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The European Reference System Coming of Age

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Abstract and figures

More than ten years ago, the advantages of the GPS technology were recognized and a first GPS campaign covering the western part of Europe was organized in order to establish a uniform European Reference Frame (EUREF). Through successive GPS campaigns, the network has been extended towards eastern parts of Europe and various countries have undertaken densification campaigns. The international co-operation within Europe has resulted in the establishment of a high accuracy, threedimensional geodetic network with links to global and national reference systems. Strategies and guidelines have been developed for network densification, observation procedures, data flow and data analysis. This has resulted in today's permanent GPS network comprising in excess of more than 80 stations, a data handling service and supported by 12 analysis centers. The results show an accurate and consistent network (+/-3mm in the horizontal component, +/-6mm in the height component). Since 1995, emphasis has been placed on the height component, resulting in an extended and improved adjustment of the United European Leveling Network (UELN) and the establishment of the European Vertical GPS Reference Network (EIJVN). Today, the EUREF Network contributes towards multi-disciplinary activities such as the estimation of meteorological parameters and links to tide gauges.

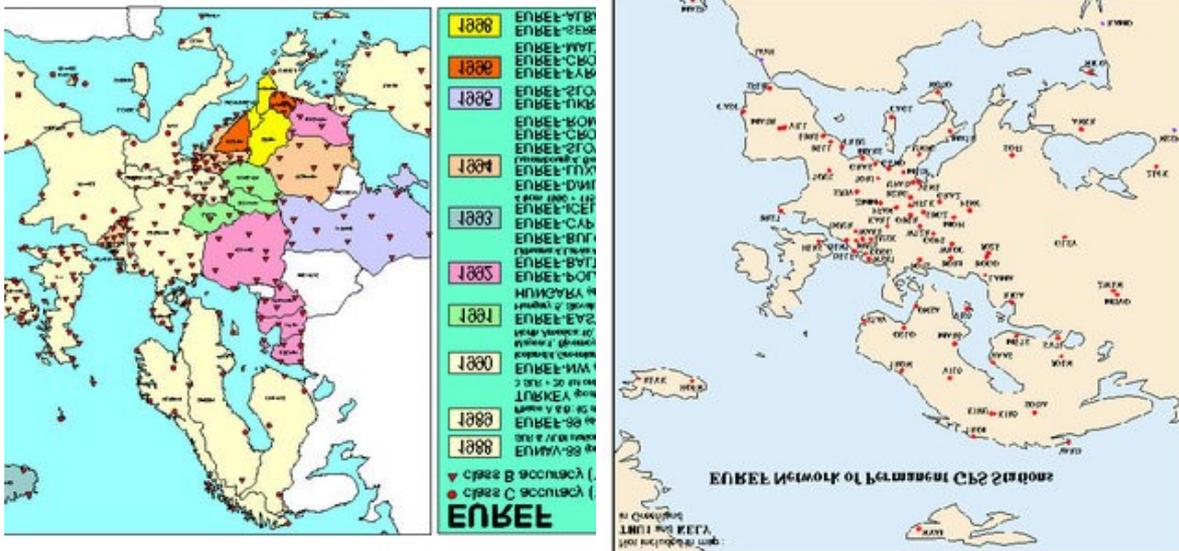


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The European Reference System Coming of Age

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Abstract. More than ten years ago, the advantages of the GPS technology were recognized and a first GPS campaign covering the western part of Europe was organized in order to establish a uniform European Reference Frame (EUREF). Through successive GPS campaigns, the network has been extended towards eastern parts of Europe and various countries have undertaken densification campaigns. The international co-operation within Europe has resulted in the establishment of a high accuracy, three dimensional geodetic network with links to global and national reference systems.

Strategies and guidelines have been developed for network densification, observation procedures, data flow and data analysis. This has resulted in today's permanent GPS network comprising in excess of more than 80 stations, a data handling service and supported by 12 analysis centers. The results show an accurate and consistent network (± 3 mm in the horizontal component, ± 6 mm in the height component).

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Keywords. EUREF, reference system, reference frame, GPS, permanent GPS networks, leveling network

1 General Remarks

At the end of the eighties, the requirement for the provision of geoinformation data on a uniform geodetic reference system grew tremendously due to the availability of GPS and its versatile application in many areas of surveying, navigation, transportation and logistics amongst others. Demand for uniform maps covering Europe, for example, from the car industry for navigation purposes or from EUROCONTROL for precise

positions at airports and navigation aids, the survey agencies in Europe were forced to establish a uniform reference frame. At that time, the uniform network over Europe was the European Datum ED50 resp. ED87, derived by the IAG Commission RETrig, as a result of the combination and readjustment of the national triangulation networks, which never fulfilled the new requirements. Also the World Geodetic System 1984 (WGS 84) with its realization via GPS of only a few meters did not fulfill the expectations.

Regarding the future needs of precise basic reference networks for both practical and scientific applications and for the investigation of geokinematic and geodynamic aspects the IAG at its General Assembly in August 1987 formed the new subcommittee EUREF, which should continue the work of RETrig, employing new space techniques for the implementation of a European Reference Frame. One month later the Comité Européen des Responsables de la Cartographie Officielle (CERCO), which was faced with similar problems - more from the view of digital maps and practical applications - established the CERCO Working group VIII (WG VIII), which should focus on the application of GPS in the national land survey agencies. (H. Seeger became the president of the CERCO WG VIII). In order to avoid the duplication of work a joint meeting of both groups was held to analyze the requirements and to set up the steps necessary to realize the European Reference Frame (EUREF). A steering committee was established. Members were Augath/Germany, Bordley/UK, Boucher/F, Engen/N, Gurtner/CH, Seeger/Germany and Sigl/Germany.

Some investigations (e.g. EUNAV) using GPS, which at that time was in the test phase with only seven satellites, were conducted to study its application for the realization of EUREF. A timeslot of only a few hours per day with more than 4 satellites was available. The receivers were still in a development phase (dual frequency, code- and phase measurements on a few channels only etc.). GPS observations were carried out in collocation with SLR (Satellite Laser Ranging) and VLBI stations, in order to compare and estimate the accuracy. The maximum deviation of only 3cm



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The European Reference

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