The TRISHNA mission (Thermal infraRed Imaging Satellite for High-resolution Natural Resource Assessment)

Philippe Gamet[1,2], Bimal K. Bhattacharya[3], Mehul R. Pandya[3], Jean-Louis Roujean[2], Mark Irvine[4], Gilles Boulet[5], Albert Olioso[6], Kanishka Mallick[2], Emmanuelle Autret[7], Laure Roupioz[8], Ghislain Picard[9], Kathrin Nägeli[10], Corinne Salcedo[1], Chinmay K. Rajhans[11], Sébastien Marcq[1], Emilie Delogu[1], Emmanuelle Sarrazin[1,2], Clément Luitot[1,2], Marie Weiss[12], Philippe Maisongrande[1]

[1]CNES, Toulouse, France, [2]CESBIO (Univ Toulouse, CNES, CNRS, INRAE, IRD), Toulouse, France, [3]SAC, ISRO, Ahmedabad, India, [4]ISPA (INRAE), Bordeaux, France, [5]Indo-French Cell for Water Science, Indian Institute of Science, Bangalore, India, [6]URFM (INRAE), Avignon, France, [7]LOPS (*Ifremer, Univ. Brest, CNRS, IRD)*, Brest, France, [8]DOTA (ONERA), Toulouse, France, [9]IGE (CNRS, IRD, Université Grenoble Alpes, INRAE, Grenoble-INP), Grenoble, France, [10]UZH, Zurich, Switzerland, [11]URSC/ISRO, Bengalore, India, [12]EMMAH (INRAE), Avignon, France

The TRISHNA mission (Thermal infraRed Imaging Satellite for High-resolution Natural Resource Assessment) is a future joint mission of CNES (French Space Agency) and ISRO (Indian Space Agency) dedicated to thermal infrared (TIR) measurements for monitoring ecosystem health.

TRISHNA will provide global coverage of continental surfaces (including inland waters) and coastal waters up to 100 km from the shore, at a spatial resolution of 60 m. The satellite will orbit at an altitude of 761 km with an 8-day cycle. Its wide swath (±34°, corresponding to more than 1000 km) will enable acquisitions around mid-day and mid-night every 2–3 days.

The mission will deliver new insights in several domains: ecosystem stress and water use, coastal and inland waters, urban heat islands, solid Earth, and the cryosphere. To encourage the development of scientific, public-service, and commercial applications, the global user community will have free, full, and open access to TRISHNA data and service information.

Distributed products will include:
(i) Level-1C: top-of-atmosphere reflectances and brightness temperatures, orthorectified and resampled on a uniform spatial grid (Sentinel-2 tiles, Copernicus DEM);
(ii) Level-2A: surface reflectance, land surface temperature (LST), sea surface temperature (SST), land surface emissivity (LSE), cloud mask, and atmospheric variables such as aerosol optical depth and total water vapour content;
(iii) Level-2B: vegetation variables (fraction of absorbed PAR – fAPAR, Green Area Index – GAI, Fraction of Vegetation Cover – FCV), albedo, evaporative fraction, and daily evapotranspiration;
(iv) Level-3: continuous time series of daily evapotranspiration.

The satellite carries two instruments with 11 spectral bands: five in the VNIR domain (blue, green, red, NIR at 865 nm, and a water vapour band at 910 nm), two SWIR bands for high-altitude cloud detection and snow/cloud discrimination, and four TIR bands enabling accurate temperature–emissivity separation. The TIR instrument targets high radiometric performance, with noise below 0.2 K and absolute calibration accuracy better than 0.5 K, leading to an overall uncertainty of 1–1.5 K for land surface temperature over vegetation.

TRISHNA is scheduled for launch in 2027 with an expected operational lifetime of 5–7 years. Strong synergy is being developed with the thermal missions Land Surface Temperature Mission (ESA) and Surface Biology and Geology mission (NASA), particularly in system and ground-segment design, to improve data comparability and interoperability. Harmonization efforts focus on mission design, product definition, and joint calibration/validation activities, including common sites and protocols.

The TRISHNA science team brings together members of the French and Indian scientific communities, with representatives from the LSTM and SBG teams, to foster international scientific cooperation.