National Report for the Netherlands

H. VAN DER MAREL[1], J. VAN BUREN[2], R. MOLENDIJK[3], M. SALZMANN[2], G. VAN WILLIGEN[3]

1. Active GPS Reference System for the Netherlands (AGRS.NL)

The active GPS reference system for the Netherlands was constructed in 1996 as a multipurpose permanent GPS observing system. Last year marked a change in policy. The main function of the AGRS.NL will be the operational base of the geometric infrastructure of the Netherlands. The geometric infrastructure consists of the national coordinate systems for position (RD), for height (NAP) and the newly introduced ETRS89. This policy excludes the use of the AGRS.NL for real time (RTK) purposes.

Much of the present hard- and software dates from 1996 when the AGRS was installed. Many of the components are no longer available and hard to maintain. Therefore all the hard- and software, except the receivers and antenna, which were already replaced in 2000, will be replaced to meet modern standards and TCP/IP based communications. Three out of five stations will be directly on the Internet. Also the hard- and software at the computing centre in Apeldoorn will be replaced. Many of the modifications will in fact be simplifications in order to get a well maintainable system. Early 2002 a project started to optimise the data maintenance system, coordinate processing and quality assurance of the AGRS.NL.

Also following the above mentioned policy the present product of RINEX data at a 30 sec interval per station, and downloadable per minute, will be replaced by RINEX daily files at 30 sec interval per station. The number of stations will remain five, which means a spacing between stations of around 100 km. For a very limited number of customers, mainly for scientific purposes, more frequent files at other intervals will be made available directly at the stations without interfering with the main data flow of daily files (see next section).

2. Permanent GNSS activities at the TU Delft

The TU Delft continues to provide hourly RINEX files for the five AGRS.NL stations (Delft, Eijsden, Terschelling, Apeldoorn and Westerbork) with minimal latency through her ftp-site. In order to improve the reliability and continuity of the data stream the data will not flow anymore through the computing centre in Apeldoorn; starting autumn 2002 the raw receiver data will be retrieved directly from the five permanent AGRS.NL stations. This also opens up the possibility for higher data rates and other intervals.

In addition, the TU Delft continues to make available the data from the IGS receivers in Kootwijk and Westerbork (using the same antenna as the AGRS.NL receiver), and the IGLOS station in Delft (collocated with the AGRS.NL receiver). Very good news is that the future of the IGS station Kootwijk is now much clearer; the last few years Kootwijk was under thread of being closed down, but we are happy to report that the property has been sold recently and we have an agreement with the new owner to continue the permanent GPS observations.

In 2002 the TU Delft installed three new receivers in the Netherlands, in Cabauw, Eindhoven and Delft. Cabauw, in the middle of the Netherlands, is a meteorological site with radiometers, radars, a wind-profiler, a 213 m mast with meteo-sensors and other equipment. Data for Cabauw and Eindhoven will be available from the ftp-site at the TU Delft starting June 2002. The newly installed receiver in Delft is used as a data-collection site for the EGNOS System Test Bed (ESTB) in the framework of a EuroControl project.

3. GPS-service providers for RTK

Several GPS-RTK service providers, some of them commercial, are active in the Netherlands. They mainly cover the densely populated western part of the Netherlands and two main infrastructural projects: a new railway from Rotterdam to Germany, and the new high-speed line (HSL) from Brussels to Amsterdam. Furthermore, Rijkswaterstaat operates about 30 RTK stations along the coast and main waterways.

One company announced its intention to operate a network of 25 receivers (of which 8 supplied by SAPOS) in the Netherlands using the GEO++ network RTK software. This network is scheduled to become operational by the end of 2002.

On April 17 2002 a meeting was organised with providers, users and certification authorities of the Netherlands. The Dutch model, presented in our last years National Report, of GPS-service providers certified by the mapping authorities was generally accepted. The users wanted more extensive certification instead of the yearly coordinate control at this moment. An important point for research is how to certificate a network of reference stations for example the Virtual Reference Concept and network RTK.

[1] Hans van der Marel, Delft University of Technology, Geodetic Engineering, Thijsseweg 11, NL-2629 JA, Delft, h.vandermarel@geo.tudelft.nl

[2] Joop van Buren / Martin Salzmann, Kadaster, Postbox 9046, NL-7300 GH Apeldoorn, joop.vanburen@kadaster.nl / Martin.Salzmann@kadaster.nl

[3] Ronald Molendijk / Gert van Willigen, Rijkswaterstaat, Meetkundige Dienst, Postbox 5023, NL-2600 GA Delft, r.e.molendijk@mdi.rws.minvenw.nl / g.w.vwilligen@mdi.rws.minvenw.nl

4. Transformation issues: standard format for correction grids?

With the publication of the detailed transformation between ETRS89 and RD/NAP including the RD-correction grid, the redefinition of the RD was formally completed. At this moment 25 software providers obtained (for free) the necessary files.

Several countries have now adopted the model of correction grids for a detailed transformation between their national system and ETRS89. These models must be implemented in software. To avoid different software solutions for each country a standard format for transformation parameters and correction grids is necessary. We propose the use of XML. XML is a family of widely accepted standards to which belong HTML and GML. XML is a very open standard. We suggest a small working group to make proposals for detailed specifications.

5. Levelling of the GPS-base stations

In 2002 the precise levelling of all 415 GPS-base points in the Netherlands was completed. These points now form a base for control of GPS-measurements. Even in this era of active GPS-networks control points as the GPS-base stations are valuable for testing purposes. The new height values will also contribute to a new and even more precise geoïd model for the Netherlands.

6. New realisation of NAP (Amsterdam Ordnance Datum) heights

In order to be prepared for detection of distortion in the heights of almost 200 first order NAP benchmarks in the Netherlands the fifth primary levelling project had been initiated in 1994. As already mentioned in previous national reports the fifth primary levelling project included three campaigns of measurements.

1. The largest part consisting of 7330 km spirit and hydrostatic levelling that had been started in 1996 and had been finished late 1999. After the final computation in 2000 the data set had been verified with already available as well as additional secondary levelling. This comparison improved the blunder detection and had resulted in the final heights this year.
2. Close to the EUVN 97 GPS-campaign more then 80 GPS stations had been connected to a number of EPN stations. These GPS stations were equally distributed and were located nearby first order NAP benchmarks. All of the GPS stations had been included in, or connected to the main levelling lines of the fifth primary levelling network. The EUVN guidelines were applicable to this GPS campaign. The final ETRS89 heights had been computed in 1999.
3. The primary gravity network of 200 stations had been re-measured with relative gravimetry. At five of the stations some repeated absolute gravity measurements have been carried out.

Additional to the mentioned measurements, research had been carried out on the (local) stability of the first order, underground NAP benchmarks. Last year geological and geophysical information showed that a limited number of benchmarks not including Amsterdam (!) could be marked as mutual stable. To enable a better and durable link to the NAP datum it was decided to use one of these benchmarks (Loenermark) as computation base for the levelling network of the fifth primary levelling.

The data of the levelling part of the fifth primary levelling network will be sent to the European database at the BKG this year.

This year it was decided to connect all recent levellings to the results of the fifth primary levelling project. This will result in a revision of all NAP heights for public use. The results of the GPS measurements will be used to make a more accurate geoid model available (see below). Finally, the gravity measurements have been compared to previous campaigns. The Netherlands Geodetic Commission has published the results [CROMBAGHS et al, 2002].

A new evaluation of vertical land movement in the Netherlands as detected by geodetic techniques and probable natural causes like tectonics, compaction and isostasy (see [KOOI et.al., 1998]), is foreseen. For this purpose, in 2001, new software for a kinematic adjustment was developed. We expect to have the first results this year.

The Survey Department of Rijkswaterstaat will take the survey-vessel “De Niveau” out of service by the end of 2002. This means the end of regular hydrostatic levelling in the Netherlands. In the future maintenance of the NAP benchmarks will be carried out by a combination of GPS and spirit levelling.

7. New Dutch Geoid NLGEO2002

Together with the publication of the revised NAP heights a new geoïd will be presented. This model will replace the current “De Min” geoïd. However, the same methodology had been followed to compute this geoïd. With additional (foreign) gravity data and the EGM96 model (in stead of OSU91A model) first a new gravimetric geoïd has been computed. Together with the combined GPS/levelling stations of the fifth primary levelling project and the GPS-base network as final check this resulted in the model NLGEO2002.

References

CROMBAGHS MARC, ERIK DE MIN, GOVERT STRANG VAN HEES (2002) *The first absolute gravity measurements in The Netherlands – period 1991-1999*, Netherlands Geodetic Commission, Publications on Geodesy, volume 50, March 2002

KOOI H., P. JOHNSTON, K. LAMBECK, C. SMITHER, R. MOLENDIJK, 1998, *Geological causes of recent (~100yr) vertical land movement in the Netherlands*, Tectonopysics 299, pp. 297-316.