

Large Scale Mapping of Schirmacher Oasis and Larsemann Hills

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ABSTRACT

Being the national mapping agency of India, Survey of India has the mandate to provide the map on Antarctica region. Since 10th Expedition to Antarctica (1991-92), Survey of India has been taking part actively in scientific activity/map mapping of unique terrain.

During the first few expeditions the horizontal and vertical control was provided to establish the datum for future mapping needs. In the successive expeditions, mapping on scale 1:5,000 with contour interval 5m and scale 1:1,000 with contour interval 1 m has been taken up.

INTRODUCTION

From 23rd expedition (2003-04), Survey of India has also started studies of Inter Plate Movement between Indian and Antarctic plates. Neo-tectonic studies and glacier movement studies in the Antarctica region were also started. For plate movement studies 7 days campaign mode GPS observation is carried out at Maitri during each expedition. For neo-tectonic studies so far 28 stations have been established and campaign mode observations will be carried out during future expeditions.

Since 26th Expedition, Survey of India has started survey work in Larsemann Hills. The map of area around new station site at Larsemann Hills on scale 1 :2,500 with contour interval 5 m has already been published. As per the requirements, mapping of the station site on 1:1,000 scales with contour interval 1 m was completed during 27th expedition.

In addition to the mapping, Survey of India has also provided surveying related technical assistance to other organizations.

Survey of India will continue to participate in the expeditions and will contribute to the research in terms of surveying, mapping and better understanding of the region.

Objectives

- Establishment of horizontal and vertical reference frame for detail mapping and scientific activities.
- Large scale mapping of the Schirmarcher Oasis on scale 1:5,000 with contour interval of 5 meters
- Establishment of relative gravity network of 1 km. mesh at Schirmarcher Oasis, connecting all GPS stations.
- Preparation of different gravity anomaly maps of the Schirmarcher Oasis region in Antarctica on 1:5,000 scale with contour interval of 1mgal.
- To monitor the plate movement of the continent with respect to Indian plate.
- Studies for neo-tectonic activities of the Antarctica region.
- Large scale mapping of Larsemann Hills on scale 1:5,000 with contour interval of 5 meters

Objective of SOI in Antarctica for the Year 2008-09:

a) At Larsemann Hills, Bharati Island, Antarctica:

The project of Survey of India in Larsemann Hills, Antarctica is to carry out 7-days GPS observation campaign at Survey of India Reference Point near Apple hut for studying the inter plate movement between Indian and Antarctic plates.

To carry out Large Scale mapping on 1:5,000 scale of survey with 5 metre Contour Interval for an area bounded between

- Latitudes $69^{\circ} 25' 00''$ S and $69^{\circ} 25' 30''$ S and Longitudes $76^{\circ} 11' 00''$ E and $76^{\circ} 14' 30''$ E.
- Latitudes $69^{\circ} 24' 45''$ S and $69^{\circ} 25' 00''$ S and Longitudes $76^{\circ} 13' 30''$ E and $76^{\circ} 14' 30''$ E.

b) At Schirmarcher Oasis, Maitri, Antarctica

i. The project of Survey of India in Schirmarcher Oasis, Maitri, Antarctica is to carry out 7-days GPS observation campaign at Survey of India Reference Point south of Priyadarshani Lake for studying the inter plate movement between Indian and Antarctic plates.

ii. To carry out Large Scale mapping on 1:5,000 scale of survey with 5 meter Contour Interval for an area bounded between Latitudes $70^{\circ} 44' 30''$ S and $70^{\circ} 45' 00''$ S and Longitudes $11^{\circ} 40' 30''$ E and $11^{\circ} 43' 00''$ E.



Data Collection I Instruments used

For 7-days GPS observation campaign at Larsemann hills and Schirmarcher Oasis for studying the inter plate movement between Indian and Antarctic plates Trimble GPS-5700 dual frequency Geodetic receiver was used in static mode with 30 second epoch interval.

The raw data was downloaded in laptop from GPS receiver immediately after completion of each day GPS observations. The raw data was converted into Rinex format for further processing and archiving in G.&R.B., Debra Dun.

For Large scale mapping on 1:5,000 scale with 5 metre contour interval at Larsemann hills and Schirmacher Oasis GPS path finder was used combined with conventional method of Plane Tabling. Details capturing and contouring is done in the field itself.

Work done at Larsemann Hills

The allotted task of 7-days GPS observation campaign at Survey of India reference Point near Apple hut in Larsemann hills was completed successfully for studying the inter plate movement between Indian and Antarctic plates .

The allotted task of Plane Tabling Survey on 1:5,000 scale with 5 metre Contour Interval for the mapping of Bharti Island for an area bounding between

i. Latitudes $69^{\circ}25'00''S$ and $69^{\circ}25'30''S$ and Longitudes $76^{\circ}11'00''E$ and $76^{\circ}14'30''E$ was successfully completed.

ii. Latitudes $69^{\circ} 24' 45''\text{S}$ and $69^{\circ} 25' 00''\text{S}$ and Longitudes $76^{\circ} 13' 30''\text{E}$ and $76^{\circ} 14' 30''\text{E}$ was successfully completed.

In addition to above allotted tasks mentioned in Sl. No.i & ii, we were able to provide some control points data and profile surveys required for the construction of new station site at Larsemann hills as per verbal instructions of Voyage Leader Shri Ajay Dhar and by the German Architect at different sites such as

- i) Route from Jetty to station site
- ii) Drinking water pipe line from Sea to station site
- iii) Station site
- iv) Drainage pipe line from station site to sea
- v) Sites for helipads, fuel dump etc.

Work done at Maitri

The allotted task of 7-days GPS observation campaign at Maitri station on Survey of India Reference Point south of Priyadarsini Lake was completed successfully for studying the inter plate movement between Indian and Antarctic plates.

The allotted task of Plane Tabling Survey on 1:5000 scale with 5 metre Contour Interval for the mapping of some part of Schrimacher Oasis bounding between Latitudes $70^{\circ} 44' 30''\text{S}$ and $70^{\circ} 45' 00''\text{S}$ and Longitudes $11^{\circ} 40' 30''\text{E}$ and $11^{\circ} 43' 00''\text{E}$ was successfully completed.



Area Surveyed

i. At Larsemann hill, Large scale mapping on 1:5000 scale with contour interval 5metre was carried out for an area of 2.41 sq.km.

ii. At Schirmacher Oasis, Large scale mapping on 1:5000 scale with contour intervals metre was carried out for an area of 1.44sq.km.

Total area surveyed during the season is 3.85sq.km.

RESULTS

I. MAPPING

P.T.section done in Larsemann hills was first scanned and then digitized at G. & R.B., Dehradun & also merged with the map of adjoining part of Larseman hills done by the members of 26th Antarctica Expedition. This digitized map is submitted for S.G.'s approval. After approval the final map will be published as soon as possible.

1. GPS DATA

Post processing software Bemese 5.0 was used for processing the 7days data of Maitri Station & Larsemann Hills. List of co-ordinates and heights of stations at Maitri & Larsemann hills is given below

| MAITRI STATION | | | | | | | |
|-------------------|----------|----|-------|-----------|----|-------|-------------------------------|
| YEAR | LATITUDE | | | LONGITUDE | | | ELLIPSOIDAL HEIGHT (in meter) |
| | 0 | ' | " | 0 | ' | " | |
| 2004-05 | S 70 | 45 | 51.55 | E 11 | 44 | 2.76 | 132.4412 |
| 2005-06 | S 70 | 45 | 51.55 | E 11 | 44 | 2.761 | 132.3802 |
| 2006-07 | S 70 | 45 | 51.55 | E 11 | 44 | 2.761 | 132.38662 |
| 2007-08 | S 70 | 45 | 51.55 | E 11 | 44 | 2.759 | 132.3662 |
| 2008-09 | S 70 | 45 | 51.55 | E 11 | 44 | 2.755 | 132.2732 |
| LARSEMANN STATION | | | | | | | |
| YEAR | LATITUDE | | | LONGITUDE | | | ELLIPSOIDAL HEIGHT (in meter) |
| | 0 | ' | " | 0 | ' | " | |
| 2007-08 | S 69 | 24 | 21.22 | E 76 | 11 | 39.99 | 51.553 |
| 2008-09 | S 69 | 24 | 21.22 | E 76 | 11 | 40 | 51.536 |

REMARKS/CONCLUSION

The allotted work could be successfully completed despite bad weather with high speedy chilly winds. In such a hostile weather it was very challenging to complete the assigned task in the stipulated time frame. But keeping the high tradition of Survey of India, we almost completed the assigned task within the stipulated time. The encouragement and moral support given by Maj.Gen.V.P.Srivastava, Addl.S.G, G&RB, Shri Prashant Kumar, Suptdg. Surveyor and all other officers and staff of Survey of India through e-mails/internet has been an added advantage to the team spirit and we are thankful to all of them.

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RESPONSIBILITY

The allotted tasks are carried out by Shri K.V.Ramana Murthy, Officer Surveyor as SoI Team leader, Shri Maheshwar Singh, Surveyor, Shri Manjeet Singh, Surveyor and Shri Vimal Kishor, Surveyor under the able guidance of Shri Prashant Kumar, Suptdg. Surveyor, Shri Nitin Joshi, Suptdg. Surveyor, Shri S.P.Bahuguna, Suptdg. Surveyor and under overall supervision & guidance of Maj .Gen.V.P.Srivastava, Addl .Surveyor General, G&RB, Survey of India, DehraDun.
