The Indian-French TRISHNA mission

Monitoring our ecosystem health from space

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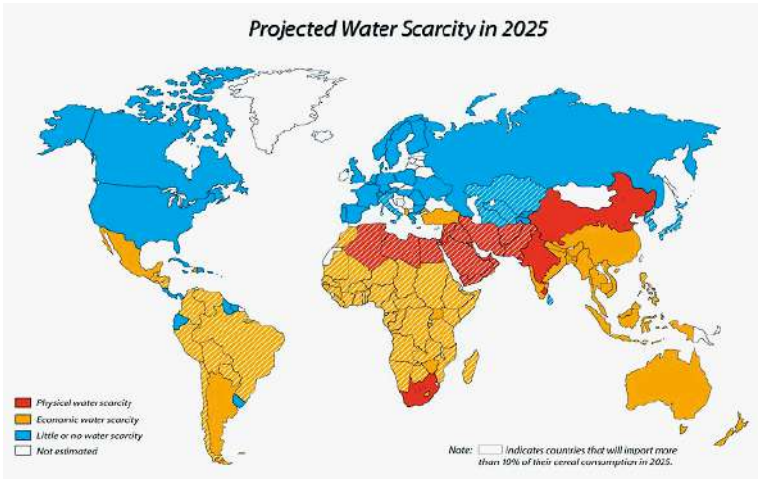
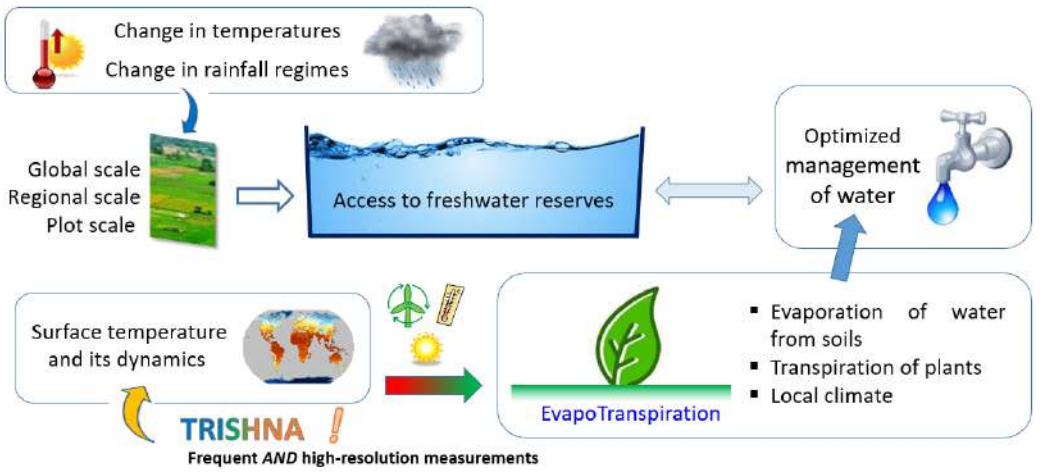
Why TRISHNA ?





Mission Datasheet

Band name	Wavelength Center (µm)	FWHM (nm)
Blue	0.485	70
Green	0.555	70
Red	0.670	60
NIR	0.860	40
WV	0.910	20
Cirrus	1.380	30
SWIR	1.610	100
TIR 1	8.65	350
TIR 2	9.0	350
TIR 3	10.6	700
TIR 4	11.6	1000

Spectral bands

- ISRO/CNES cooperation, launch 2025, 5-year lifetime
- Scientific & operational applications
- Focus on **ecosystem stress and water use** + **coastal & inland waters**
- Global coverage
- 4 TIR bands + 5 VNIR bands + 2 SWIR bands
- Revisit : 3 acquisitions at equator per 8 days period
  761km-8day orbit reducing hot spot constraints in intertropical zone
- ± 34° scan angle, 1030km swath
- Nadir spatial resolution (VIS-NIR-SWIR-TIR):
  57 m for continental and coastal areas, binned at 1 km over open ocean
- Overpass time : 1 PM (LTDN)
- NeDT 0.2K
- Indo-French(*) Joint Science Team, synergies with ECOSTRESS, SBG, LSTM science & application teams
  (*) with other contributors
- Free and open data policy for worldwide scientific community
- Level2 products: masks, LST, SST, LSE, TWVC, reflectance, albedo, vegetation indexes, evapotranspiration, water stress index

Save the date !!

TRISHNA Scientific Workshop

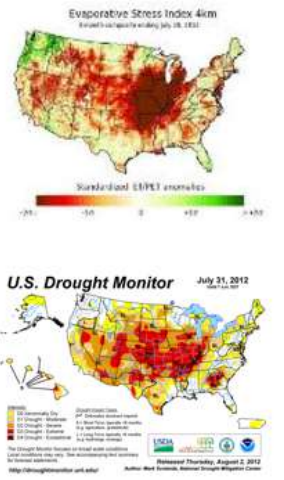
Toulouse, France, 22-24 March 2022

https://labo.obs-mip.fr/multitemp/trishna-workshop-toulouse-2022

Also visit: trishna.cnes.fr

Ecosystem Stress and water use

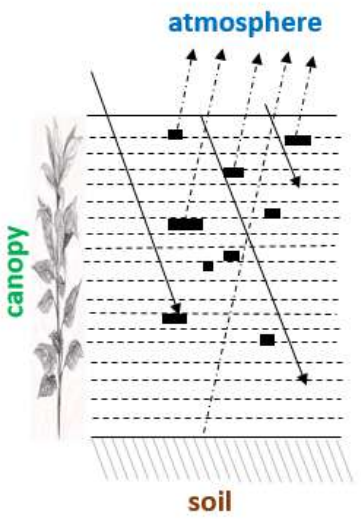
Area	What is at stake	What TRISHNA brings
Irrigated Agriculture	▪ Optimize irrigation ▪ Manage consumption of water ▪ arbitrate water savings ▪ additional irrigation ▪ follow the droughts and their impact on yield ▪ Better diagnosis of vulnerable areas (fire, drought, frost impact)	ETR STRESS TEMPERATURE
Rain-fed Agriculture		
Ecosystems		



Biogeophysical and biogeochemical processes

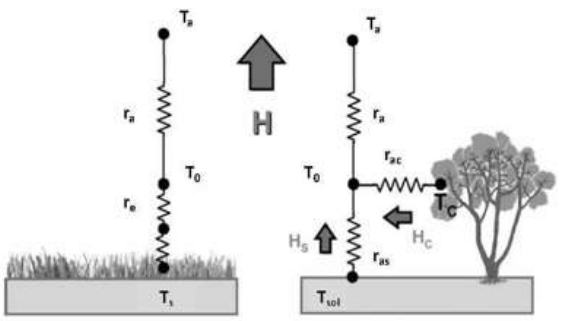
Multi-layer transfer Models

(MuSICA, SCOPE)
Ogée et al., 2003
Van der Tol et al., 2009



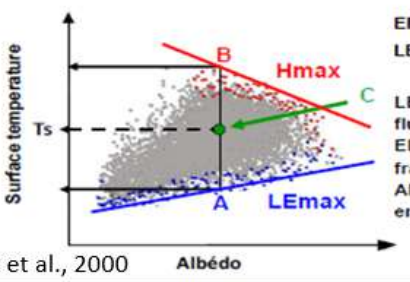
Single- and two-source resistance schemes

(Kustas et al., 2009)
Ras : soil-air aerodynamic resistance
Rac : vegetation-air aerodynamic resistance
Tsol : ground temperature
TC : canopy temperature
Hs : Sensible heat flux from the ground
Hc : Sensible heat flux from the canopy



Contextual methods

S-SEBI calculates an evaporative fraction at any point C from temperature limits for each albedo class A and B

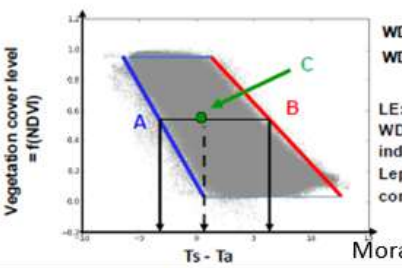


EF = CB / AB
LE = EF*AE

LE: latent heat flux
EF: evaporative fraction
AE: available energy

Roerink et al., 2000

Water Deficit Index model estimates a stress factor for a given point C according to temp. limits A and B (identified by range of vgt coverage deduced from solar domain data)



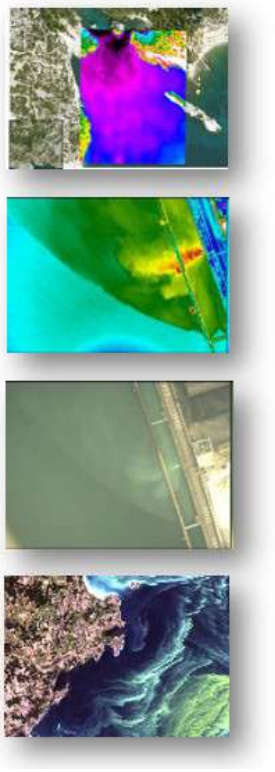
WDI = AC / AB
WDI = 1 – LE / LEp

LE: latent heat flux
WDI: water deficit index
Lep: LE in potential conditions

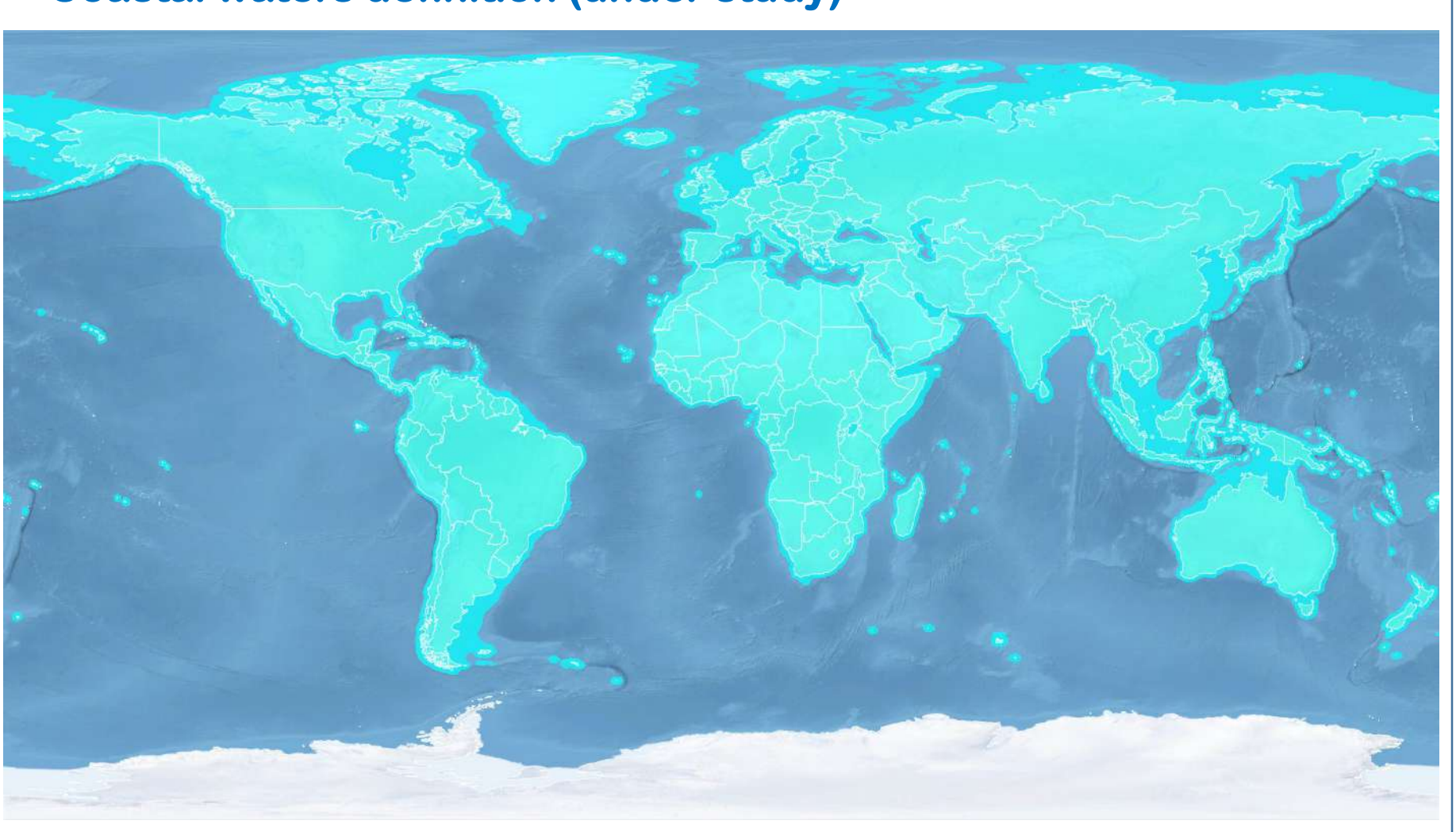
Moran et al., 1994

Coastal and inland waters

Area	What is at stake	What TRISHNA brings
Coastal Waters Inland waters Sea Ice	▪ Mixing processes • Water Quality, algal bloom, halieutic resource, spring discharge (resurgence), discharge of water, pollutants • Ecosystem Productivity (phytoplankton) • Halieutic resource • Melting and frost Processes	TEMPERATURE REFLECTANCES COLOR INDICES



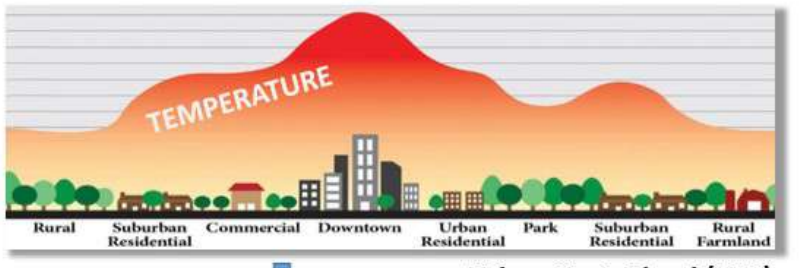
Coastal waters definition (under study)



Definition of TRISHNA full resolution acquisitions

Criteria: distance to the coastline, bathymetry → users needs shall be collected !!

Urban Microclimate monitoring



Urban Heat Island (UHI)

Air Temperature
Rugosity, Wind
Radiative trapping
Impermeability of the soils

Themes:
Hydrology, building heat model, urban climatology

What TRISHNA brings:

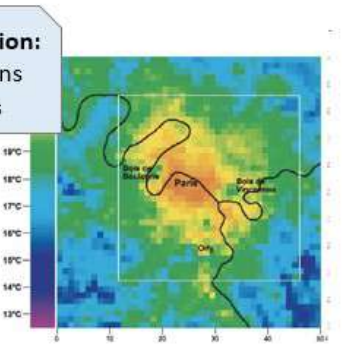
- High revisit, global coverage
- LST, LSE
- Type of soil
- Rugosity

Exogenous data
+ Remote Sensing data
+ urban microclimatology model

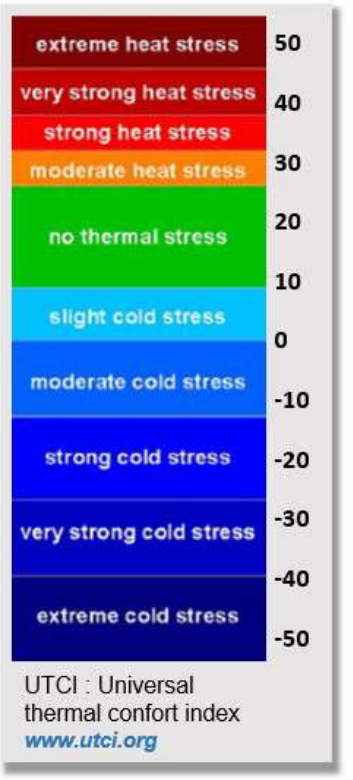
Air Temperature

Connection with population health, comfort and safety

Urban population:
2008: 3.3 Billions
2050: 5 Billions

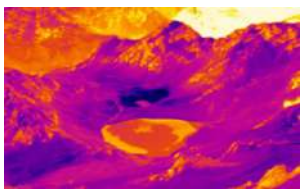


AVHRR Aug. 9, 2003 UHI over Paris (Do usset, 2007)



UTCI : Universal thermal confort index
www.utci.org

Cryosphere: scientific questions



How can combined thermal and optical data improve prediction of the **energy budget** and melt of snow and ice covered surfaces?

How can high resolution and improved revisit time help to capture the **small-scale variability** of surface temperature in mountainous areas?

Can **debris-covered glaciers** be better mapped and characterized with improved surface temperature data?

How can we better assess **lake ice cover** formation, evolution and decay?

How can we better assess **water dynamics under lake ice** and ensure safety when travelling on ice (especially in the case of giant ice rings)?

Solid Earth: scientific questions

How can **thermal anomalies** be used to anticipate volcanic eruptions?

How can multispectral TIR data help understand **volcanic ash transport**?

How can a better ash vertical density assessment help mitigate the risks of **ash fallout**?

How can a better ash vertical density assessment help **air traffic safety**?

How can estimating SO_2 depletion rates help assess **sulfuric acid** environmental impact?

How is the **energy** of solar and atmospheric radiations deposited, absorbed and dispatched through the ground or back to the atmosphere by conduction, convection or evaporation?

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TRISHNA

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