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TRISHNA : a new high spatio-temporal resolution Indian-French mission in the thermal infrared

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The climate change context, along with the increasing scarcity and deteriorating quality of the water resource leads to monitor different components of the water cycle. A particular attention is paid to agricultural lands which represent about 70% of the water consumption at global scale. Thermal infrared (TIR) data from space are well adapted to these purposes, but the spatial variability of the surface requires that the complexity of both physical and biological processes involved must be assessed at a small scale at which decisions concerning water management or implementation of policies devoted to the water use and to the mitigation of climate change effect are effective. In addition, surface fluxes show short-time scale variability, which requires frequent observations. Spatial systems combining both high spatial resolution and revisit capacities, which do not exist today, are therefore needed in the TIR. After several previous advanced studies, the French CNES and Indian Space Research Organization (ISRO) are in the process of defining a new satellite mission combining a high spatial resolution (50m) and high revisit capacities (about 3 days) in the TIR with global coverage. The monitoring of energy and water budgets of the continental biosphere and the monitoring of coastal and continental waters are the two main scientific objectives driving the mission. Four complementary objectives are added : urbanization, solid earth/geology, cryosphere and atmosphere.
We present the mission specifications and their consolidation based on recent research activities. In particular original results dealing with the impact of atmospheric turbulence on surface temperature measurements and of the directional anisotropy on TIR signal are presented, and we illustrate how they all together drive the trade-offs made to define the required instrumental accuracy and sensitivity, the spatial resolution and the revisit, and the orbit height, among others. For instance the choice of a 761 km orbit has been made to provide accessibility at any location 3 times per 8 day-periods in different viewing geometry, and to reduce the number of data contaminated by hot spot angular effects within the inter-tropical zone. The overpass time is set in the beginning of afternoon at 13:00 LST best suited for stress detection. The mission will embark simultaneously a TIR and a VNIR-SWIR instrument which spectral bands are discussed. Recent improvements brought to surface energy balance and evapotranspiration modelling are briefly examined. We shall also highlight temporal extrapolation and integration methodologies developed to build continuous time series of water consumption from cloudfree TRISHNA data at daily (or longer) time scales needed for practical applications in the fields of agriculture and hydrology. After a brief overview of the instrumental concepts considered, the milestones of the mission development will finally be presented with a launch planned at the 2024 horizon.