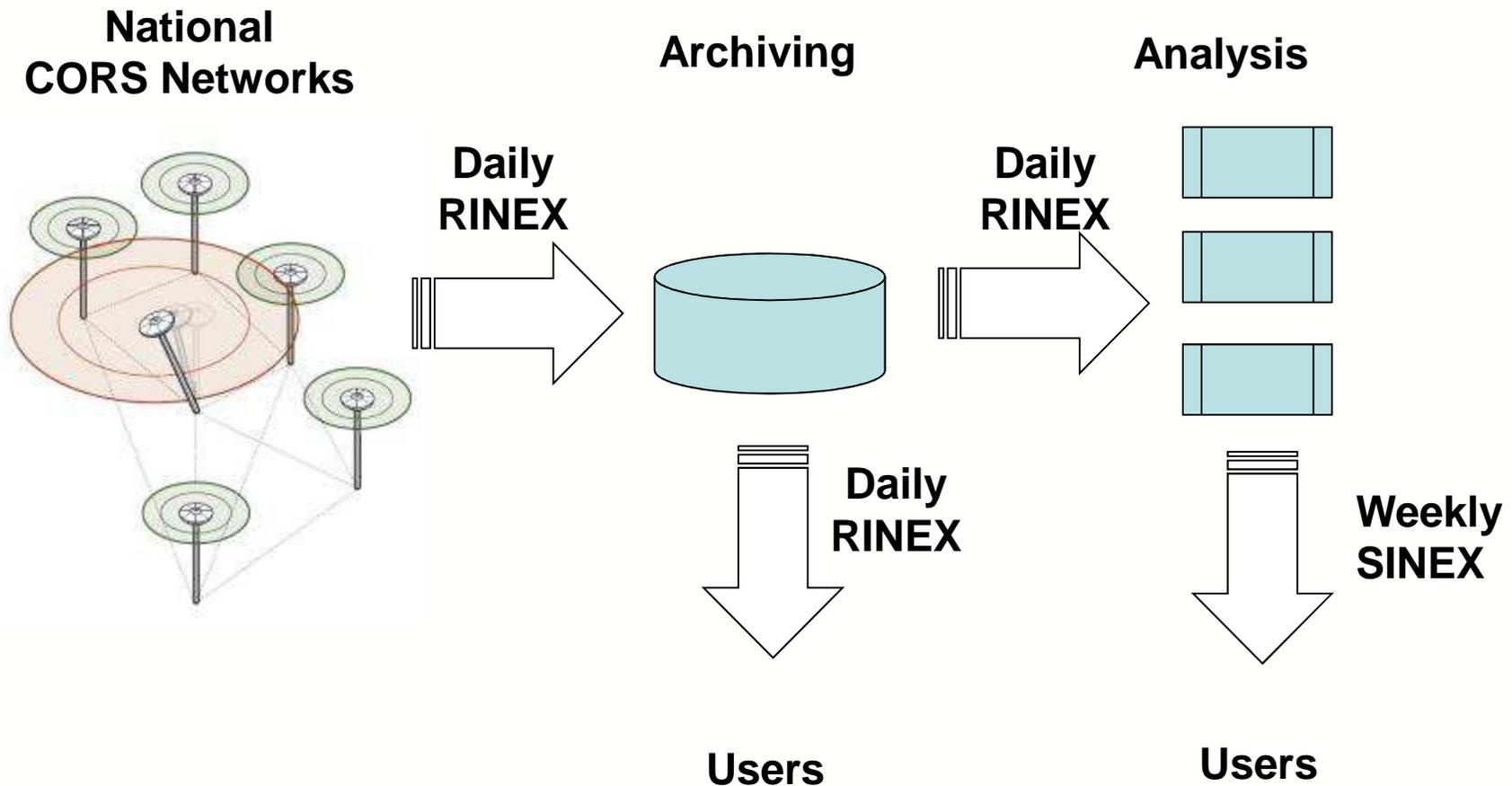
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Asia Pacific Reference Frame: Data Flow



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Where to Find APREF Data and Products

- APREF data and products are provided with an open access data policy via the internet following the practice of the IGS
- Daily GNSS RINEX data with a delay of 24 hr after observation, see:

<ftp://ftp.ga.gov.au/geodesy-outgoing/gnss/data/daily/>

- Station log files, see:

<ftp://ftp.ga.gov.au/geodesy-outgoing/gnss/logs/>



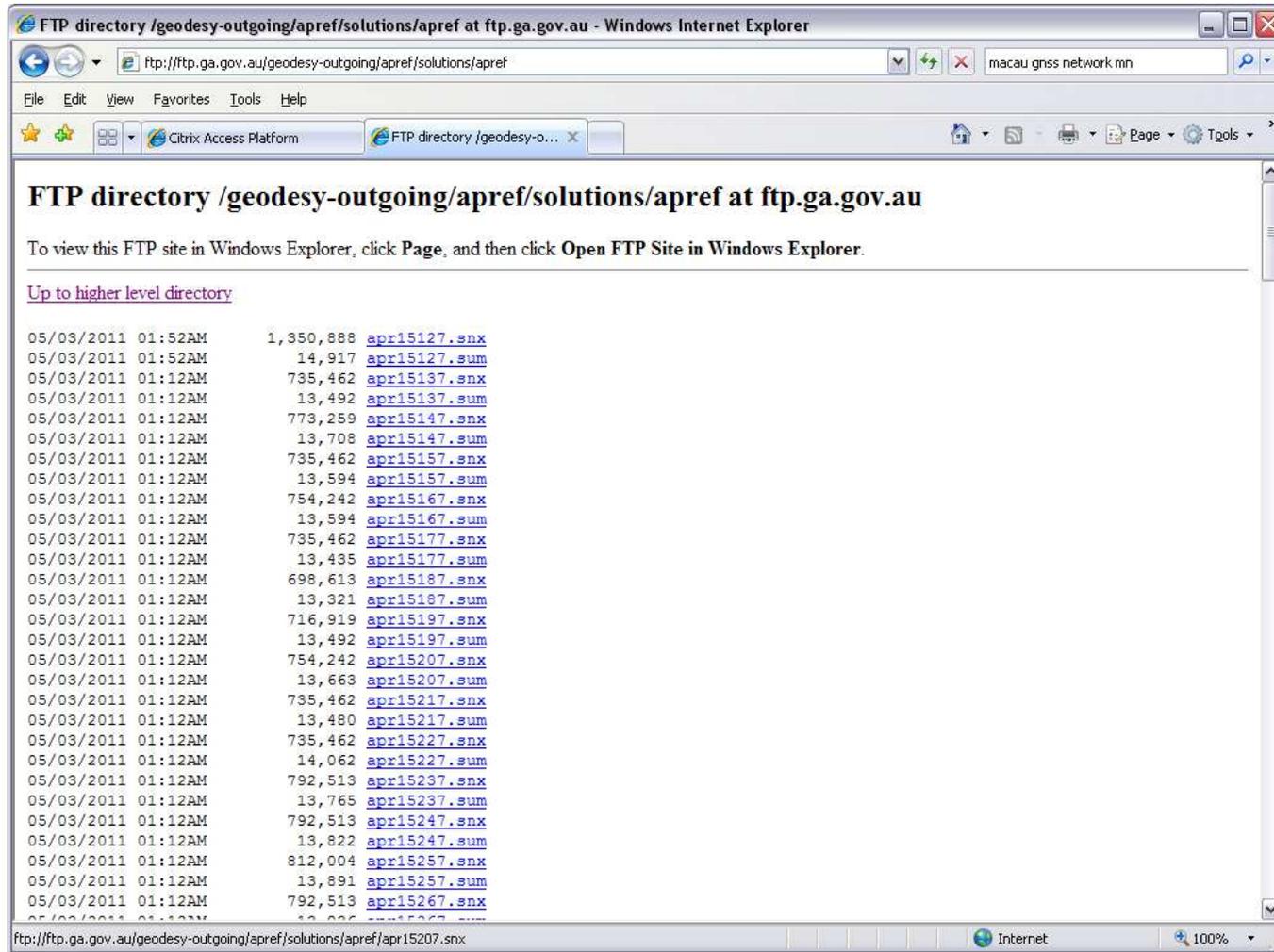
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APREF Weekly SINEX file (i.e. coordinates)



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Weekly Station Coordinate and Performance

Weekly station coordinates

ITRF2008 Cartesian Coordinates (X,Y,Z) @ 22/06/2011

00NA	59975M001	-4073662.2922	4712064.7447	-1367874.4683
01NA	59974M001	-4084823.4609	4702026.6604	-1369125.8453
02NA	59973M001	-4078496.4549	4711380.1330	-1355915.1332
20NA	59972M001	-4050985.3396	4212133.7934	-2547954.8094
21NA	AUM000184	-4048578.9364	4210151.5056	-2554917.6069
ADEL	AUM000008	-3926936.9094	3461614.4215	-3631644.2263
ALBU	AUM000009	-4324312.5655	2817311.0325	-3735264.7605
ALBY	50191M001	-2441714.5963	4629128.5358	-3633363.2024

Weekly station performance

Total number of stations: 303

Station	#Days	Weekday 0123456	Repeatability (mm)		
			N	E	U
00NA 59975M001	7	XXXXXXX	0.48	1.18	1.87
01NA 59974M001	7	XXXXXXX	0.54	1.61	5.80
02NA 59973M001	7	XXXXXXX	0.79	1.95	3.59
20NA 59972M001	7	XXXXXXX	0.41	1.29	2.00
21NA AUM000184	7	XXXXXXX	0.61	1.65	0.98
ADEL AUM000008	7	XXXXXXX	1.28	1.19	4.02
ALBU AUM000009	7	XXXXXXX	1.64	0.98	5.10
ALBY 50191M001	7	XXXXXXX	1.62	2.87	4.30
ALIC 50137M001	4	XXXX	0.28	1.26	1.47
ANDA 59971M001	7	XXXXXXX	0.64	0.87	1.74
ANTW AUM000010	7	XXXXXXX	1.47	0.83	3.70
APOL AUM000011	7	XXXXXXX	1.44	1.44	7.61
APSL AUM000012	7	XXXXXXX	3.27	1.23	5.96
ARM DUM000143	7	XXXXXXX	0.60	1.42	2.74
ARTU 12362M001	5	XXXXX	3.16	2.20	3.20
ASPA 50503S006	7	XXXXXXX	2.39	2.88	12.17
AUCK 50209M001	7	XXXXXXX	1.27	1.66	4.47
AUKT 50216M001	7	XXXXXXX	1.63	1.66	4.81
BAIR AUM000015	7	XXXXXXX	1.14	1.06	5.46
BAKO 23101M002	7	XXXXXXX	2.97	3.40	10.00
BALN AUM000180	7	XXXXXXX	0.40	1.24	3.82
BAN2 22306M003	7	XXXXXXX	2.74	2.94	7.17
BBOO 59997M001	7	XXXXXXX	0.62	0.80	1.46
BDLE 50196M001	7	XXXXXXX	1.73	2.46	2.46
BDST 59981M001	7	XXXXXXX	0.80	1.43	2.86



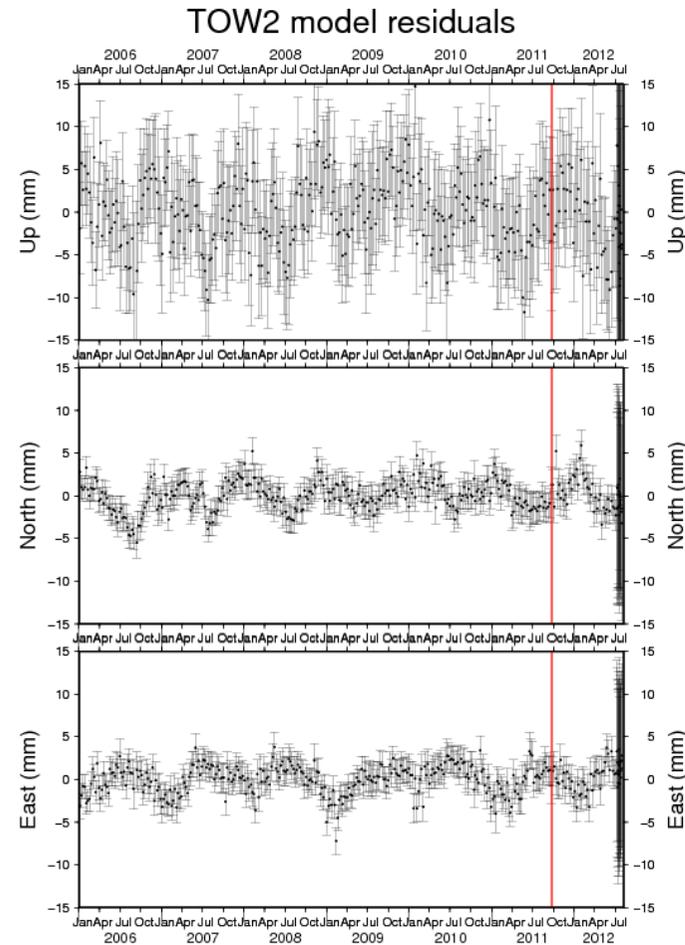
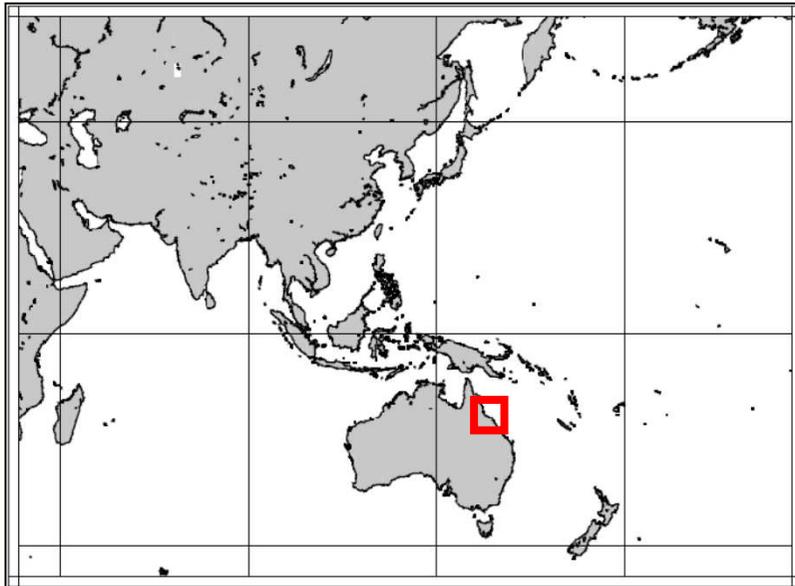
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Example Coordinate Time Series: Townsville



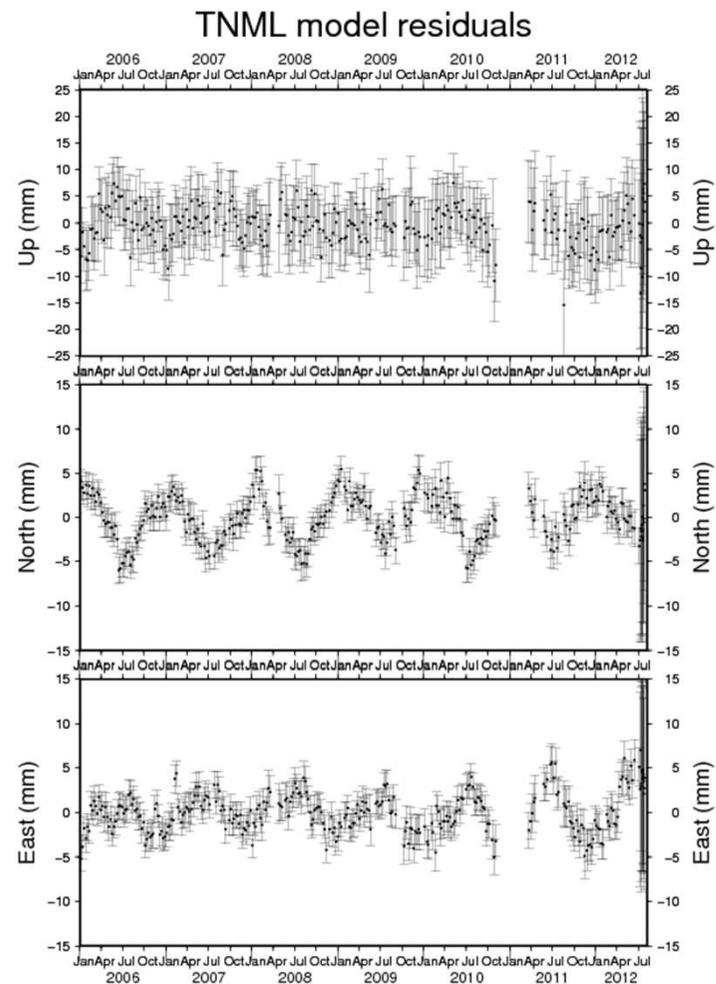
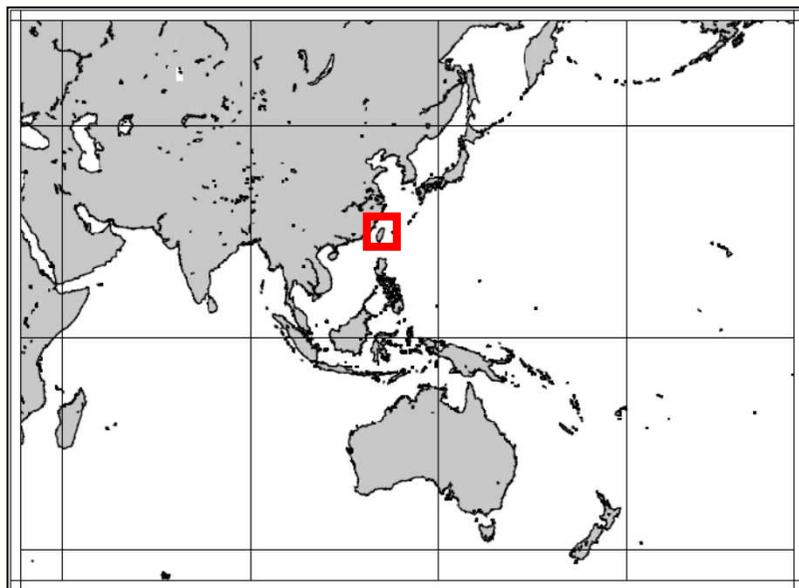
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Example Coordinate Time Series: Hsinchu, Taiwan



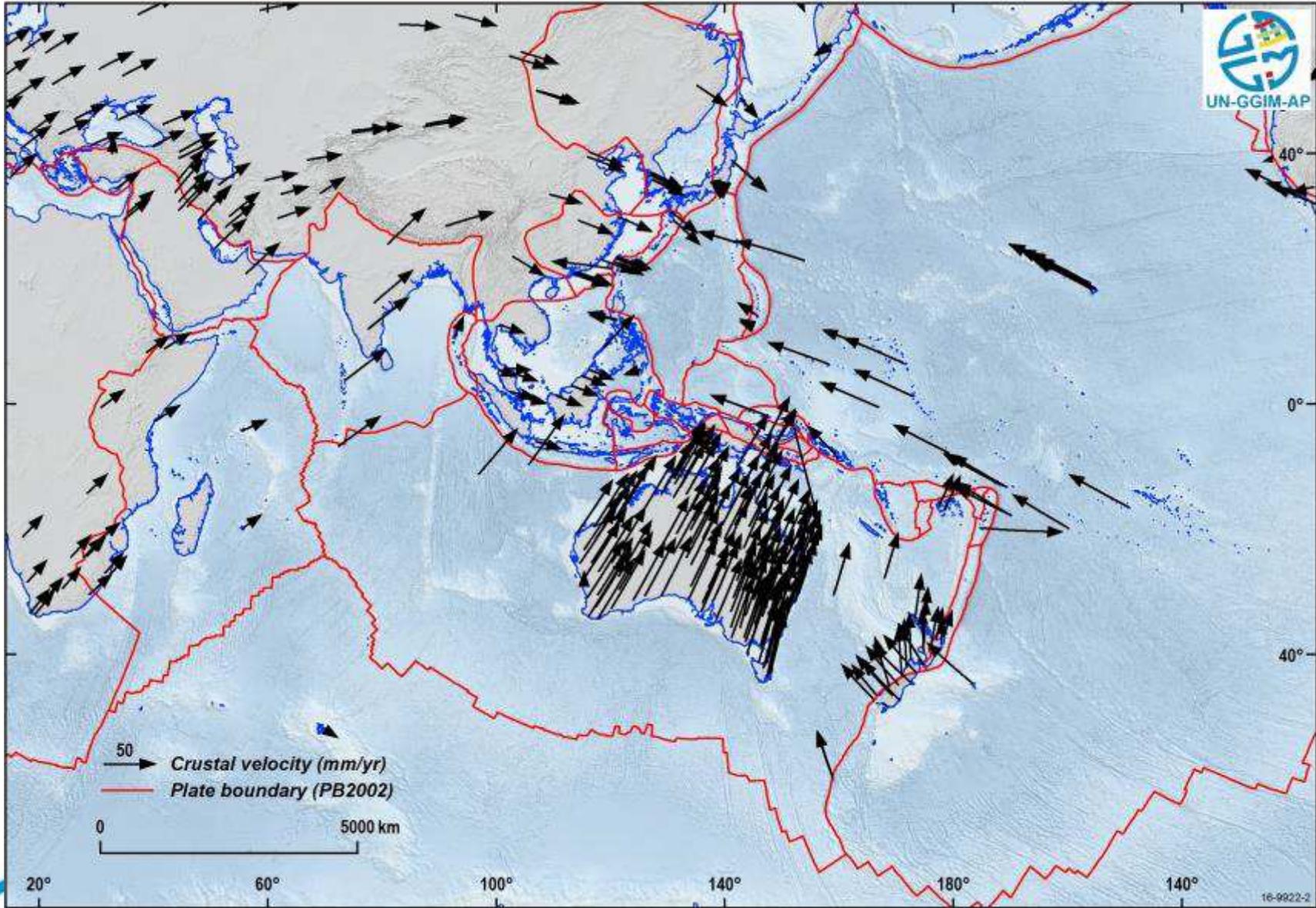
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Crustal velocities of Asia and the Pacific



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How Do I Contribute CORS data into APREF?

- Do I have a permanent GNSS station?
- Is my agency willing to share its data (30 sec, daily RINEX)
- Can I do this automatically everyday?
- Does it meet the IGS or APREF standards? Check

→ IGS:

<http://igscb.jpl.nasa.gov/network/guidelines/guidelines.html>

→ APREF:

https://www.ga.gov.au/products/servlet/controller?event=GEOCAT_DETAILS&catno=72803



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How Do I Contribute CORS data into APREF?

```
ftp://ftp.ga.gov.au/geode x
ftp://ftp.ga.gov.au/geodesy-outgoing/gnss/logs/00na_20110112.log
GA Intranet ARGN Status the age The Age - Business, ... JobOffice by nga.ne...

00NA Site Information Form (site log)
International GPS Service
See Instructions at:
ftp://igs.cb.jpl.nasa.gov/pub/station/general/sitelog_instr.txt

0. Form

Prepared by (full name) : Michael Moore
Date Prepared : 2011-01-12
Report Type : UPDATE
If Update:
Previous Site Log :
Modified/Added Sections :

1. Site Identification of the GNSS Monument

Site Name : Darwin Supreme Court
Four Character ID : 00NA
Monument Inscription :
IERS DOMES Number : 59975M001
CDP Number : n/a
Monument Description : ROOF
Height of the Monument : (m)
Monument Foundation : ROOF
Foundation Depth : (m)
```

```
ftp://ftp.ga.gov.au/geode x
ftp://ftp.ga.gov.au/geodesy-outgoing/gnss/logs/00na_20110112.log
GA Intranet ARGN Status the age The Age - Business, ... JobOffice by nga.ne...

3. GNSS Receiver Information

3.1 Receiver Type : LEICA GRX1200PRO
Satellite System : GPS+GLO
Serial Number : 459941
Firmware Version : 5.62
Elevation Cutoff Setting : 0
Date Installed : 2008-03-26T00:00Z
Date Removed : (CCYY-MM-DDTh:mmZ)
Temperature Stabiliz. : none
Additional Information : (multiple lines)

3.x Receiver Type : (A20, but note the first A5 is used in
SINEX)
Satellite System : (GPS+GLO+GPS+GLO)
Serial Number : (A20, but note the first A5 is used in
SINEX)
Firmware Version : (A11)
Elevation Cutoff Setting : (deg)
Date Installed : (CCYY-MM-DDTh:mmZ)
Date Removed : (CCYY-MM-DDTh:mmZ)
Temperature Stabiliz. : (none or tolerance in degrees C)
Additional Information : (multiple lines)

4. GNSS Antenna Information
```

Can I commit to notifying the APREF CB every time the **Station Log File** for this GNSS station changes?



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How Do I Contribute CORS data into APREF?

- Send an email to geodesy@ga.gov.au with the subject heading “Proposed APREF CORS”, in this email include:
 - the proposed 4-character site
 - photographs of the proposed site
 - a completed site log-file
 - a link to some sample data from the site



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