



Permanent Committee on GIS Infrastructure for Asia and the Pacific

Working Group 1

Regional Geodesy

**Report from Working Group 1, Workshop
at Chengdu**

8 September 2004

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REGIONAL GEODESY WORKING GROUP REPORT TO EXECUTIVE BOARD, CHENGDU 8th SEPTEMBER 2004

1. Background

At the 16th United Nations Regional Cartographic Conference for Asia and the Pacific (UNRCC-AP) meeting in Okinawa in July 2003, Resolution No.2 was endorsed calling for the continuation of PCGIAP regional geodetic activities for the next three years through the following projects:

- Enhancement of a regional geodetic infrastructure through annual cooperative campaigns, including ties to vertical datum origin points,
- Review the status of the regional geoid in relation to current and improved global gravity models available from satellite gravity, and the application of absolute gravity as a means of developing a regional gravity reference frame,
- Promoting the application of new geodetic adjustment techniques and datum change transformation parameters for regional spatial data integration and for geo-referencing cadastral and statistical information,
- Encourage the transfer of GPS technology to Pacific Island nations and other developing countries through regional and local geodesy workshop activities,
- Development of a catalogue of regional tide gauges for monitoring sea level changes and placement of GPS at key sites, and
- Review the status of geodetic networks in individual countries and upgrade the PCGIAP web site information.

To take this resolution forward a project draft work plan was developed with identified responsibilities and milestones for the period 2003 -2006. This workplan was endorsed during the 10th PCGIAP meeting in Bangalore in January 2004.

It introduces a new phase in the Regional Geodesy WG1 activities, to apply the benefits from the regional geodetic framework, which was established to facilitate high precision positions in all countries. The new focus addresses the need to flow down from the regional geodetic infrastructure to upgrade the national geodetic adjustments within countries onto the regional datum (ITRF) in order to directly provide related spatial data sets.

An additional component was for the Regional Geodesy Working Group to interact with each of the Cadastral, Fundamental Data and Institutional Strengthening Working Groups, as defined in the recommendation components at the Bangalore 10th PCGIAP meeting:

- The development and integration of the cadastral and land tenure layers within the regional spatial data infrastructure using geodetic referencing techniques, and
- Institutional strengthening for building spatial data infrastructure through capacity building, education, training, and workshops together with identification of needs and funding options for member countries to improve participation in PCGIAP activities.

The impact is that now the basic regional geodetic framework is well in hand, the time has come for Working Group 1 to expand its geodetic referencing into the activities of the other working groups to enhance the building of an integrated spatial infrastructure on a uniform datum. Geo-referencing connections need to be made from the regional geodetic framework to the cadastral frameworks in WG3, the statistical (census)

information in WG2, and a greater interaction with WG4 to achieve institutional strengthening and subsequent participation.

2. The Chengdu Workshop WG1 Sessions on 7 September 2004

The WG1 sessions were attended by representatives from Australia, China, India, Indonesia, Japan, Korea and Vietnam (Appendix 1). Pengfei Cheng and Hiromichi Tsuji chaired the sessions and John Manning acted as rapporteur.

3. The Global and Regional Reference Frameworks

The first agenda item included reporting on progress with Regional Geodetic Network processing, and planning for the October 2004 campaign. The need for future epoch campaigns was reviewed as this was no longer considered to be a technological necessity. Geoscience Australia (GA) had requested that the Campaigns be terminated after 2004. GPS observations could be taken at any time and processed in AUSPOS or included in daily global solutions by institutions such as GA. As the campaigns had helped some countries, who were not represented at the workshop, to gather equipment and resources, and provided a core even symbolic activity which has endorsed by the UNRCC for three year, it was resolved to continue the campaign in 2005. The situation would then be reviewed at the 2006 UNRCC meeting. GA would be asked if they could continue their excellent leadership of this project until that time. It was accepted that the style of the campaign would change. It was seen that a focus on specific theme campaigns (such as at tide gauges) or focused on the gaps in the network, connections to vertical datums or specific sub regional campaigns (such as the Pacific region) may be a better approach.

To this end India would look at working together with nearby countries to fill the gap in the regional network in that sub region. China would approach Russia regarding the CIS states and Australia and New Zealand would concentrate on the Pacific sub region to make best use of existing GPS base stations. GPS equipment manufacturers would be approached to try to obtain loan of receivers for extended time period campaigns.

The workshop highlighted that all campaign data gathered in the campaigns so far needs to be carefully archived and made available for on line downloading. The combined position results developed by GA from the first 6 campaigns should be published as a PCGIAP technical report, circulated to members for approval before being submitted to the International Earth Rotation and Reference Systems Service (IERS) for inclusion in the next ITRF solution.

4. Datum Transformation Methods

Discussion included the need for the WG1 to move forward from the Regional Network as a deliverable end point to helping countries readjust and upgrade their national networks using the global positions from the PCGIAP campaigns. China presented their readjustment strategy on some 50,000 astro-geodetic points from 16 sub blocks using inhouse software.

Australia commented on direct adjustment software being developed in Australia (DNA) and New Zealand (SNAP). The impact of tectonic motion on geodetic datums and how to deal with this was discussed with examples from Australia, China, India, Indonesia, and Japan.

China and Australia made presentations on high level examples of datum transformation methods and china presented a research comparing methods on a limited area. Japan introduced the flow of readjustment of Japanese national geodetic datum (JGD2000). Korea made a presentation on crustal deformation monitoring using the permanent GPS array in Korea.

5. User Requirements for Accuracy of Geodetic Frameworks

The interaction with the other Working Groups (WGs) was raised to expand the geodetic framework as a basis for fundamental data and the need to provide positional correct data to national emergency users in times of crisis. The user requirement for geodetic positioning from other WGs was addressed and a proposal for joint study groups with WGs 2 and 3 was endorsed.

6. Regional Gravity

China made a presentation of national gravity network including recent absolute gravity measurements with FG5 in China. The significant progress made with absolute gravity was presented by Japan reporting on recent occupations in Malaysia (Kuala Lumpur and Kota Kinabalu) and China (Wuhan, Naning, and Beijing). Comparisons had been made at Wuhan between three FG5 units. China commented that they may be able to take an FG5 to nearby countries for observations possibly in Vietnam.

China reported on the release of new global gravity models from Champ and Grace Satellite missions and recent developments in China to improve the national Geoid by firstly addressing regional Geoids using absolute gravity ties and satellite gravity data. This is an interesting model for application to PCGIAP. Australia reported on recent gravity activities undertaken include the Japanese FG5 absolute gravity equipment occupation of a site in China and in Perth en route to Syowa Antarctica and in Canberra during its return to Japan.

7. Mailing listserver and Web site update

Japan reported on its recent activities to develop a listserver to facilitate easy e-mail interaction with the members of the Working Group. The need to update the working group web site was also discussed. Australia tabled a web print out of known geodetic datum information for all PCGIAP countries and said it was very important that this information be upgraded and maintained on the web site. Other aspects for the web site were raised such as the need for a copy of the WG reports to the respective EB in the last ten year to provide the historical record. It was felt that certain key technical reference material pertaining to Regional Geodesy should be maintained on the site or cross linked.

In addition, an introduction to the ISO/TC211 Registry of Geodetic Codes and Parameters (draft text of TS19127) was given from Japan. If approved at ISO/TC211, maintenance of such a registry could be one of WG1's activities.

8. APRGP 2003

The major activity of the Working Group since the 10th PCGIAP has been the organisation of the 2003 annual geodetic campaign data and planning for the October 2004 campaign. The list of registered participants included some 30 countries. It was felt that the strong response to the campaign announcement was due to the improved contact list developed by the project manager Geoff Luton (GA). This again raised the important issue of the need for regular communication and the maintenance of regional geodesy contact lists for the working group. As all the data had not been supplied, no data had been distributed for processing. It was agreed that a cut off date should be enforced for data such as end on September for the 2003 data, so that attention could then be focused on the 2004 campaign.

9. Support to TIGA project

Australia has recently delivered initial regional solutions to the TIGA project of the International GPS Service which monitors the vertical motion of continuous GPS base stations collocated with precision tide gauges. All data and solutions are available from Geoscience Australia. The WG agreed to support the TIGA project with GPS data from sites near tide gauges where possible for sea level monitoring.

10. Future Directions

The WG report to the 10th PCGIAP session was discussed as it contained a number of suggested future directions, such as :

- The need for better understanding of the positional accuracy requirements from user of the geodetic framework.
- The use of benchmarking surveys to gather data on the methods and completeness, and positional accuracy, of individual geodetic networks.
- The use of special sub regional projects such as the new project to unify geodetic framework and datums across the Borneo land mass.

Cross linkages yet to be developed for Working Group 1 with other working groups were seen as

- Using geodetic positions as the basis for bridging between topographic information and cadastral information. Topographic information is usually based on the geodetic network and the issue is one of accuracy of the data sets whereas the cadastral framework or DCDBs are often use local frameworks or customised projections and need to be georeferenced. WG1 would be happy to take on a chairing role in a task group on this issues.
- Institutional strengthening for Pacific Island countries is an immediate issue for working group4 and the issues of assistance to East Timor is

quite urgent (even before this country gains UN standing), possibly by invited participation as observer status.

Working Group linkages with IAG Commission 1 as a regional commission on Asia Pacific Reference framework were discussed and a joint open Regional Geodesy Workshop in the IAG General Assembly in Cairns (August 2005) was proposed. The possible linkage with PCIDEA and AREF as an extension of PRGP2004 was considered.

11. Borneo project

The project is for the unification of Borneo geodetic datums- leading in the future to an environmental GIS. This would benefit from cross working group involvement in working together in the extension of geodetic control to the cadastral framework and integration of this data with topographic information.

Brunei undertook to collate input with Indonesia and Malaysia and prepare project scoping for circulation following the ASEAN Flag meeting in China in March 2004. The project will have the following general approach:

- Commence Geodetic observations during 2004 annual campaign
- Existing network points
- Ties to sea level tide gauge
- Followed by further densification by GPS and possible connection to cadastral frameworks
- Use as a framework for GIS infrastructure using WG2 guidelines
- Tie Topographic and cadastral data sets (WG3) as appropriate
- Includes land tenure and land use (use of ALOS ?)
- Potential for external funding (WG4)

12. Work Plan

The current workplan was reviewed and updated where necessary. Two new projects were added (Appendix 2).

13. Next Meeting

In addition to WG activity at the annual PCGIAP meetings, the following separate regional geodesy workshops are proposed:

- August 2005 – IAG conference Australia (Cairns)
- 2006 possibly Cambodia or Korea
- 2007 Pacific country possibly Fiji

14. Action items

- Request to GA to continue project leadership on APRGP annual campaigns in modified style
- Request to GA to host working group meeting prior to IAG meeting in Cairns in 2005
- Cross links with working groups 2 through 4

15. Resolutions for EB consideration

Based on discussions at WG1 sessions, Chair and vice chairs formed the following possible resolutions for Executive Board meeting consideration on September 8, 2004.

- EB considers establishing formal liaisons between WGs 1, 2, 3 and 4 for specific projects
- EB considers establishment of a regional hazards WG to identify and integrate requirements and national frameworks into APSDI
- EB encourages PCGIAP members to consider the loan of GPS equipment to assist in sub regional geodetic densification

Appendix 1 List of participants to WG1 sessions

Delegates

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Appendix 2 Revised Workplan for Regional Geodesy Working Group for period 2003-2006

	Project	Responsibility	Milestone
1	<p>Enhancement of a regional geodetic infrastructure through annual cooperative campaigns, including ties to vertical datum origin points</p> <ul style="list-style-type: none"> • Arrange regional observation campaign in 2003, and similarly for 2004 and 2005. • Observe data and forward to Australia in RINEX format with site information. • Assemble data sets of non IGS observational data and make available by CD ROM for processing. • Process individual solutions for each ARPGGPS data and send SINEX solution to Australia. • Analyse and compare solutions promote technology transfer at each workshop or Working Group meeting. • Prepare combined regional solution for ITRF densification. 	<p>Australia project leader</p> <p>All countries to participate to level of resources available</p> <p>All countries</p> <p>Australia</p> <p>Individual countries</p> <p>All participants</p> <p>Australia</p>	<p><i>[Similar for 04 and 5 campaigns]</i></p> <p>Completed (October 2003)</p> <p>September 2004</p> <p>November 2004</p> <p>March 2005</p> <p>May 2005 (11th PCGIAP)</p> <p>August 2005 (WG1 workshop)</p>
2	<p>Review the status of the regional geoid in relation to improved gravity models available from satellite gravity, and apply absolute gravity as a means of developing a regional gravity reference frame</p> <ul style="list-style-type: none"> • Monitor the status of the regional geoid and development of new improved global gravity models developed from satellite gravity missions. • Connect gravity datums of individual countries by use of absolute gravity observations. 	<p>Australia, China, Malaysia, Japan</p> <p>Malaysia, Australia</p> <p>Japan, China</p>	<p>Ongoing; August 2005</p> <p>Ongoing</p>

3	<p>Review the application of new semi dynamic geodetic adjustment techniques, datum change parameters, and geo-referencing cadastral and statistical information, for regional spatial data integration</p> <ul style="list-style-type: none"> • Research new software development for application within individual countries. • Gather information of adjustment methods used in individual counties. • Gather information on geo-referencing of cadastral and statistical information used in national spatial data infrastructures in each country. • Prepare technical reference paper on suitable methodologies and present examples at regional geodesy workshops as guide to member nations. 	<p>New Zealand</p> <p>Australia</p> <p>Australia</p> <p>New Zealand</p> <p>New Zealand</p>	<p>August 2005</p> <p>December 2004</p> <p>June 2005</p> <p>August 2005 (WG1 workshop)</p>
4	<p>The transfer of Geodetic and GPS technology to developing countries, and to Pacific Island nation, through regional geodesy workshop activities</p> <ul style="list-style-type: none"> • Identify funding sources (with Working Group 4) for access to GPS equipment resources to support participation in annual regional geodesy workshops for presentation of geodetic campaign results and technology. • Promote loan of GPS equipment to Pacific Island nations for regional campaigns and promote the knowledge of GPS techniques making use of available continuous GPS base stations in the region. 	<p>China</p> <p>China/Working group</p> <p>All countries</p>	<p>[Possible workshop dates]</p> <p>Completed (Chengdu meeting, September 2004)</p> <p>August 2005 (WG1 workshop)</p>

5	<p>Development of a catalogue of regional tide gauges for monitoring sea level changes and GPS placements close to tide gauges to monitor land motion</p> <ul style="list-style-type: none"> • Facilitate GPS connections to tide gauge datum benchmarks and vertical origin points and integrate into regional framework campaigns. • Gather information on precise tide gauges and collocated GPS and DORIS stations and place on WG web site. 	<p>New Zealand, Vietnam, Indonesia</p> <p>Australia</p> <p>New Zealand</p>	<p>integrate with annual regional campaigns</p> <p>final report August 2005</p>
6	<p>Review the status of geodetic networks in individual countries and upgrade PCGIAP web site information.</p> <ul style="list-style-type: none"> • Gather updated information from all countries and update the WG web site with datum and transformation details. • Develop a list server and seek contacts from each country 	<p>Japan</p> <p>Japan</p>	<p>ongoing annually</p> <p>October 2004</p>
7	<p>Undertake a specific project to connect vertical datums in the Indo China region related to sea level and the water flow in the Mekong River Basin.</p> <ul style="list-style-type: none"> • Undertake GPS observations at tide gauge bench marks across the region during the APRGP 2003 campaign together with associated benchmarks along the Mekong River system. 	<p>Vietnam, Cambodia, Thailand</p>	<p>Partly completed September 2004; Report Aug 2005</p>

8	<p>Borneo geodetic datum unification project</p> <ul style="list-style-type: none"> • To establish GPS network across Borneo including connection to tide gauges • Discuss with other WGs for the establishment of Borneo SDI to include cadastre and topographic data sets 	<p>Indonesia, Malaysia, Brunei</p>	<p>First meeting held in May 2004; Field campaign after meeting in October 2004</p> <p>May 2004 (11th PCGIPA)</p>
9	<p>Cross linkage with other working groups</p> <ul style="list-style-type: none"> • Identify user requirement on geodetic infrastructure • Contact working groups WG2 and WG3 	<p>China, Australia, Japan</p>	<p>August 2005</p>