Processing DORIS data in a multi-satellite mode: Time scale issues

P. Willis (Pascal.R.Willis@jpl.nasa.gov) (1)(2), W. Bertiger (William.I.Bertiger@jpl.nasa.gov) (2),
Y. Bar-Sever (Yoaz.E.Bar-Sever@jpl.nasa.gov), B. Haines (Bruce.J.Haines@jpl.nasa.gov) (2),
R. Muellerschoen Ronald.J.Muellerschoen@jpl.nasa.gov) (2),
D. Kuang (Da.Kuang@jpl.nasa.gov) (2)

(1) Institut Geographique National, Direction Technique, 2, Avenue Pasteur, BP 68, 94160 Saint-Mande, France, FAX: 33-(0)1-4398-8171
(2) Jet Propulsion Laboratory, MS 238-600, 4800 Oak Grove Drive, Pasadena, CA 91109, USA, FAX: 1-818-393-4965

On December 7 2001, in the scope of a continued US-French long-term scientific cooperation, the new Jason-1 satellite was launched as a follow-on to the successful TOPEX/POSEIDON (T/P) mission. The goal of this paper is to describe DORIS-processing activities conducted at JPL and IGN within the framework of the Jason-1 Precise Orbit Determination (POD) effort.

To enable better cross-calibration of the sensors, the T/P and Jason-1 satellites are flying closely together in their preliminary tandem phase. This formation-flying configuration enables new DORIS data analysis strategies that have been developed at JPL using the Gipsy-Oasis II (GOA) software. By processing T/P and Jason-1 data simultaneously in the same adjustment run, one can now make full profit of this new tandem mode situation, which is a precursor to other future satellites flying in formation.

In a first step, we will present the modeling that has been developed in the GOA software as well as the mathematics behind our improved filtering strategy. The first preliminary DORIS data sets provided by CNES showed inconsistencies in the satellite time scales that do not influence single-satellite analyses, but have important implications on multi-satellite processing. In order to address this, a new preprocessing strategy was adopted by CNES to better support multi-satellite techniques. We will describe the mathematical equations that relate the DORIS measurement to the different time scales involved and show simple condition equations that need to be fulfilled for DORIS estimated biases when recovered on a pass-by-pass basis. We will also provide justification for the overall method and the reasons why it will be increasingly important to use similar multiple-satellite approaches. In view of the new dual-channel capability of the new on-board DORIS systems, such a strategy should prove more valuable as other satellites are launched and become available simultaneously. The corresponding increase in the daily number of available DORIS data should enable better recovery (and de-correlation) of various estimated parameters (e.g., station and satellites positions, clocks, troposphere delays).

In a second step, preliminary results will be presented for POD, and for recovery of ground station coordinates as well as Earth orientation parameters. In order to test the actual scientific interest of this method, these results will be compared with regular results using a more classical approach of single satellite processing. In particular, orbit comparisons will be presented using standard internal testing method (orbit overlaps) as well as external methods (using Laser data as control point).