



Estimation of abridging Molodensky parameters to transform from old Italian reference systems to modern ones

Valerio Baiocchi (1), Keti Lelo (1), and Gábor Timár (2)

(1) Sapienza, Geodesy and Geomatics, I.T.S., Roma, Italy (valerio.baiocchi@uniroma1.it, +390644585515), (2) Dept. Of Geophysics and Space Science, Eötvös University of Budapest, Hungary (timar@ludens.elte.hu, +3613812192)

The history of geodetic systems used in Italy from the end of the 19th century to the beginning of the 20th century is complex and, in the past, this has led some researchers to misinterpretations. For this a bibliographic research on geodetic systems used in Italy in this period was executed and explained in the present work.

Towards the end of the 19th century, after the unification of the country, the "Ufficio Tecnico del Corpo di Stato Maggiore" (first nucleus of the future IGM) was entrusted to unify the geodetic reference systems of the Italian pre-union states to produce a unique Italian triangulation network (Datum) for the whole national territory. At the same time, the "Ufficio del Catasto" (National Cadastre Office), for its purposes, began the production of a cartography in projection Cassini-Soldner, representing only the thematic layer of its interest: the delimitations of properties. Although officially the triangulation network used in those years are the same both for cadastre and IGM (systems of Genoa, Monte Mario[old], Castanea delle Furie), in many cases temporary orientations were used on cadastral maps and on IGM maps. This ambiguity led frequently to misinterpretation and errors to geo-reference of present and historic Italian cartography.

To estimate the abridging Molodensky parameters for the coordinate transformation between the old Italian and the new worldwide systems (WGS84-ETRS89), the identical points' old and new coordinates are used, as well as the geoid undulation values to get the spatially correct results. To accomplish this task, using the ellipsoidal coordinates and the ellipsoid size and shape parameters, the three-dimensional Cartesian coordinates (position vectors) of the identical points are computed, both in the old and modern systems. The abridging Molodensky parameters resulted as a simple difference between these position vectors of a point. Using this method, the following parameters can be derived (accuracy cca. 3 meters):

Genova1902(Bessel) to WGS84: $dx=+519$ m; $dy=129$ m; $dz=530$ m.

MonteMario(Bessel) to WGS84: $dx=544$ m; $dy=135$ m; $dz=511$ m.

In Sicilia and the southern part of Italy, a third system was defined with the fundamental point at Castanea delle Furie, north of Messina, on top of a summit NNW of the village centre. Its WGS84 coordinates (according to IGM) are:

Latitude= $38^{\circ} 15' 85.405''$; Longitude= $15^{\circ} 31' 12.871''$ s (from Greenwich)

The old coordinates of the fundamental point:

1875 triangulation: Latitude= $38^{\circ} 15' 53.38''$ s

1910 triangulation: Latitude= $38^{\circ} 15' 53.637''$ s

The azimuths has been determined to Milazzo, longitudes are set to local zero. As the longitude value of this point is still unknown to other prime meridians (Rome, Greenwich), the usage of its modern longitude value results an error up to 20 meters in the following transformation (using the 1910 data):

Castanea1910(Bessel) to WGS84: $dx=524$ m; $dy=145$ m; $dz=534$ m.