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Overview of the high spatial and temporal resolutions MISTIGRI mission in the Thermal Infrared

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(a)

 High spatial resolution (~ 50m) • High revisit capacities (1 day)

• Definition and consolidation of mission specifications during a A phase (sept 2009 - end 2011)



SCIENTIFIC OBJECTIVES



• Agriculture/forestry/natural vegetation productivity/ irrigation

- Biogeochimical cycles / carbon budgets / soil pollution
- Hydrology/ water management Actual evapotranspiration map (c) derived from surface temperature (b) over Barrax area (southern Spain, a)

Urban environment monitoring

• Urban climatology and heat waves / pollutants diffusion and air quality / anthropogenic fluxes



Monitoring of coastal and continental waters

• Monitoring of the coastal areas • Submesoscale activity in coastal and open ocean

• Monitoring of lakes and rivers / floods • Air-sea fluxes, GHG, biogeochemical cycles

• Lagunaes / estuaries / deltas

• Biological activity and productivity / discharges / water quality



REMOTE SENSING CONTEXT

	Landsat TM/ETM+	16 days	60 - 120 m
	LDCM	16 days	100 m
Need of a mission	ASTER	16 days	90 m
combining high resolution			
and high revisit in the TIR			
	Meteosat MSG, GOE	15mn S	2.5 – 5 km
	AVHRR	2-4/day	1 km
	MODIS	1/dav	1 km

• Urban heat island (UHI) / welfare, health of inhabitants

• Urban hydrology

Difference between daytime and nightime LST over the Madrid city (DESIREX, 2008) retrieved from Airborne Hypersepctral Scanner (AHS) data (Sobrino et al., 2009)



System (a) with zooms at 6 km (b) and 0.75 km (c) resolutions (Capet et al., 2008)

Other applications

Vulcanology

• Risk assessment, coalmine and peat fires, epidemic outbreaks...

•... cf. ESA Fuegosat Synthesis Study, 2010

Ref : Lagouarde et al., IJRS, 2012, in press

Spatial variability of Ts over a dry maize field from 2 images

of a 20mn sequence at 10 Hz

(the area approx. indicates a

100 m pixel)

STRATEGY of the MISSION

FLUXNET, urban and LTER networks

Mission based on a network of experimental sites worldwide (similarity with Venus strategy)



SPATIAL RESOLUTION (~ 50 m)







ORBIT and ACCESSIBILITY





561 km, 1 day

720 km, 2 days

REVISIT and OVERPASS TIME

Revisit imposed by both the temporal variability of observed processes (fluxes, drying events) and the cloudiness (data availability)



Analysis of hourly solar irradiance data from INRA AGROCLIM network 1993-2009, over 2 locations in France and for 3 revisit assumptions

Revisit also imposed by the performances and accuracy expected from models (and by frequency and duration of stress periods)



Analysis of the impact of the revisit on the accuracy of daily AET retrievals (based on a simulated dataset 1950 – 2100, A1B IPCC scenario, with a selection of cloudfree days)





Sensitivity of the efficiency of reconstruction of daily evapotranspiration (from simulation of AET time series) to time of acquisition (Delogu et al., 2012, Gentine, 2007)

Ref : Olioso et al., Lagouarde et al., Boulet et al., RAQRS III, 2012 Valencia; Delogu et al., HESSD 2012

DEVELOPMENT of AET ALGORITHMS



Mapping latent heat flux (LE) over Crau plain (S-E France) from LANDSAT-7 data

Ref : Olioso et al., 2012, TOSCA Conf., Paris



Analysis of MODIS cloud

Europe for summer (June

masks (2000-2009 over

1st - August 31st), for 2

revisit assumptions



MISSION ARCHITECTURE

Instrumental concept

• Satellite 1.5 slow down (pitch rotation of the platform)

TIR-3	10.3	
TIR-4	11.5	
TIR-1	8.6	
TIR-2	9.1	

array (25µm pitch) NedT 0.5K (0.2K aimed at) • Absolute accuracy = 1K

A simulator has been built to specify channels and to evaluate accuracy of Ts derived from TES algorithm. Merging TIR1 and TIR2 for reducing noise currently investigated.

VNIR instrument: **Central wavelength** •1D CCD array Band (µm) • 4 bands 0.450 Blue Use: - TIR registration 0.670 Red - cloud detection **Near-InfraRed** 0.865 - vegetation indices - surface emissivity first guess for TES Near-InfraRed 0.910 - disaggregation of TIR

Ref : Lesaignoux et al., 2012, RSE submitted; Briottet, 2012, TOSCA Conf., Paris

MISTIGRI satellite view (a: front, b: back) showing the VNIR-TIR instrument installed on the MYRIADE platform (in yellow)

• On-ground TDI-like binning (30 lines) • On-board blackbodies for TIR calibration (283 and 313K) Platform

• Compatibility of the **MYRIADE** CNES platform with the mission • Myriade data storage 16 Gbits

Feasibility study

• Evaluation of performances of microbolometers and of the TIR instrument currently being performed at CNES

First instrumental design proposed by TAS

Ground segment Already largely existing

• Venus developments

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