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Topic (iv): Standards and metadata

GEOGRAPHIC STANDARDS OF THE COMMISSION SERVICES

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Invited paper

ABSTRACT

The GI&GIS project of the Joint Research Centre is actively involved in assisting in the creation of the European Spatial Data Infrastructure as well as in activities related to the conception, creation and harmonisation of Pan-European spatial databases relevant for European Union policies, mainly through the support and co-ordination of networks in various thematic fields. A lot of work has been done in collaboration with Eurostat to improve geographic information management and access within the Commission. This paper focuses on the results in the field of geo-spatial standards (co-ordinate reference systems, projection systems, reference data definition, metadata). Some of these standards have already been adopted by the Commission, others will be adopted soon when they are more consolidated, and finally some problems are identified in certain areas requiring further investigation and maybe new standard development in the near future.

I. GI IN THE COMMISSIONS SERVICES

1. The Commission's services deal with questions relating to GI[2] -GIS[3] from different points of view. The Directorates General (DG) Information Society, Enterprise and Research concentrate their activities in this field on research and development, standardisation and development of the European market.

2. Eurostat and the JRC are considered more as technical services in support to political DGs, the first providing the European Union with a high-quality statistical information service, the second providing technical and scientific support to the policy making process. The European Environment Agency is also active in this field, focusing on the provision of information about Europe's environment for policy making agents and the public.

3. The remaining Commission departments must be seen as users or suppliers of geographical information. Their task is to meet the multiple needs of the Institution arising from the drafting, follow-up and evaluation of Community policy. This group consists mainly of DGs Agriculture, Environment, Transport, Regional Policies.

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[1] Prepared by Alessandro Annoni.
[2] Geographic information.
[3] Geographic information systems.

4. In December 1999 various services of the Commission decided to create COGI (Commission group interservice for Geographic Information). The mandate of COGI (lead by EUROSTAT) is to co-ordinate the use of geographic information and to assure the application of common technical GI standards within the Commission services to improve the efficiency and cost effectiveness of European policy monitoring that require a spatial analysis of the European territory at European and global level.

5. The creation of COGI is justified not only by the internal needs of the Commission but also at specific request from the external world. The establishment of COGI is a very important development with potential benefits for the GI sector throughout Europe. A 1997 study on GI-POLICY funded by the Commission (Info2000 programme) clearly indicated the extent to which developing a clear policy within the Commission, which is still the major user of pan-European GI, was a pre-requisite for discussing the implementation of European-wide GI policies with member states and national organisations.

II. RATIONALE FOR GI STANDARDS

6. The use of GIS in the European Commission began in earnest with the CORINE[4] project of Directorate General Environment. After the creation of the European Environment Agency, an internal Commission task force stressed the usefulness of GIS as a tool in the integration of data derived from different sources (socio-economic data, environmental data, data on transport, etc.). This led Eurostat to establish the GISCO project in 1991 (Geographic Information System of the Commission).

7. The GISCO database is recognised by all Commission services as a reference database for geographical data. It contains a very wide range of basic topographical and thematic data covering the entire territory of Europe. For several years now, the GISCO reference database is accessible to all the Commission's departments (its architecture is currently built around Arc/Info). Data are stored in the Computer Centre in Luxembourg. To use the data the users must copy them into their own environment.

8. In 1998 Eurostat decided to launch a new project to review this architecture in collaboration with the Joint Research Centre (Ispra) in the light of numerous technical developments in the field of GIS since the beginning of the project in 1992 (spatial data stored in relational databases accessible online, integration of geographical and alphanumeric data in end users' applications, new and different users profiles, etc.).

9. In the first part of the project carried out in 1998, three different components were considered in order to evaluate the efficiency of the new architecture: Information, Process and Technology. The following aspects were analysed:

- To what degree is the maintained part of the data normalized?
- In which way is the GISCO dataset accessed?
- Which different classes of users can be identified?
- To what extent do the current available systems cope with present demand?
- Which is the priority: data analysis, data dissemination or data maintenance?
- What is the available budget for implementation?
- What standards are applicable to GISCO (i.e. on Metadata)?
- What is the technology trend on reference data at a European Scale?
- How do Member States implementation programs interact with the new GISCO architecture?
- Which is the European Commission policy in terms of Spatial Data Infrastructure?
- How to connect GISCO needs to GIS activities in the next framework programme?

10. It should be underlined that in the last 3 years we can observe an increasing awareness in Europe of the relevance of GI as well as a new tendency to improve access to data and information for European citizens. The technological push (internet) and the intention to increase transparency of EU policies

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4 CORINE project: "CooRdination de l'Information sur l'Environnement".

generated new initiatives and directives to facilitate and simplify data access (eEurope[5], access to environmental information[6], copyright[7], etc.).

11. In addition it has been recognised that all themes of the environment policy[8] have a spatial dimension (water, air, climate, soil, biodiversity, …). The spatial or territorial dimension of environmental policy, a common factor for all of these themes, is increasingly recognised as an important element to be taken into account in the formulation of environmental and other sector policy making alike. There is a trend in Community policies to require in legislative acts the collection of GI (ESDP[9], ICZM[10], LPIS[11], WFD[12], Nature protection[13]) and the development of GIS.

12. There are however important obstacles to be removed:

- lack of geographical data covering the European territory;
- difficulty of access to information where it exists (lack of metadata, copyright, price);
- lack of harmonisation in existing information (quality, semantic, reference systems).

13. A new initiative for a legal framework for a European Environmental Spatial Data Infrastructure (EESDI) has been recently launched by the Directorate General Environment to establish the foundation for easy access to harmonised Geographic Information in the EU and accession countries. The legal framework for EESDI needs to address data requirements for spatial data directly or indirectly related to the environment, institutional and organisational capacity for data collection and maintenance, a data policy and data access modality framework[14] and technical standards.

14. The long term vision behind EESDI, in line with the principles of subsidiarity, is that spatial data should be collected and maintained at the most appropriate level, and shared for information provision and policy-making, monitoring and evaluation at all the other levels, from the local and regional to the Community and global level.

15. The JRC's GI&GIS project was defined in 1998 with the objective of assisting the creation of the European Spatial Data Infrastructure (ESDI) as foreseen in the draft Communication GI2000[15]. The intention of this project is to play an active role in the definition of standards as well as in the activities related to the conception, creation and harmonisation of Pan-European spatial databases relevant to EU policies. The new initiative EESDI fits well with the original objective and it provides additional impetus to reflect, identify or eventually develop and adopt geo-spatial standards.

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5 eEurope: An Information Society for All (http://europa.eu.int/information_society/eeurope)

6 Directive 90/313/EEC and new proposed Directive 2000/0169.

7 New copyright directive *Decision 2000/278/EC* (http://eurorights.org/eudmca/index.html)

8 As stated in priority actions (art. 9) of the 6th Environment action programme COM (2001) 31 Community "Environment 2010: Our future, Our choice": ". . . *Reviewing information and reporting systems with a view to the introduction of a more coherent and effective system to ensure reporting of high quality, comparable environmental data and information. . . . Reinforcing the development of geographical information systems and the use of space monitoring applications in support of policy making and implementation* . . .".

9 European Spatial Development Perspective COM(2000)547.

10 Integrated Coastal Zones Management COM(2000)545.

11 Council Regulation no. 1593/2000 Integrated Administration and Control System (IACS) – Land Parcel Identification System.

12 Water Framework Directive 2000/60/EC.

13 Birds Directive (79/409/EEC) and the Habitat Directive (92/43/EEC).

14 Data policy and access addresses questions such as ownership, copyright, privacy, pricing, storage, distribution of data.

15 GI2000: Towards a European Policy Framework for Geographic Information – EC DG Information Society.

III. GI STANDARDS IN COMMISSION

16. Spatial information is increasingly required to help in the definition and monitoring of EU policies having a spatial impact on European territory (Common Agricultural Policy, Regional Development, Environment, etc.). Users started to require better data. Consequently, the following aspects should be taken into account: Quality, Certification, Authority, Consistency, Updating, Time stamp, Harmonisation, Accessibility, Interoperability.

17. Europe is a patchwork of several countries with different traditions in terms of their geographic choices. Europe has very extensive and comprehensive collections of national spatial information but it is often difficult to find and access. In addition, there is very little seamless, harmonised pan-European data available. Such information is scarce and difficult to obtain because national data was created in accordance with 15 different traditions and standards that do not fit easily together. It is deplorable that Europe is not linked through geographic information. This effectively stops a healthy European market for applications from development and is a significant problem for many cross-border projects in, say, flooding control or natural parks.

18. Data might exist locally but not EU-wide (for example, urban level data at NUTS5, to support new policy concerns such as urban policy). New policies spanning geographically across different administrative units require new data collection efforts (for example in the case of the new river basin districts). New units of analysis require new data and characterization methods (for example the increasing use of landscape as a geographical entity).

19. The combination of national data with European data is a highly complex and by no means trivial undertaking. Several aspects must be addressed such as: a common reference system, a set of suitable projection systems, the definition of a minimum set of core data, a strategy for GI metadata, semantic problems and data access.

20. Some of these topics were investigated during the first two years of activity of the GI&GIS project as well as part of other EC funded projects (PANEL-GI, ETEMII, MADAME) via discussion amongst leading experts from the field of European geodesy and GI-GIS participation in ad hoc international workshops and/or expert meetings. The following sections provide a short overview of some of the identified solutions.

IV. TOWARD A COMMON EUROPEAN COORDINATE REFERENCE SYSTEM

21. Exact knowledge, understanding, management and subsequent processing of the coordinates of any GI dataset are one of the central aspects of cross-border GI interoperability. "Location or position on or near the Earth's surface may be described using coordinates. Coordinates are unambiguous only when the coordinate reference system to which those coordinates refer has been fully defined. Each position shall be described by a set of coordinates that shall be related to a coordinate reference system. A coordinate reference system consists of one datum and one coordinate system" (ISO 19111 Spatial referencing by coordinates).

22. There exist various coordinate reference systems in which a geographic location may be described mathematically by coordinates. In each system, the position has its own coordinate values. To understand any set of coordinate values, one needs to know without any ambiguity to which 'system' it belongs. A complete mathematical description of that 'system' is also required. And finally, particularly if data belonging to different co-ordinate systems is to be shared, a knowledge of the parameters and algorithms that relate that specific 'system' to others, or preferably to an agreed common coordinate reference system, is necessary.

23. It is therefore strongly recommended that all coordinates be accompanied by an unambiguous identification of the system in which they are expressed. Defining coordinates is a specialist issue that has its own specific terminology. For the layman, there are three main types of coordinates:

- Elevation, or height: it expresses (or is related to) the 'vertical distance' between a location and a 'horizontal' surface defined as the reference (generally in meters, feet);
- Geographical coordinates: expresses in terms of longitude and latitude the position of a location on a sphere or an ellipsoid (generally in degrees, minutes, seconds);
- Cartesian co-ordinates, or map projection: expresses the position of a location in terms of Easting and Northing on a plane on which the Earth's surface has been projected (generally in kilometres/meters or miles/feet).

24. The definition of a geodetic datum generally includes the dimension of an ellipsoid, its position and orientation relative to 'the Earth'. There is traditionally at least one main datum per country, but often many more. Each country has its own implementation of a map projection (Lambert, Mercator, Azimuthal) that is basically chosen to minimise the distortions on the national territory. Conversion, within the same datum, from one type of map projection to the other, or to latitude and longitude is a simple matter of applying mathematical formulae, and can be as accurate as one desires. However, transformation from one datum to the other is always an approximation, and is based on empirical formulas and algorithms, deducted from measurements (typical accuracies vary from 10cm. to 100m).

25. A common reference system for geographic information is needed as a first step to ensure that data are compatible across Europe. In December 1999, in a workshop organised by JRC and MEGRIN[16], the need for a common Spatial Reference System for Europe was discussed as a first step towards ensuring that geographic data are compatible across Europe. It has been noted in fact that the European Continental Plate is moving uniformly about 3 cm per year (fig.1), relative to the ITRS (International Terrestrial Reference System), with the exception of the south-eastern extreme of Europe (Greece, Turkey). For this reason, in order to produce reasonably stable co-ordinates for Europe, the EUREF[17] Sub-Commission decided to define a system connected to the European plate.

26. This system is called ETRS89: European Terrestrial Reference System. ETRS89 was identical to the ITRS in the year 1989. Since 1989, ETRS89 coordinates, fixed in relation to the European Plate, have regularly shifted from their values expressed in ITRS. However, this shift is well known, monitored by IERS and EUREF, and transformations from one to the other are possible for the most part to an accuracy of 1 cm. There was consensus amongst the experts that this is the system to adopt at European level and several countries have already done so. ETRS89 is now available due to the creation of the EUREF permanent GPS station network and validated EUREF observations.

27. In November 2000 COGI adopted ETRS89, with the underlying GRS80 ellipsoid, as the geodetic datum for the geo-referenced coordinates of its own data. The coordinates to express and store positions related to ETRS89 datum should normally be ellipsoidal (geodetic latitude, geodetic longitude and, if appropriate, ellipsoidal height).

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[16] MEGRIN (Multipurpose European Ground Related Information Network) was created in 1993 on the initiative of CERCO (Comité Européen des Responsables de la Cartographie Officielle) with the aim to help National Mapping Agencies (NMAs) of Europe to meet the increasing demand for cross-border products and services.

[17] EUREF (European Reference Frame) is the name of a network of geodetic stations as well as the name of the Sub-Commission for Europe (former EUREF and UELN/REUN) of the Commission X of IAG (International Association of Geodesy), created in 1987 as a successor of RETRIG.

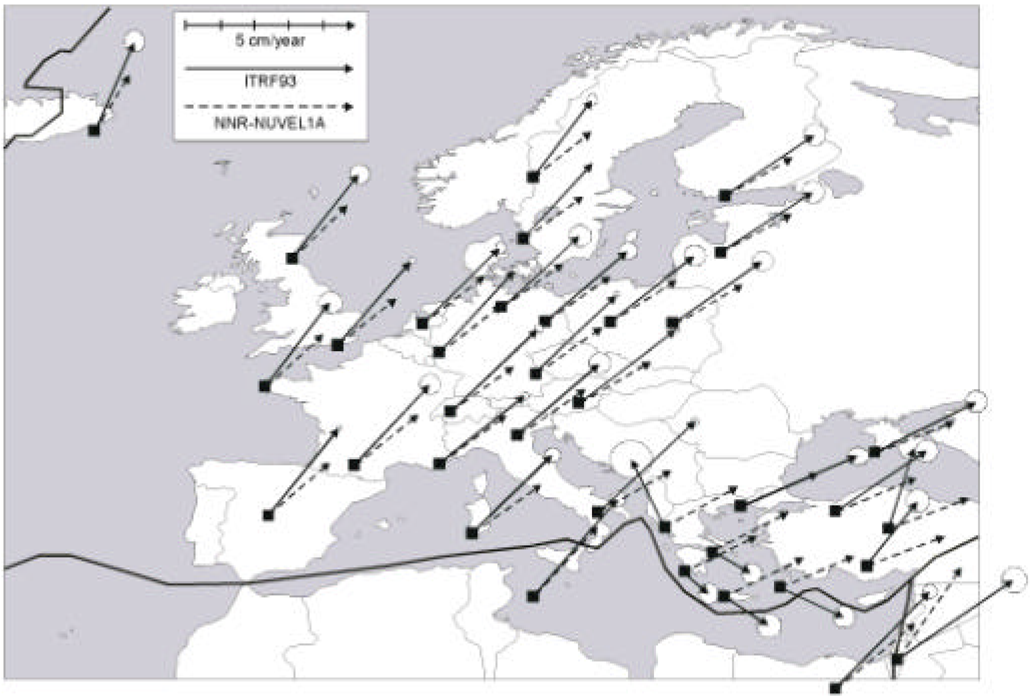

Fig.1 Movement of the European Continental Plate (source EUREF)

28. Official parameters should be available in the public domain to transform from national systems to ETRS89. On 10 May 2001, 27 out of 37 countries delivered such parameters. 22 of the files are publicly available under http://crs.ifag.de. The remaining 5 are still being prepared and will be soon included. A direct link will be added from the EUREF homepage (http://www.euref-iag.org), from EuroGeographics homepage (http://www.eurogeographics.org) and from the EC GI-GIS web portal (http://www.ec-gis.org). Some countries are still missing (Belgium, Cyprus, United Kingdom and, Latvia) but they will be completed soon. It may prove difficult to obtain data from Macedonia, Romania, Russia and Ukraine for either security reasons, or because the country is not yet connected to ETRS89, or the parameters have not yet been computed.

29. Definition of a vertical datum is more delicate. There is generally at least one vertical datum per country, and two main categories of height. Ellipsoidal height is the third dimension of the location related to an ellipsoid, and is a length. Geoidal height is related to a physical model of the Earth's surface (the geoid), and is a physical component of a location, related to gravity.

30. In 1994 EUREF began its activities for development and establishment of European height systems. Several projects were initiated, with the work based on excellent cooperation between EUREF, NMAs, Working Group VIII of CERCO and the Technical Working Group (TWG) EUREF.

31. Since 1994 the work at the United European Levelling Network (UELN) has been continued after a break of 10 years under the name of UELN-95. In accordance with Resolution No. 3 of the EUREF Symposium 1994 in Warsaw, the objective of the UELN project is to establish a unified vertical datum for Europe at the one-decimeter level with simultaneous enlargement of UELN as far as possible to the Eastern European countries. The results of the adjustment with status as of end 1998 were handed over to each participating country under the name UELN-95/98.

32. The European Vertical Reference Network (EUVN) was prepared in parallel to the UELN. It is an integrated network of GPS, levelling and tide gauge observations as a static height reference. On the basis of UELN and EUVN it was possible to derive relations between the UELN datum Normaal Amsterdams Peil and the national heigt datums.

33. As a result of the UELN and EUVN project, the IAG Sub-Commission EUREF defines the European Vertical Reference System 2000 (EVRS), including a European Vertical Datum and related parameters, as realization and for practical use as a static system (http://evrs.leipzig.ifag.de). The differences between the national height systems and the UELN95/98 are shown in fig. 2; the sea level of some countries may differ more than 2 m. This makes it impossible to build a coherent digital elevation model to be used for strategic transactional applications such as flooding risk. The next step to a European kinematic height network, the European Vertical System 2000 (EVS 2000), is under preparation. The Commission could adopt EVS 2000 in the near future.

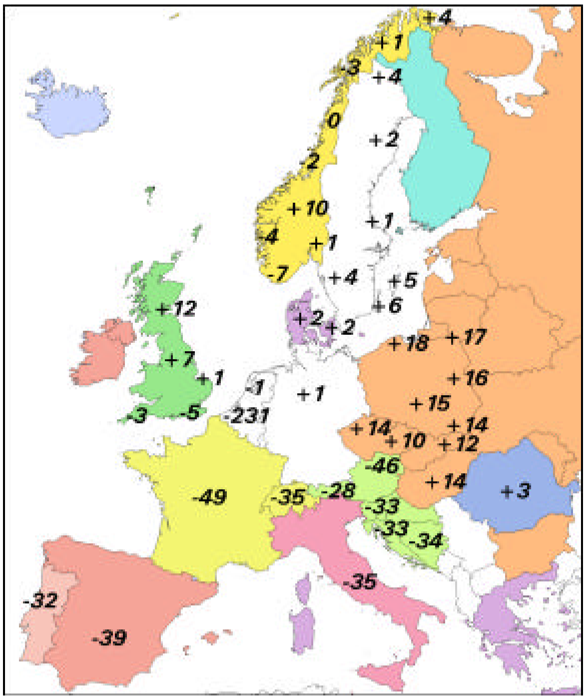

Fig.2 Differences (in cm) between national height systems and the UELN95/98 (source EUREF)

V. TOWARD A DEFINED STANDARD SET OF PROJECTION SYSTEMS SUITABLE FOR EUROPEAN APPLICATIONS

34. A European Spatial Reference System is not sufficient; we need a set of projection systems for the cartographic representation and grid storage of pan-European geographic data at different levels of precision. Projected data are in fact used in different contexts and for different uses:

- Storage (in a centralised or in distributed databases);
- Measurement (e.g. computing distance, area, etc.);
- Display (on screen, paper maps, atlases, etc.);
- Location (projected data are used to localise objects on the ground).

35. In addition the Commission faces the general problem of integration and harmonisation of data projected in different national systems. Should it be possible to convert from one projection system to another? It is of overall importance that they be compatible with coordinates measured with GPS. Should there be a collection of national projections with procedures for transforming one projection into another?

36. Other aspects to be taken into account are:

- some European policies are fully restricted to national boundaries (no data harmonisation), a second group require integration into a European system (data harmonisation), the last emerging group concerns access to distributed data bases (GIS interoperability);
- the accuracy required by the various policies is ranging as well as the extent (local to global);
- some data are already available, some should be collected/created;
- technical specifications are needed both for data collection/creation and for data conversion;
- the specifications/recommendations should foresee a stepwise approach identifying current solutions and suggesting long term strategy for quality improvement. In this sense the limitations of current GIS software and their future evolution (for example OGC specifications) should be taken into account.

37. If we consider the current situation in Europe we have to admit that the situation appears rather discouraging. According to a recent survey of the situation in Europe there are 5 different types of reference ellipsoids and 8 different types of cartographic projections used by the 37 CERCO members. How could they agree on one single projection system and which one should be selected? Which member countries would be able to afford the costs for changing their system? Can a unique map projection be proposed?

38. To discuss this subject, the JRC and EuroGeographics[18] organised a second workshop in December 2000 to analyse the primary needs for map projection(s) in the Commission and to obtain expert advice to determine the appropriate projections. While unanimity was easily reached for the conclusions of the Workshop on Spatial Reference Systems in 1999, this second Workshop had much more difficulty in reaching a consensus. The main reason is that, while a unique Spatial Reference System is nearly totally scale- and application-independent, this is not the case with Cartographic Projections.

39. There would be significant cost resulting from the data conversion needed when adopting any new grid/projection system (but changes are necessary due to the inadequacy for pan-European purposes of existing grid/projection systems in use within the Commission). A pan-European coordinate reference system which minimises the error in measurements of area (for many statistical purposes) and which also maintains correct angles and shapes (for purposes such as topographic mapping) cannot be created through usage of the ETRS89 ellipsoidal coordinate reference system alone, and a map projection is required to supplement the ellipsoidal system. The mapping of the ellipsoid cannot be achieved without distortion, and it is impossible to maintain area, direction and shape through a single projection.

40. The workshop expressed a set of recommendations[19] for the Commission:

- For conducting statistical analysis and display, the Pan-European Equal Area coordinate reference system of 2001 (PEEA2001), an equal area projection of the ETRS89 coordinate reference system, is recommended. The Lambert Azimuthal Equal Area projection with the centre of projection at 53°North and 10°East should be applied. In order to avoid negative coordinate values, false Northing and Easting values are added to the projected coordinates;
- The Commission should research a single indexing system for statistical purposes, seeking a multi-resolution solution for an equal area gridding system;
- The Commission should adopt the Pan-European Conformal coordinate reference system of 2001 (PEC2001) for conformal pan-European mapping at scales of less than 1:499,999 (1:500,000, 1:1,000,000,…). The workshop recommends applying the Lambert Conformal Conical projection

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[18] EuroGeographics was formed by a merger of CERCO and MEGRIN in September 2000 (http://www.eurogeographics.org/).

[19] Further details of the recommended projections are given in proceedings of the workshop.

with standard parallels at 38° North and 61° North. The centre of the false origin is located at 53° North, 10°East. Values for false Easting and Northing are added to avoid negative coordinate values;

- The Commission should adopt the Pan-European Transverse Mercator grid system (PETM) for its applications requiring a conformal projection, including large-scale topographic mapping, when the collection scale of the mapping data is between 1:10,000 and 1:499,999. The PETM consists of the Universal Transverse Mercator grid system applied to the ETRS89 coordinate reference system;
- The EC should maintain the PETM, the PEC2001 and the PEEA2001 as its standards for an extended period, in order to provide stability and confidence for data providers and users;
- The EC should always identify coordinate reference systems and transformations in the format required by International Standard 19111.

41. The choice of the area of interest and the projection centre was a very delicate problem because distortions increase with distance, as shown in figure 3.

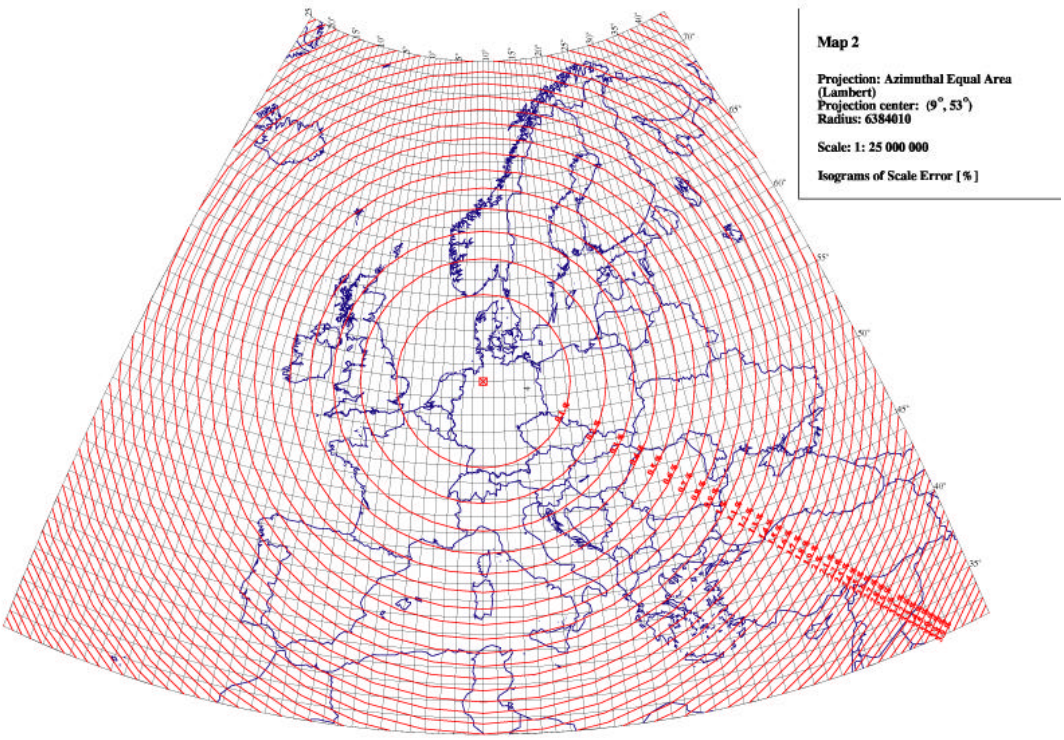

Fig. 3 Isograms of scale errors (%)

42. It was also recommended to NMAs and EuroGeographics that transformation parameters and formulae between national coordinate reference systems and ETRS89 providing co-ordinates of an accuracy at the 1~2m level should be placed in the public domain at the earliest possible opportunity and the availability of the information should be made widely known.

43. We face the problem of wrong projection formulae in GIS systems widely diffused on the market and a lack of knowledge about the right parameters. Some interesting initiatives (i.e. Mapref[20]) are based on voluntary efforts but they cannot fully solve the problems related to liability and officiality of the parameters to be used. Without the assurance that all data providers are using the correct formulae and

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20 http://www.geocities.com/mapref/mapref.html

are documenting the projection system used in a standard and unambiguous way, it will be impossible to guarantee the interoperability of the data.

VI. STANDARDS IN GEO-SPATIAL METADATA: RECOMMENDATIONS AND PRACTICAL GUIDELINES

44. Metadata is the information and documentation which makes data understandable and sharable for users over time (ISO11179). We can distinguish different levels of Metadata of increasing detail: Metadata for Inventory (i.e. internal to an organisation), Metadata for Discovery (i.e. that necessary for external users to know who has what data, where to find it, and how to access it), and Metadata for Use (i.e. a full description of an information resource that enables users to make a judgement about the relevance and appropriateness of the resource before access it).

45. Metadata standards are important because they unify the way in which data can be inventoried, discovered and used. A correct management of metadata is paramount for the success of initiatives like e-Europe (in particular for Government on-line: electronic access to public service that focuses on the extent to which digital information can transform old public sector organisation and provide faster, more responsive services). Standardisation of metadata, including metadata for Geographic Information (GI) resources, is therefore a priority.

46. At the time of writing, no international standard on metadata is available. The position of the Commission on metadata standards is that the document ISO/TC211 19115 Geographic Information - Metadata should be adopted as soon as it becomes available as an international standard, which is projected to be just after the summer 2001. It is recommended that in the mean time services of the Commission use both the current draft of ISO/TC211 19115 Geographic Information - Metadata, and the suggestions of the Dublin Core (DC) metadata initiative.

47. If an organisation has not yet started documenting its GI resources, then it is recommended that it set up a database with at least the Core IS 19115 elements, also mapped to the DC. Various institutions already started to implement alternative metadata standards like CEN TC 287. It is recommended that these institutions adopt, in the medium-long term, a migration plan that allows the conversion of existing standards to IS 19115.

VII. A MINIMUM SET OF REFERENCE DATA

48. The standards discussed until now concern the geodetic framework and the methods used to document the data. In addition, we have to solve the problem of harmonisation of core data, the semantic of which is influenced by the different cultures of the EU countries. This difference is becoming visible when we try to aggregate national data to develop a European dataset. The Commission has already made efforts to guarantee at least the availability of “standardised” reference data.

49. Many people have tried to define the term reference data. Whilst it has been difficult to obtain consensus over this definition, people have been clear on what they want from it, i.e. an up-to-date set of information that consistently references different geographical features on which they can establish their applications. This argument is a key aspect for the definition of ESDI. It has been strongly debated first during the preparation of GI2000 and then in the context of the ETEMII[21] project. It is now one of the central themes of EESDI.

50. There is an emerging consensus to give priority to the reference data equivalent to the 1:10,000 scale. This priority emerges from the initiatives that are underway in the vast majority of European countries for the realisation of data bases 1:5,000 to 1:10,000 covering the whole national territory. The

21 ETEMII – European Territorial Management Information Infrastructure (IST Project) (http://www.ec-gis.org/etemii).

derivation (and the updating) of the 1:25,000-100,000 databases (closer to most of the Commission’s uses) from the 1:10,000 databases corresponding to the same data models has been indicated as one possible way forward.

51. This idea comes from the difficulty to derive common European 1:25,000, 1:50,000 and 1:100,000 databases from the existing national 1:25/50,000 databases – they are too heterogeneous – is widely shared; the alternative is to wait for the development on a global scale of the military databases (it is not possible to foresee their updating for non-military purposes). As for the “vision”, it must be stressed that the debate often insisted on the distinction between initiatives of European interest and initiatives of support for the activities of the Commission.

52. The topographic database 1:10,000, corresponding to the reference data to the same data model and interoperability, is recognised as a priority – at the European level – for the development of a significant part of the applications of public and private interest. It is therefore a strategic choice at the continental level. The possibility to derive and to update the 1:25/50000 and 1:100,000 informative layers from the 1:10,000 database meets an important need of the European public operators at the EC level. At the national and regional level, in the same way, this is an important objective (even if of limited significance), taking into account the affordable costs and times of implementation.

53. The debate is on-going without a consensus, and it is very hard to accommodate the different visions, policies and strategies. In some cases, the insistence – almost exclusive – on metadata as a tool to access the existing databases does not contradict the usefulness of investing in data creation for ESDI, but rather confirms the impossibility of implementing it within a reasonable lapse of time and with moderate costs.

VIII. CONCLUSIONS

54. Building or re-structuring European spatial data bases is a difficult exercise. In addition to the above-described technical aspects, the differences on data policy (pricing, copyright, intellectual property right) and in organisational issues (centralisation vs. decentralisation, public-private partnership) should also be considered.

55. The adoption of common standards, the availability of official tools to convert from national to European systems, and an increased awareness of data stakeholders to document their data are a necessary first step which should be relatively easy to implement. More complex aspects such as reference data standardisation or semantic harmonisation require further work to define common technical specifications (close to most of the specifications adopted at national level) and should be analysed in a case by case optic, as should methods of harmonising thematic nomenclatures (i.e. soil, forest, geology, land use).

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