Optical Tracking Extended Network in Support to Operational Flight Dynamics and Conjunction Analysis for Meteosat

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Within the Meteosat Second Generation (MSG) programme, the Flight Dynamics team at EUMETSAT operationally performs routine orbit determination, using S-band range measurements from proprietary ground stations, for the 4 geostationary satellites in this fleet.
Occasionally, directional measurements are also received from a number of optical tracking sensors on ground; they can be processed by the FDS in parallel, together with the available ranging data, within the same least-squares batch estimation process. This allows obtaining particularly robust solutions, where the system becomes sufficiently overestimated to solve additional relevant auxiliary parameters and perform an accurate fine tuning of the different measurement biases. Independent optical data can be also used to improve conjunction analysis with poorly tracked secondary objects.

In the past years, EUMETSAT performed different trials with different service providers, operating 1 or 2 telescopes only.
During last year, the focus was on testing solutions, making use of multiple telescopes, to cope with weather diversity and very short-notice tracking requests.
This paper summarises some examples of the beneficial effect obtained when using merged sets of ranging and angular measurements, available for the four MSG satellites in orbit.

High quality optical directional observations have been repeatedly received from the International Scientific Observing Network (ISON) and used intensively in orbit determination performance assessments.

To assess possible advantages over single source of optical measurement, various analyses have been performed of data sets, involving multiple optical measurement sources, providing data in parallel.
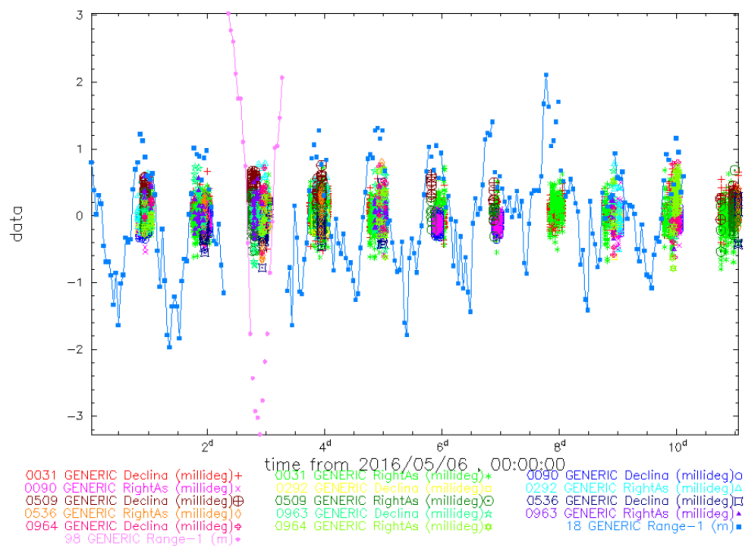An example of data fusion orbit determination is shown aside

Fig. 1. Orbit Determination residuals, data fusion, 10 days arc: ranging from 2 ground stations, angles from 7 optical sensors.

This paper will also report a case of on-demand optical tracking, performed in support of conjunction analysis. Enhanced obit knowledge of an initially poorly tracked secondary object was obtained for a close encounter on 01 November 2016, between METEOSAT 11 (2015-034A) and INTELSAT 3-F7 (1970-032A). The improved results allowed then deciding not to perform an avoidance manoeuvre, which would have otherwise disrupted normal routine operations. The decision was taken based on cross-comparison of the available JSpOC CDM with 3 different and independent conjunction analyses, based on 3 different optical sensor networks.