TIME TRANSFER BY LASER LINK (T2L2), FIRST RESULTS

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Abstract

The Time Transfer by Laser Link (T2L2) instrument has been developped jointly by the Observatoire de la Côte d'Azur and CNES. It has been accepted to fly onboard Jason-2 in July 2005. The goals of time transfer experiences between ground laser stations and board are together technolological and scientific. Concerning the technological aspects it is about transfering time by an optical link with a precision of 10 picosecond, for the first time. The scientific objectives concern fundamental physics and space geodesy. Because T2L2 is using the same utltra stable oscillator (USO) than the DORIS instrument, the time transfer from a ground laser station during the overflight of Jason-2 (around 1000 seconds) will provide a unique opportunity to precisely monitor the oscillator at least at 10^{-12} relative level ($\Delta f/f$) ; as a consequence the Doppler DORIS orbitography could be improved locally by a factor 5 to 10.

The T2L2 typical data set consist in 3 primary dates : (1) the ground transmit time of a laser pulse emitted from a ground laser station with a resolution of 1-2 picosecond (if available at the station), (2) the spacecraft receive time (thanks both to T2L2 and DORIS USO) with the same resolution, and (3) the ground receive time or the 2-way time-of-flight of the laser pulse which is reflected by the Laser Reflector Array (LRA) onboard Jason-2. The (1) and (3) data are provided by Satellite Laser Ranging (SLR) stations (as full rate data), while the data (2) come from the satellite itself (T2L2 to Jason-2 and then to the Mission Instrument Center located at CNES in Toulouse). The OCA is responsible of the scientific data treatment.

We present the principle of the correlation between ground SLR and onboard T2L2 data, in order to identify each complete set of 3 primary dates. Then, we show the first results in term of time transfer between ground stations and board at the level of 1 nanosecond and less. Finally we describe the necessary corrections and calibration to be implemented in the treatment that will improve the firts results from 1 nanosecond to a few picoseconds.