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Future of Space Geodetic Measurement Combination

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In the framework of the French Groupe de Recherche en Géodésie Spatiale (GRGS) activities, a new approach of combination is studied, which directly combines the space-geodetic observations of DORIS, GPS, SLR, and VLBI techniques using the same models and software for all the individual data processing. The purpose is to better use all the information provided by the different techniques by reducing the number of steps of the combination processing to the minimum. This new approach also permits the use of supplementary links between techniques.

In this work, we present possible evolutions of this combination, in terms of techniques to combine, method of combination and solutions to estimate. Indeed, in the future, we can imagine to realize, not only a combination of four space geodetic technique measurements but also a combination of these measurements with others as for example GRACE, CHAMP measurements, and even terrestrial technique measurements as terrestrial gravimetric one. Regarding the products of such a combination, we can imagine to obtain not only terrestrial reference frame and EOPs but also celestial reference frame, gravity field, zenithal tropospheric delays, etc. The idea is to obtain the most possible coherent products.

Such evolution will of course need upgrade methods in the combination. We can think to use for example stochastic algorithms, wavelet decompositions, etc.We can also consider the possibility to estimate satellite orbits, stations positions, EOPs, and other products during a same estimation process and not, as it is currently done, to estimate orbits first and, then, geodetic products as the reference frame. It is obvious that this work does not present all possible evolutions but possible realistic developments. To conclude, the idea of data assimilation for geodesy and geophysics is introduced.