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Philippe De Maeyer



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Philippe De Maeyer

Introduction

- 1 Although Belgium has had its own base cartography organised on a national scale for over a century, the federalisation process and the new regional structures which resulted have redrawn the landscape of base cartography production in this country.
- 2 The succession of constitutional reforms during the 1970s and 80s gave birth to a new Belgium, one based on legislative and executive powers both at the national level and at the level of the Communities and the Regions. The Community concept relates to the persons who compose it and to the ties which bind them together (language, culture, etc.). The Regions have competencies in the areas affecting the use of the 'territory', in the broad meaning of that term. Thus, as a result of these constitutional reforms, base cartography was no longer an issue subsumed solely under the national authority, but had become a regional matter as well.
- 3 Over the same period, a technological revolution was taking place. The computerisation of cartography and geographical information has so far gone through two major successive stages.
- 4 The first phase saw the introduction of computers into the cartographic production process. Computer-assisted design (CAD) and computer-assisted cartography tools took over part of the photomechanical work. Nevertheless, the structure of the digital databases was still oriented towards a paper cartographic product. The layers of information were structured in such a way as to make possible either the mechanical engraving of films or a sequential rasterisation of the data, thus yielding a series of raster layers arranged by theme or print colour. This would allow direct exposure of the plate-ready films directly.
- 5 In a second phase one saw, as a result of the development of both the concepts and the possibilities of computerisation, a shift from the use of pragmatic cartographic databases towards the conception of geographical databases. Later, one will also note this evolution in the approach taken by the various regional administrations towards base cartography.

This leads us to see not only the purely cartographic aspect, but rather to consider a base cartographic reference system.

History

- 6 As with other countries, in Belgium too one finds that systematic base cartography was long an essentially military matter.
- 7 The first official base cartography was performed by the Dépôt de la Guerre. It was based on a new triangulation and a new levelling. The first map sheet was published in 1866. Several topographic editions would follow, at scales of 1/10,000, 1/20,000, 1/40,000, 1/40,000 or 1/80,000, published by the Institut Cartographique Militaire, the successor in 1878 to the Dépôt de la Guerre.
- 8 A major revolution for base cartography took place just after the Second World War. It was brought about by the Institut Géographique Militaire, created in 1947 and later to be transformed into the Institut Géographique National (IGN) (1976). The new maps were established according to Lambert's conic conformal projection instead of Bonne's equal-area projection. The reference spheroid ceased being that of Delambre, to the advantage of the Hayford's spheroid (1924 international spheroid). Since Belgium became a member of NATO at that time, it was also necessary to adapt the scales. One therefore switched from the scales of 1/20,000, 1/40,000 and 1/160,000 of the so-called ordnance survey maps to a topographic cartography on the scales of 1/25,000, 1/50,000 and 1/100,000. From a technological perspective, the introduction of photogrammetric methods made it possible to accelerate production.
- 9 While cartographic design in the early post-war period was dictated by military needs, maps would later be compiled to better meet the needs of other administrations and civilians.
- 10 In the 1980s, as a result of the new technological possibilities, the IGN could automate its cartographic production. This computer-assisted cartography would be largely based on a raster or vector-raster technology. Later we will see that, beginning in the 1990s, the IGN would successfully introduce use of geographical information systems, while keeping the emphasis on a cartographic – thus visual – product whose communicative role remains essential. The IGN also played a fundamental role in establishing and maintaining the geodetic grid.
- 11 While one accepts as the definition of a base map that it is 'a cartographic series directly produced from land surveys or aerial photographs and capable of serving in the production of other maps or cartographic series, most often on smaller scales', one should note that other base cartographic documents have been created since Belgian independence (1830).
- 12 Thus the cadastral cartography initiated in 1807 in accordance with the Napoleonic model was completed for the entire Belgian territory in 1843. Belgium – unlike other countries, such as France – was very quickly able to find a solution for the annual updating of this cartographic document. As a document intended for tax purposes and not having any direct legal significance, it was and is often used as a reference document. To such an extent that, in the mid-19th century, private publishers obtained the publication rights. This cartography later served as a frame of reference for establishing thematic maps. The most common scales are 1/1,250 and 1/2,500; nevertheless, in highly urbanised centres,

documents on the scale of 1/500 were created, and in some cases the scale of 1/5,000 was allowed. Following (inter alia) the original establishment of the parcel plans in a local grid, one should, from a geometrical point of view, use these plans with a certain degree of wariness. A revision programme was launched in 1937. Certain map sheets revised or established within the framework of the regrouping of lands are on the scale of 1/1,000 or 1/2,000. Currently, the national coverage is composed of 28,200 sheets managed by the Ministry of Finance.

- 13 In the period from 1951 to 1970, the Ministry of Public Works published, for its own needs in high-density urban zones, topographic maps for around 20 major cities on the scale of 1/5,000. The last city to be updated was Brussels in 1982. Thus, these documents are only of historical value today.
- 14 Finally, let us note that two private companies launched initiatives of national coverage by orthophotos in the 1970s and 80s.

The present situation

- 15 As mentioned in the introduction, the current actors in base cartography are not only the national or federal authority, to which the Institut Géographique National (IGN) is attached, but also the various authorities with territorial competence (the regions).

Institut Géographique National

- 16 The publication scales of topographic and chorographic cartography currently in effect are: 1/10,000, 1/20,000, 1/50,000, 1/100,000 and 1/250,000. Because the series of topographic maps on the scale of 1/20,000 is not yet fully completed, some map sheets remain available on the older scale of 1/25,000. The former series of 1/10,000 and 1/25,000 had a common design base on a scale of 1/15,000.
- 17 Currently, besides the 1/100,000, all of IGN's cartographic publications are produced from digital databases. Three databases were developed, centred on three central scales, respectively 1/10,000, 1/50,000 and 1/250,000. Each database is characterised by its own topological structure, by its accuracy, its geodetic reference system and its exchange formats.
- 18 The central scale of 1/10,000 is used to produce the paper map at 1/20,000 and 1/10,000. The maps are completely produced in a digital way. A complete new vector database on a g.i.s. platform is created using photogrammetry, photo-interpretation and data collection on the field. The object and layer definition in the database is cartographic oriented. We should note the graphical quality and the contents of the series. The altimetric aspect was not updated when work first began on building the new database, which means that the information around the central scale 1/10,000 is for the earliest edited sheets primarily a reference system in X and Y.
- 19 The central scale of 1/50,000 is used to create the map printed on the same scale, and studies are currently being conducted in order to estimate the use of this database for production, after generalisation, on the scale of 1/100,000.
- 20 The chorographic map on the 1/250,000 scale, which was interactively generalised on the basis of the map at 1/50,000, was supplemented by classified land use data from satellite images. This cartography is available in vector and raster formats.

- 21 While finalisation of the database at 1/50,000 is scheduled for the end of the year 2000, coverage of the national territory on the central scale of 1/10,000 is only foreseen for sometime during the course of this decade. It is important to note that the big cities and the high-urbanisation map sheets are already covered. These geographical databases are also marketed in their vectorial structure.
- 22 Besides the printed maps and the vectorial geographical reference files, the IGN also publishes raster data. Two production techniques are used: either the image is generated from the vector information (if available), or the maps are scanned from the films or the latest printed edition.
- 23 Besides this cartographic information, the IGN also distributes digital orthophotos with a ground resolution of 1m² which can, for certain applications, serve as a geographical reference system.

The Regions

- 24 The regional authorities in charge of geographical information had to define their own roles. The choice was made autonomously, which means that one presently finds a regional divergence in the definition of medium-term needs. Thus, while the Flemish Region has strongly emphasised thematic information, the Walloon Region from the start opted for a heavy investment in large-scale topographic cartography.
- 25 In the short term, the actions carried out by the regions had as common denominator the desire to make available to the users, in the first place the administrations, digital geometrical reference systems. For this, some chose a raster background by scanning the separate films of the 1/10,000 topographic map; the Brussels-Capital Region, by contrast, opted for the quick solution of a vectorial reference system.
- 26 In the long term, one has the impression that the needs are the same; consequently, there remains hope that a technical standardisation will be possible.
- 27 It should be noted that the regions have a free-of-charge or minimum licence fee policy for the dependent administrations and those of subordinate territorial units (communes, provinces).

Figure 1. Numbering of the map sheets and available sheets of the new 1/10,000 and 1/20,000 series of the N.G.I. (situation April 2000).

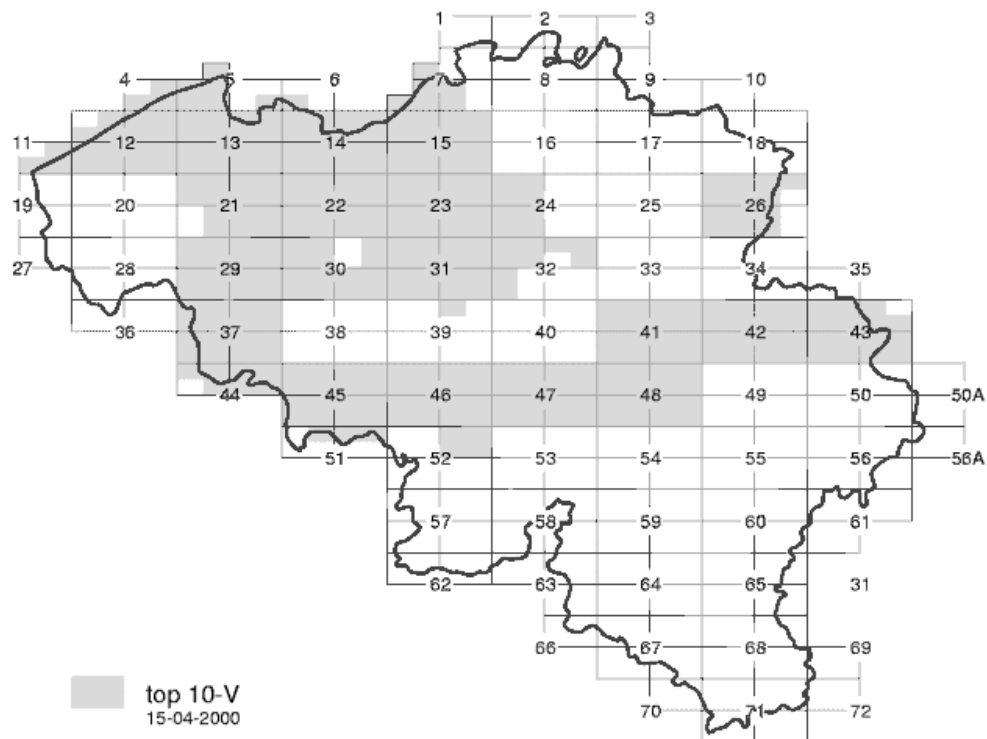
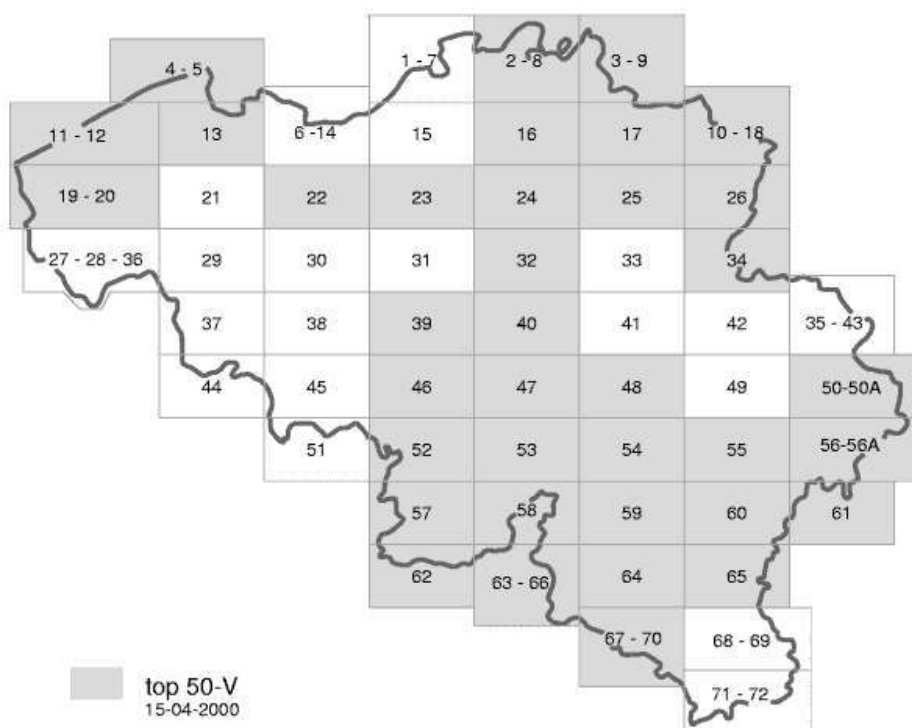


Figure 2. Numbering of the map sheets and available sheets of the new 1/50,000 series of the N.G.I. (situation April 2000).



Brussels-Capital Region

- 28 Very early on, the Brussels-Capital Region developed, within the framework of its Centre d'Informatique pour la Région Bruxelloise (CIRB – the Brussels Region Computer Centre), a strategy of being present in the field of base cartography. Thus, the digital map Brussels UrbIS was created starting in 1989.
- 29 The first version of the digital map was essentially based on the cadastral parcel plans copied on topographic data at 1/10,000. These were integrated block by block into the topographic data. The database also includes the administrative limits, the statistic sectors and an attribution of the addresses.
- 30 The data to be included in the second version of the digital base map will be comparable but, thanks to photogrammetry, will be substantially more accurate. Additional layers are planned, with (inter alia) the purpose of the buildings.
- 31 While awaiting complete availability of this UrbISTop cartography, one does already have access to the digitised aerial photographs with a resolution of 10 cm per pixel (UrbISFot). On the basis of UrbISTop, one will finally update the road and administrative geographical databases of the first version, which will henceforth be called UrbISAdm and UrbISPwn. The CIRB chose to develop its own exchange format, SUD. Utilities are provided to users which permit the UrbIS data to be easily imported into GIS (Geographical Information Systems) and CAD softwares.

Walloon Region

- 32 The Walloon Region right away launched itself on an ambitious programme of large-scale base cartography. Thus, since 1992 the Projet Informatique de Cartographie Continue (PICC – Continuous Cartography Computer Project) has had the objective of achieving three-dimensional cartographic coverage on the scale of 1/1,000 of the entire region and placing this digital information at the disposal of the public departments and private companies in accordance with a variety of formulas. Most of the data collection is being performed by companies on the basis of photogrammetric restitution, after which the administration in charge of this project (Direction de la Topographie et de la Cartographie, MET, Walloon Ministry of Equipment and Transportation) validates the data. In terms of quality, absolute accuracy (RMS) is required of 0.12m in planimetry and 0.15m in altimetry. Currently, highly urbanised and industrialised zones such the Charleroi-Namur-Liège axis and the province of Walloon Brabant are available. Parts of the provinces of Hainaut, Liège (Liège-Verviers axis) and Luxembourg (around the city of Arlon) are now being completed.
- 33 Two fundamental problems are being studied. Firstly, that of establishing the procedure and the costs of updating in the highly dynamic zones (tests in progress on a test zone Wavre-Louvain-la-Neuve). A second problem to be resolved is that of defining a more adequate scale for the wooded zones of the Ardennes plateau.
- 34 The PICC is evolving towards a broader programme: BRIGIT (Base de Référence des Items Géographiques, Informatisée and Tridimensionnelle – Computerised, Three-dimensional Reference Base of Geographical Items). This cartographic reference system, of which PICC is the geometrical foundation, will incorporate all other digital geographical data created by an administration, subject to validation by the MET.

- 35 This vast long-term programme on the scale of 1/1,000 did not prevent it from being necessary, in an initial, parallel stage, to put a complete digital base cartography of the entire territory at the disposal of the administrations within a reasonable period. One opted for a raster background from the print films IGN 1/10,000. This was performed within the framework of a coherence centre, which functioned as a co-ordinator and catalyst, standardising the thematic needs.

Flemish Region

- 36 After several base cartography attempts met with little success, in partnership with companies of recognised public utility, or initiatives lacking political consensus, the Flemish Region opted for a fundamental analysis of its needs. A committee of scientific experts was thus appointed, which presented its findings in 1993.
- 37 Since then, the OC GIS Vlaanderen has been operating within the framework of the VLM, a Flemish administrative body. This centre co-ordinates and encourages public geographical information initiatives at the level of the Flemish Region.
- 38 One of the first projects was to make available within a brief period two base cartographic reference systems. The first was a road reference system, set up by a private company, which makes it possible to satisfy the needs of a large number of users for whom high geometrical accuracy was not a major concern. At the same time, and in order to have a homogenous digital base in the very short term, scans with a resolution of 400 dpi of the films of 1/10,000 topographic maps were furnished to the administrations.
- 39 On the basis of these two reference systems, a large number of cartography or thematic database initiatives were conducted.
- 40 In this heavily-populated, fully-settled region, it proves desirable to complement the large-scale information with a cadastral layer. A pragmatic solution currently being implemented is to integrate a level of raster information from the scanned cadastral plans, as well as a vectorial level with parcel identifiers.
- 41 The Flemish Region decided to implement an ambitious project creating a large-scale reference system covering its territory. On the basis of land surveys and photogrammetric restitution, the idea was conceived of creating a reference system which can be used on the virtual scale of 1/250 to 1/2,5000. The primary objective is to create the database, with the map being a derivative product. In the surveys an approach by object is sought, the geometry also being an attribute of the object. The Region launched the works for a joint test at the beginning of the year 2000.

Conclusion

- 42 All the authorities involved in base cartography propose solutions for a basic reference cartography, either on an average scale (IGN) or on a large-scale (the regions). Raster maps are often used as a temporary solution, while awaiting a vectorial version, or as a complement to the vectorial digital maps.
- 43 In the introduction, reference was made to the two phases of development in the automation of basic geographical information. A third phase is now on its way. It will have to provide adequate solutions for distributing and using these data in real time.

Above all, this phase will pose the problem of the updating of these enormous databases and their multi-scale use. One can ask whether we don't run the risk of forgetting that a map (as well as the databases which allow one to generate it) is a spatiotemporal representation. The current conceptions of geographical information rightly attach great importance to geometrical and semantic precision. Nevertheless, one must also create for oneself the means to preserve the temporal series of these digital documents, among other things in order to allow future generations to study the evolution of our land use.

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<http://www.fgov.be>

Internet site of the Belgian Government

<http://www.ign.be>

Internet site of the Institut Géographique National (IGN)

<http://www.cibg.irisnet.be>

Internet site with information on the base maps of Région Bruxelles-Capitale (Brussels Region)

<http://www.vlm.be>

Internet site with information on the base maps of the Flemish Region

<http://internet.win.be/rainbow>

Internet site with information on the base maps of the Walloon Region

ABSTRACTS

After a short historical review of base cartography in Belgium, one can observe that the new regional structures, which resulted from the constitutional reforms during the 1970s and 80s, have redrawn the landscape of base cartography production in this country. Different national and regional authorities are presently involved in base cartography. They propose solutions for basic reference cartography, either on an average scale or on a large-scale. Raster maps are often used as a temporary solution, while awaiting a vectorial version, or as a complement to the vectorial digital maps. Authorities will have to provide in the future adequate solutions for the problem of the updating of the enormous databases and for distributing and using these data.

Après un bref aperçu historique de la cartographie de base depuis la création de l'Etat belge, on constate qu'actuellement plusieurs opérateurs sont présents. La cartographie de base est devenue, suite aux réformes constitutionnelles des années 1970-80, une matière qui ne relève plus seulement de l'autorité nationale, mais devient en même temps une matière régionale.

Toutes les instances impliquées dans la cartographie de base proposent des solutions numériques pour une cartographie de référence de base, soit à une échelle moyenne, soit à grande échelle. Les cartes matricielles sont souvent utilisées comme solution temporaire, en attente d'une version vectorielle, ou en complément des cartes numériques vectorielles. Se pose d'ores et déjà le problème de trouver des solutions adéquates pour la diffusion des données par les technologies nouvelles ainsi que pour la mise à jour de ces données.

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Mots-clés: cartographie, Belgique, carte de base, carte topographique, plan cadastral

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AUTHOR

PHILIPPE DE MAEYER

Ghent University, Department of Geography, Krijgslaan 281 (S8), B-9000 GENT Belgium,
philippe.demaeyer@rug.ac.be