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Multi-technique combination of space geodesy observations

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Over the last few years, combination at the observation level (COL) of the different space geodesy techniques has been thoroughly studied. Various studies have shown that this type of combination can take advantage of common parameters. Some of these parameters, such as Zenithal Tropospheric Delays (ZTD), are available on co-location sites, where more than one technique is present. Local ties (LT) are provided for these sites, and act as intra-technique links and allow resulting terrestrial reference frames (TRF) to be homogeneous. However the use of LT can be problematic on weekly calculations, where their geographical distribution can be poor, and there are often differences observed between available LTs and space geodesy results.

Similar co-locations can be found on multi-technique satellites, where more than one technique receiver is featured. A great advantage of these space ties (STs) is the densification of co-locations as the orbiting satellite acts as a moving station. The challenge of using space ties relies in the accurate knowledge or estimation of their values, as officially provided values are sometimes not reaching the required level of precision for the solution, due to receivers' or acting forces mismodelings and other factors. Thus, the necessity of an estimation and/or weighting strategy for the STs is introduced. To this day, on subsets of available data, using STs has shown promising results regarding the TRF determination through the stations' positions estimation, on the orbit determination of the GPS constellation and on the GPS antenna Phase Center Offsets and Variations (PCO and PCV) .

In this study, results from a multi-technique combination including the Jason-2 satellite and its effect on the GNSS orbit determination during the CONT2011 period are presented, as well as some preliminary results on station positions' determination. Comparing resulting orbits with official solutions provides an assessment of the effect on the orbit calculation by introducing orbiting stations' observations.
Moreover, simulated solutions will be presented, showing the effect of adding multi-technique observations on the estimation of STs parameters errors, such as Laser Retroreflector Offsets (LROs) or GNSS antennae Phase Center Offsets (PCOs).