

The Importance of Being Coordinated

The identification of a location by means of coordinates is not as simple as it may initially seem when using georeferenced geodata. For users who merge geodata stemming from different sources in a GIS environment, it is essential to be aware that coordinates can be expressed in different coordinate systems and that geographical coordinates (, , h) are always defined with respect to a particular ellipsoid. For example, the three geographical coordinates provided by Google Earth while navigating this virtual globe refer to WGS84. Accurate elevation data is required for proper water drainage and flood prevention measures, which are particularly relevant for people living in flat lowlands situated close to the sea. Dike constructors, dune maintainers and other water managers and engineers should be sure that water flows in the direction as computed from the elevations in their datasets, in other words from locations with higher elevation values to locations with lower elevation levels. In reality, the flow of water cannot be determined from indicated heights above an artificial mathematical body called an ellipsoid, because the ellipsoid only approximates the actual shape of the Earth and has no physical (i.e. gravitational) meaning, whereas the flow of water is determined by gravity. Consequently, to be useful in practice, elevation values should refer to the gravity field of the Earth, and more specifically to the Earth's geoid. Hence, heights or elevations may refer to an ellipsoid, in which case they are not suited for engineering purposes, but they may also be defined with respect to a geoid - that is to say a datum close to mean sea level. However, different countries use different height datums.

Large differences may exist between various ellipsoidal reference systems. For example, ED50, the reference system used in continental Western Europe excluding Sweden and Switzerland, can differ by as much as 100 metres west and south from WGS84. Similarly, differences of up to 100 metres from WGS84 can be found in the reference systems used by Great Britain and Ireland. The consequences can be devastating in practice. Suppose that digital maps used for radar control of airports would be based on the ED50 reference system while the aircraft would use WGS84 bearings during landing. It does not require much imagination to envisage that the resulting shifts could result in wrong manoeuvres and dangerous situations.