# ANALYSIS OF THE MEGHA-TROPIQUES TRAJECTORY. DETERMINATION OF « RENDEZ-VOUS » CONDITIONS WITH THE TERRA SATELLITE.

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The Megha-Tropiques mission was studied in France in the context of GEWEX, Global Energy and Water cycle Experiment. The first originality of Megha-Tropiques is to associate three radiometric instruments allowing to observe simultaneously three interrelated components (among them the MADRAS microwave radiometer) of the atmospheric engine: water vapour, condensed water and radiative fluxes. The second is to privilege the sampling of the intertropical zone, accounting for the large time-space variability of the tropical phenomena.

The key of this mission is the repetitivity of the measurement in the Tropics. One has to combine the choice of the inclination of the orbit, the scanning capability of the instruments and the height of the orbit. The limitation of the swath is determined mainly by the microwave imager, which has a conical swath. The trajectory was designed such as to obtain a repetitivity of more than 3.5 visibilities per day of each point of the zone situated between 22°S and 22°N for an orbit inclination of 20° at 866-km height. The r epetitivity reaches more than 5 per day around 13°N and 13°S. As a consequence, Meg ha-Tropiques is a LEO satellite, with a circular orbit, a recurrent cycle of 7 days. Two additional originalities can be mentioned: the precession cycle is short (51 days) ; and, resulting from the 20-degree inclination, for a given area, the overpass of the spacecraft is done at variable local time: all times of the day are possible and a given local time occurs every 51 days.

The first objective of this paper consist in analyzing the TLE time series of the Megha-Tropiques spacecraft, to check the compliance with the mission specifications. In particular, it is worth understanding that the time series for the perigee does not behave as a merely linear variation due to classical effects of zonal parameters of the Earth gravity field and third bodies effects. A model will be proposed to model the time variation of the perigee, accounting as well for odd parameters, in a form suitable to describe equatorial orbits. When determined analytically, even over short time scales, the orbit using a wrong value of the secular effect for the perigee can lead to systematic errors, that have to be avoided when using an analytical for practical purposes.

This model was implemented into the IXION s/w. NASA makes it possible to compare the MADRAS date with the one provided by the TERRA mission. Terra carries five instruments that observe Earth’s atosphere, ocean, land, snow and

ice, and energy budget. The IXION s/w was used to determine the conditions in space in time for which the observations between MADRAS and TERRA can be overlapped.

The second objective of the paper consists in comparing these overlapping conditions, on the basis of (i) the analytical model based on the extrapolation of the Terra and Megha-Tropiques TLE (following a SPG4-like method), to schedule the common views, and (ii) on precise orbits provided afterwards. The differences are then analyzed and understood from a qualitative approach, in particular those appearing to be geographically correlated.