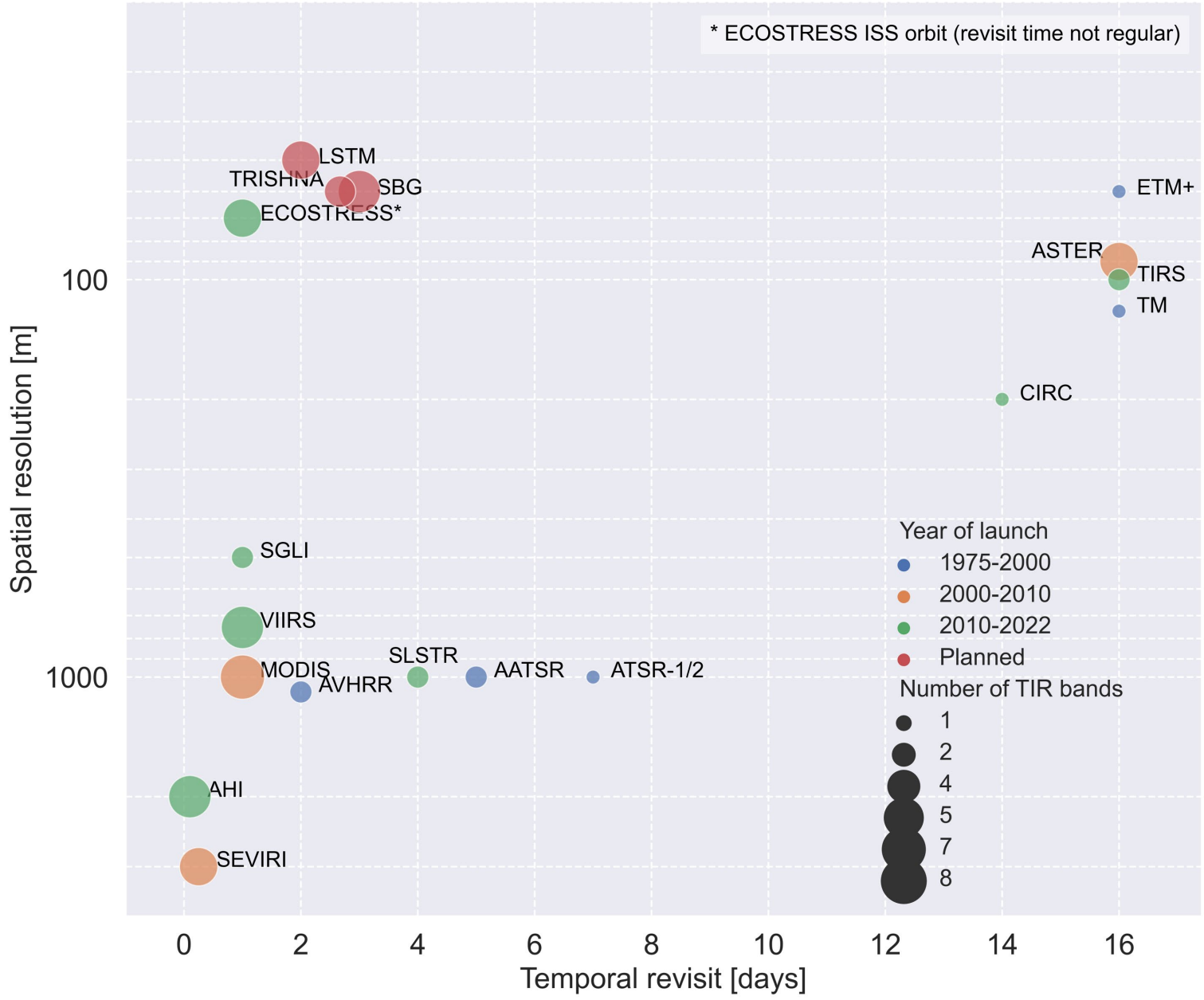
Available sensors and data: Agencies

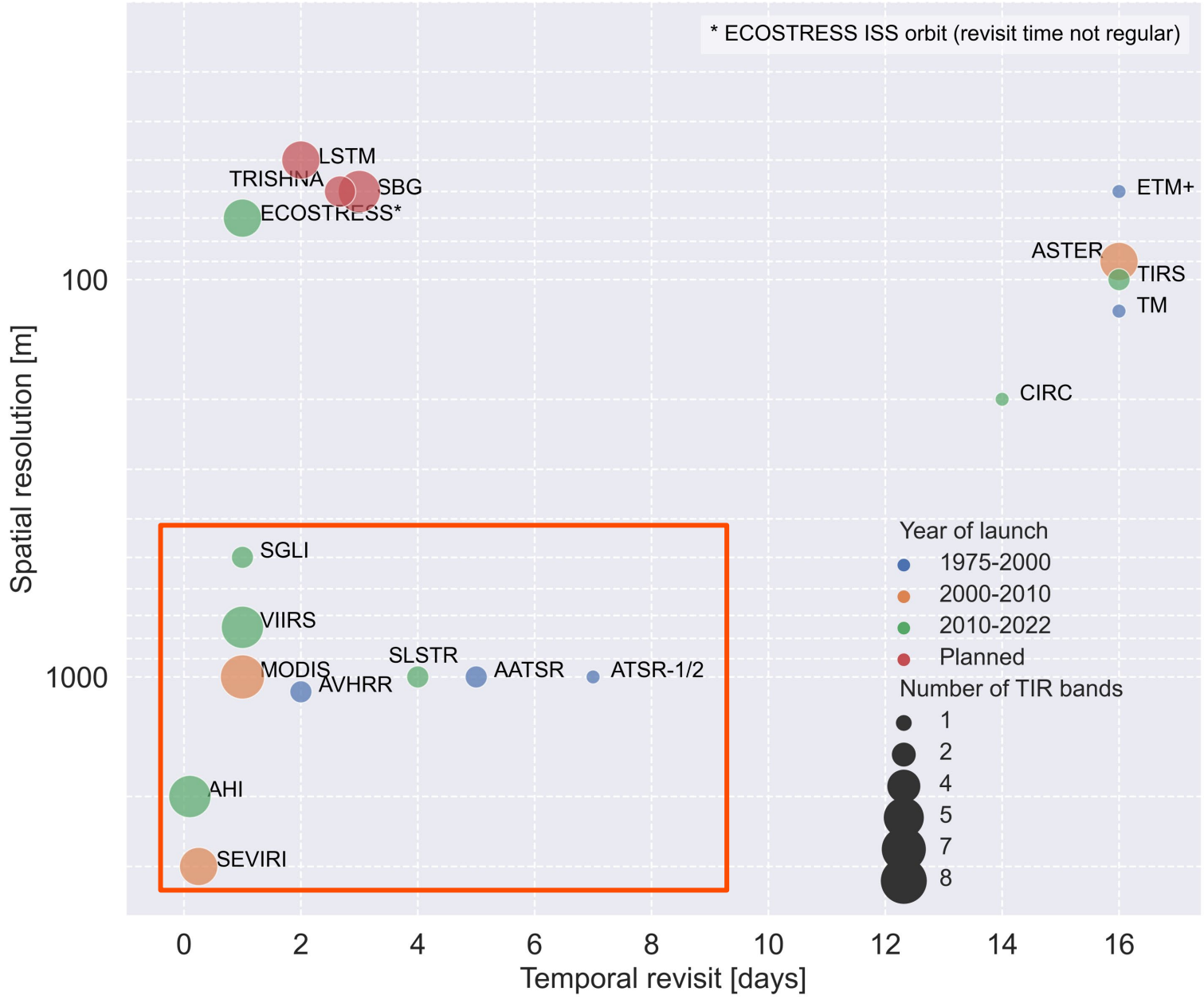


Source:

Available sensors and data: Agencies

Low spatial resolution, high revisit

- Meteo/weather applications
- Ocean applications
- Climate modelling



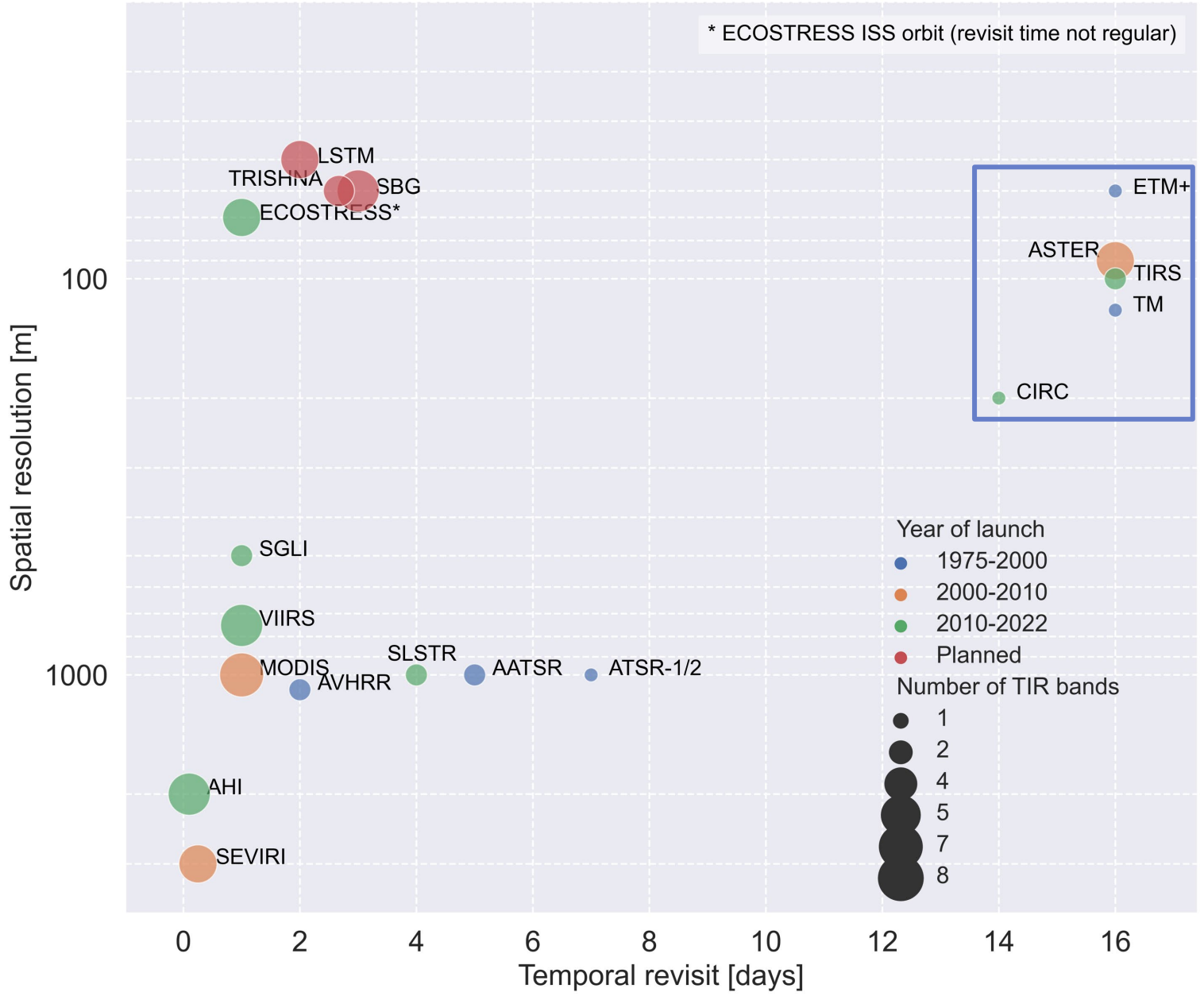
Available sensors and data: Agencies

Low spatial resolution, high revisit

- Meteo/weather applications
- Ocean applications
- Climate modelling

High spatial resolution, low revisit

- LST applications (1-2 bands)



Available sensors and data: Agencies

Low spatial resolution, high revisit

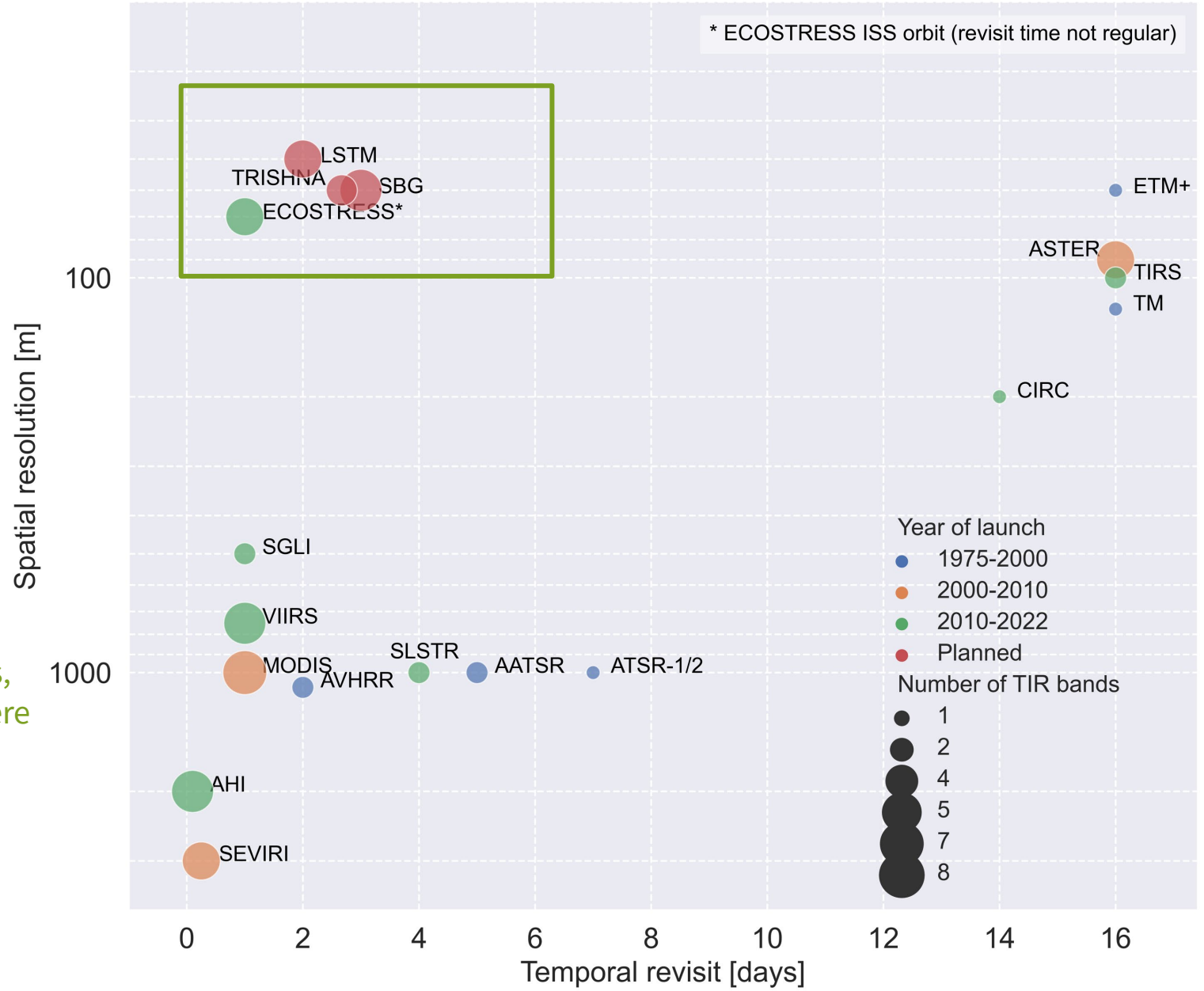
- Meteo/weather applications
- Ocean applications
- Climate modelling

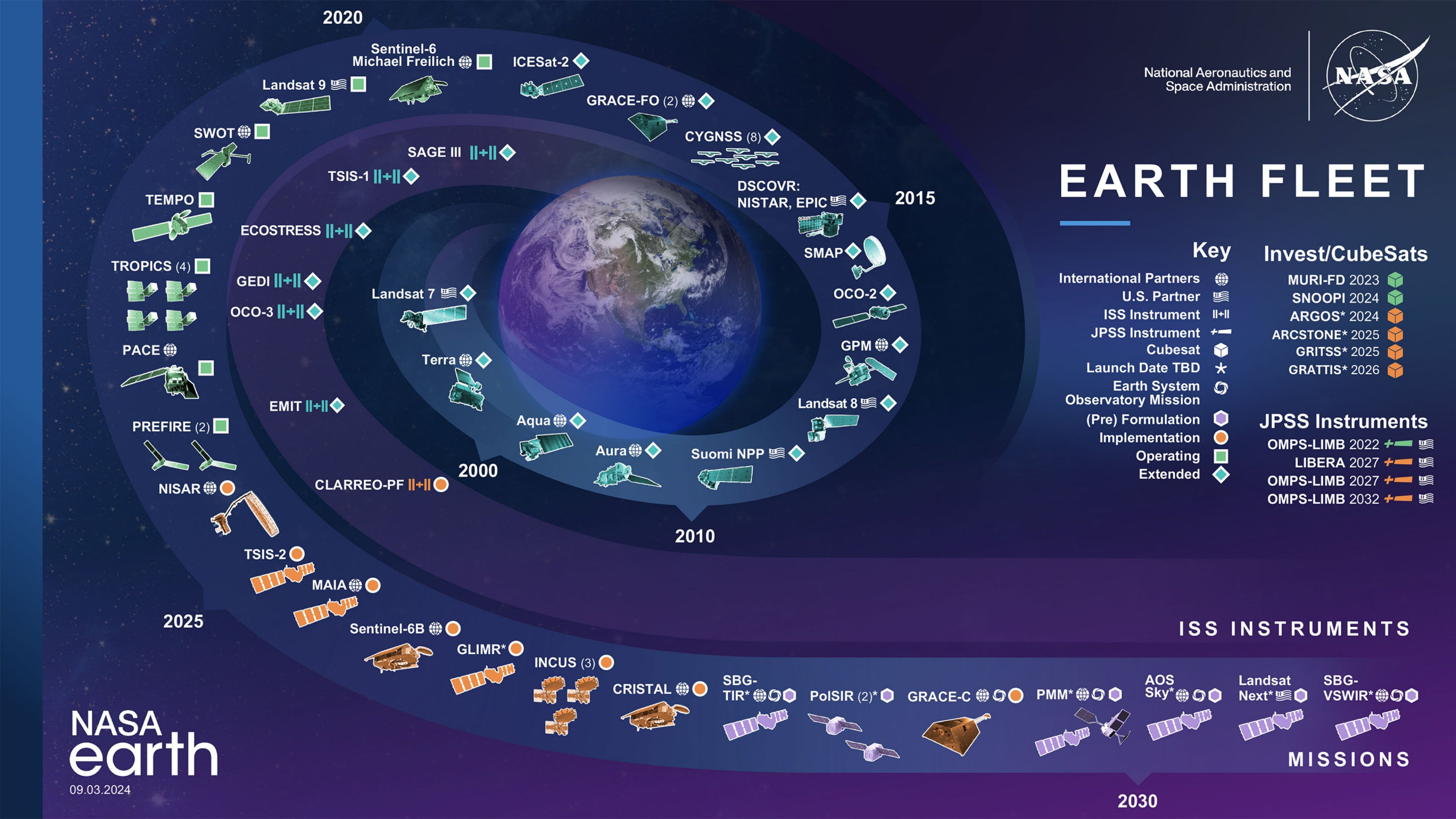
High spatial resolution, low revisit

- LST applications (1-2 bands)

High spatial resolution, high revisit

- Gamechanger in LST research
- New applications with higher accuracy products, e.g. agriculture, coastal/inland waters, cryosphere
- More on Wednesday!!





National Aeronautics and Space Administration

EARTH FLEET

Key

- International Partners
- U.S. Partner
- ISS Instrument
- JPSS Instrument
- Cubesat
- Launch Date TBD
- Earth System Observatory Mission
- (Pre) Formulation
- Implementation
- Operating
- Extended

Invest/CubeSats

- MURI-FD 2023
- SNOOPI 2024
- ARGOS* 2024
- ARCSTONE* 2025
- GRITSS* 2025
- GRATTIS* 2026

JPSS Instruments

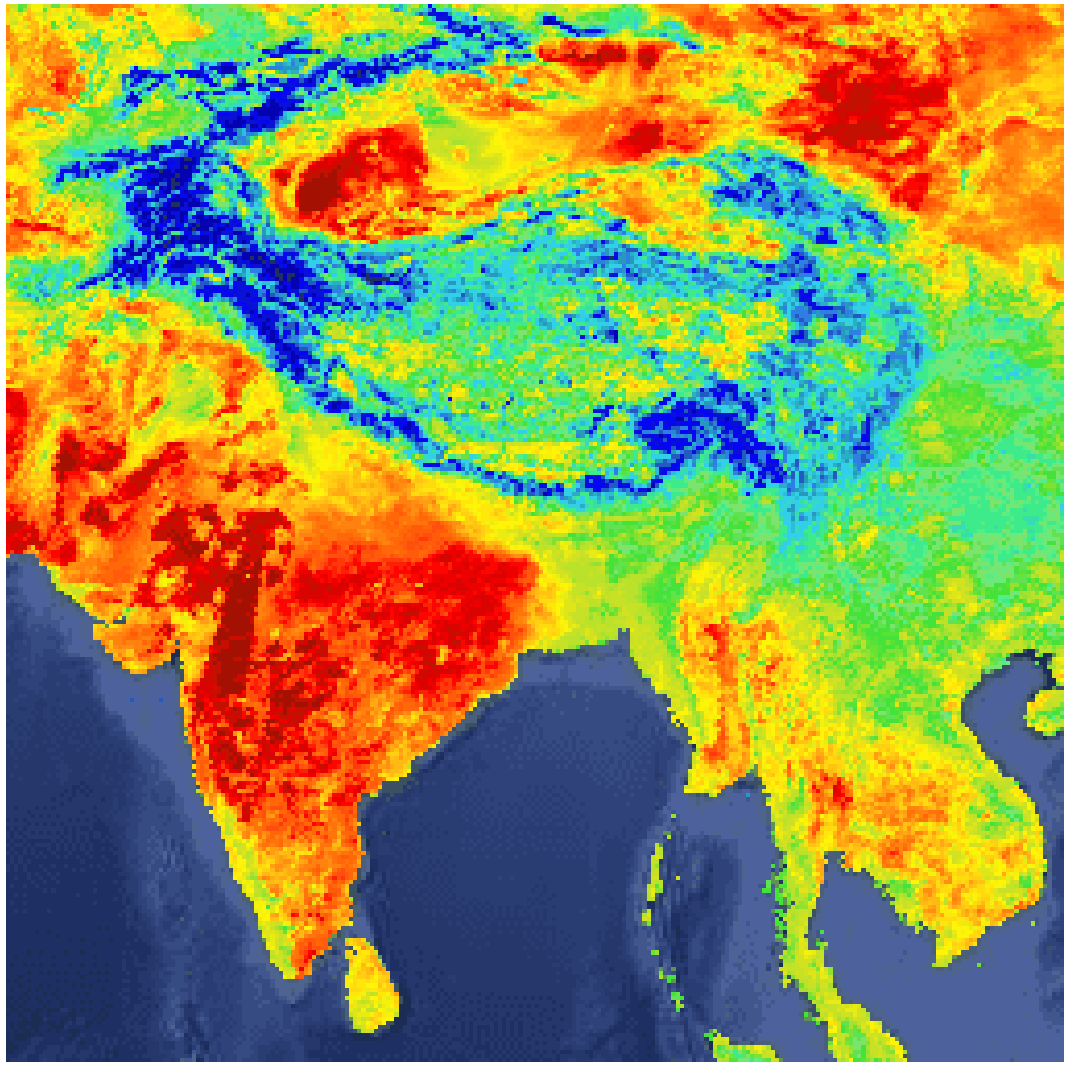
- OMPS-LIMB 2022
- LIBERA 2027
- OMPS-LIMB 2027
- OMPS-LIMB 2032

NASA earth

09.03.2024

MODIS

Platform	Aqua / Terra
Temporal coverage	1999 - present
TIR bands	10.78 - 11.28, 11.77 - 12.27
GSD	1km
Temporal revisit	12 hours
Orbit	Polar
Crossing time	10:30 (terra), 1:30 (aqua) am/pm



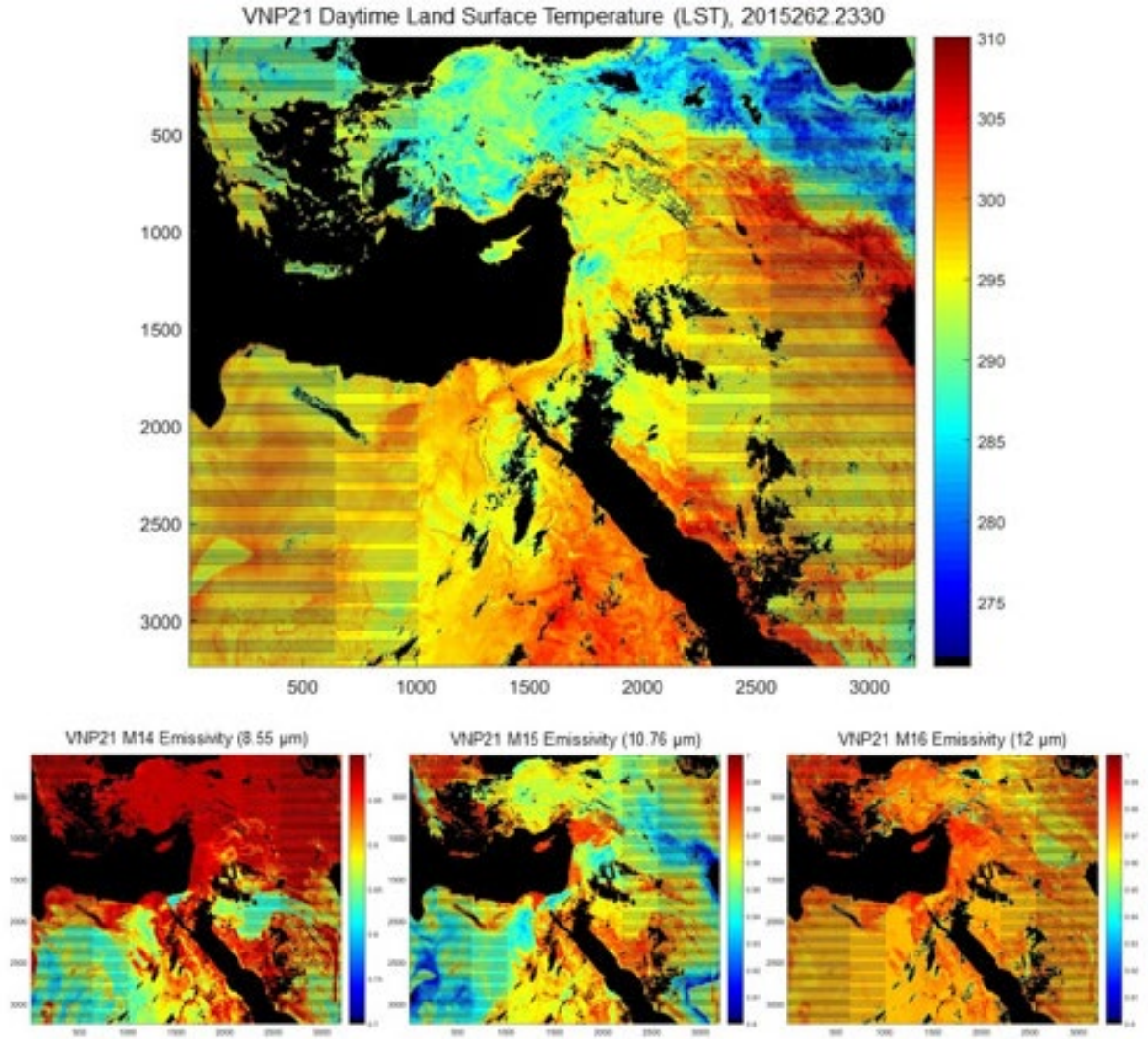
- Physics-based algorithm to retrieve the LST and Emissivity simultaneously (MOD11 and MOD21)
- Based on the ASTER Temperature Emissivity Separation (TES) algorithm
- Improved Water Vapor atmospheric correction scheme
- Global LST since 2000
- https://modis.gsfc.nasa.gov/data/dataprod/mod21.php

Source: https://appliedsciences.nasa.gov/sites/default/files/2020-11/UHI_Part1_v5.pdf

VIIRS

Platform	NSPP / NOAA 20
Temporal coverage	2011 – present, 2018 - present
TIR bands	10.26 - 11.26 11.54 - 12.49
GSD	750m
Temporal revisit	12 hours
Orbit	Polar
Crossing time	1:30 am/pm

- Same LST and E approach as MODIS to ensure consistency between the sensors
- https://viirsland.gsfc.nasa.gov/Products/NASA/LSTESDR.html

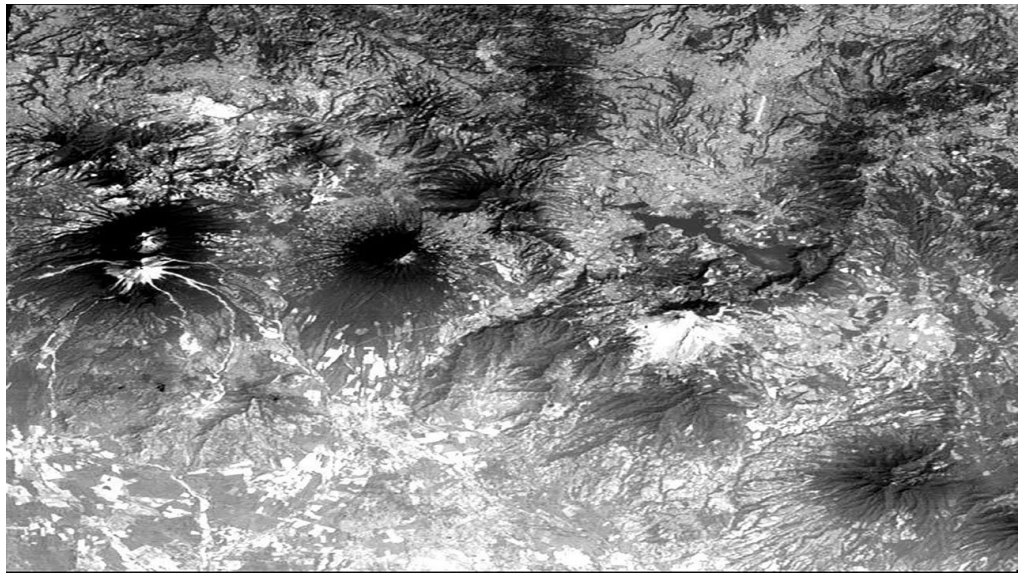


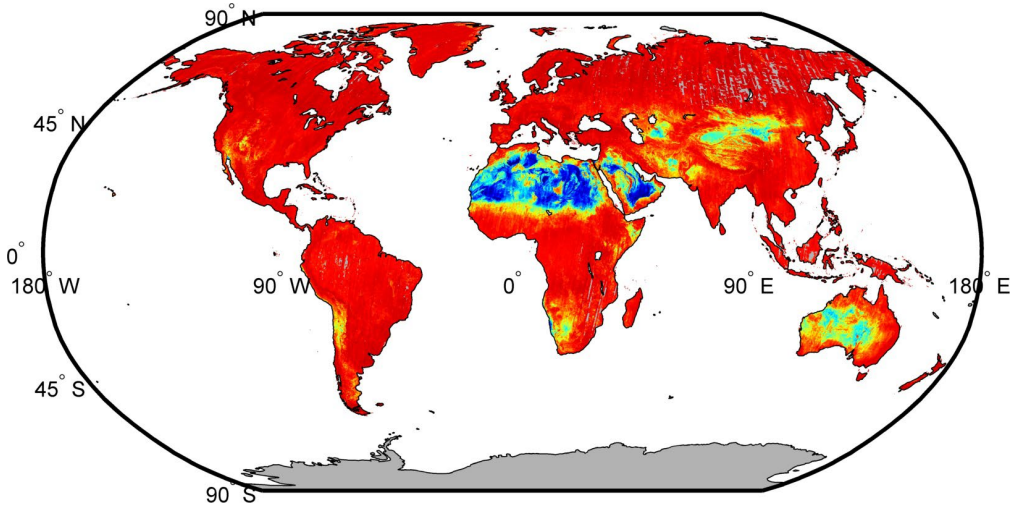
Source: https://appliedsciences.nasa.gov/sites/default/files/2020-11/UHI_Part1_v5.pdf

ASTER

Platform	Terra
Temporal coverage	1999 - present
TIR bands	10.25-10.95, 10.95-11.65
GSD	90m
Temporal revisit	12 hours
Orbit	Polar
Crossing time	10:30 am/pm

- Surface Kinetic Temperature generated from 5 TIR bands
- Emissivity and LST are derived iteratively
- Temperature/Emissivity Separation (TES) algorithm along with atmospheric correction is used
- Emissivity database used in derivation of many other LST
- https://lpdaac.usgs.gov/products/ast_08v003/, https://emissivity.jpl.nasa.gov/aster-ged



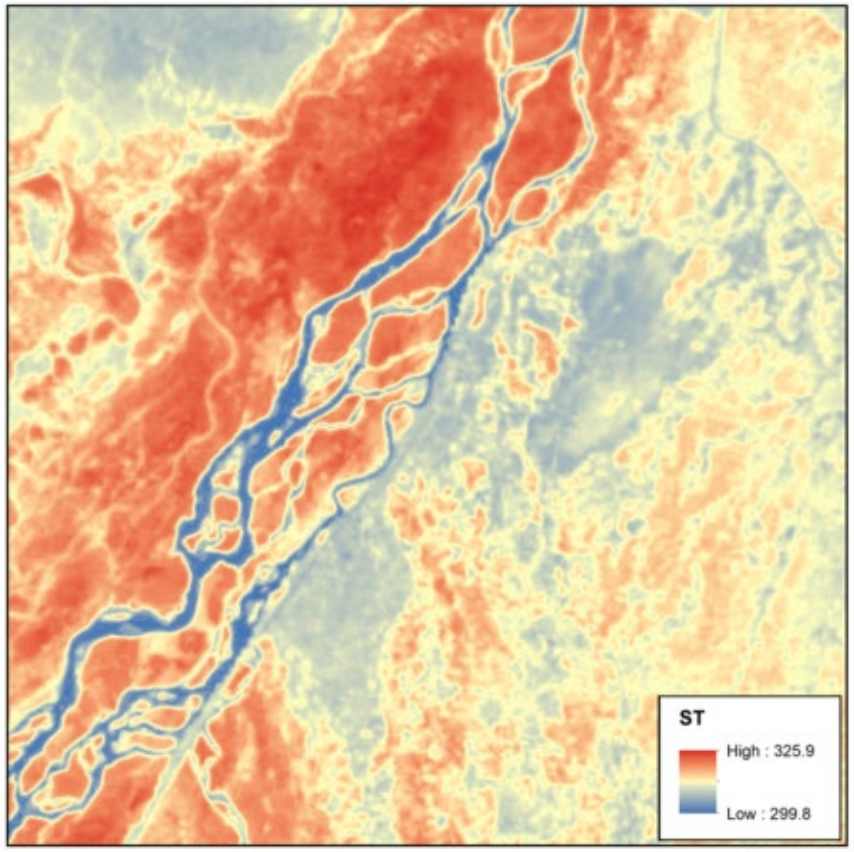


Source: https://appliedsciences.nasa.gov/sites/default/files/2020-11/UHI_Part1_v5.pdf

Landsat programme

Platform	TM (L4- / ETM+ / TIRS
Temporal coverage	1982- presents
TIR bands	10.40 - 12.50 ™ 10.40 - 12.50, 10.6 - 11.19, 11.50 - 12.51 (ETM+/TIRS)
GSD	120 m (30 m resampled) , 60 m (30 m), 100 m
Temporal revisit	16 days
Orbit	Polar
Crossing time	10am/10pm

- Part of U.S. Landsat Analysis Ready Data (ARD) products, collection 2 available
- ASTER Global Emissivity Database (GED) and NDVI data
- Atmospheric profiles of geopotential height, specific humidity, and air temperature extracted from reanalysis data
- https://www.usgs.gov/media/files/landsat-provisional-surface-temperature-product-guide



Source: Michelle A. Bouchard, based on Landsat data from the USGS

Source: https://appliedsciences.nasa.gov/sites/default/files/2020-11/UHI_Part1_v5.pdf

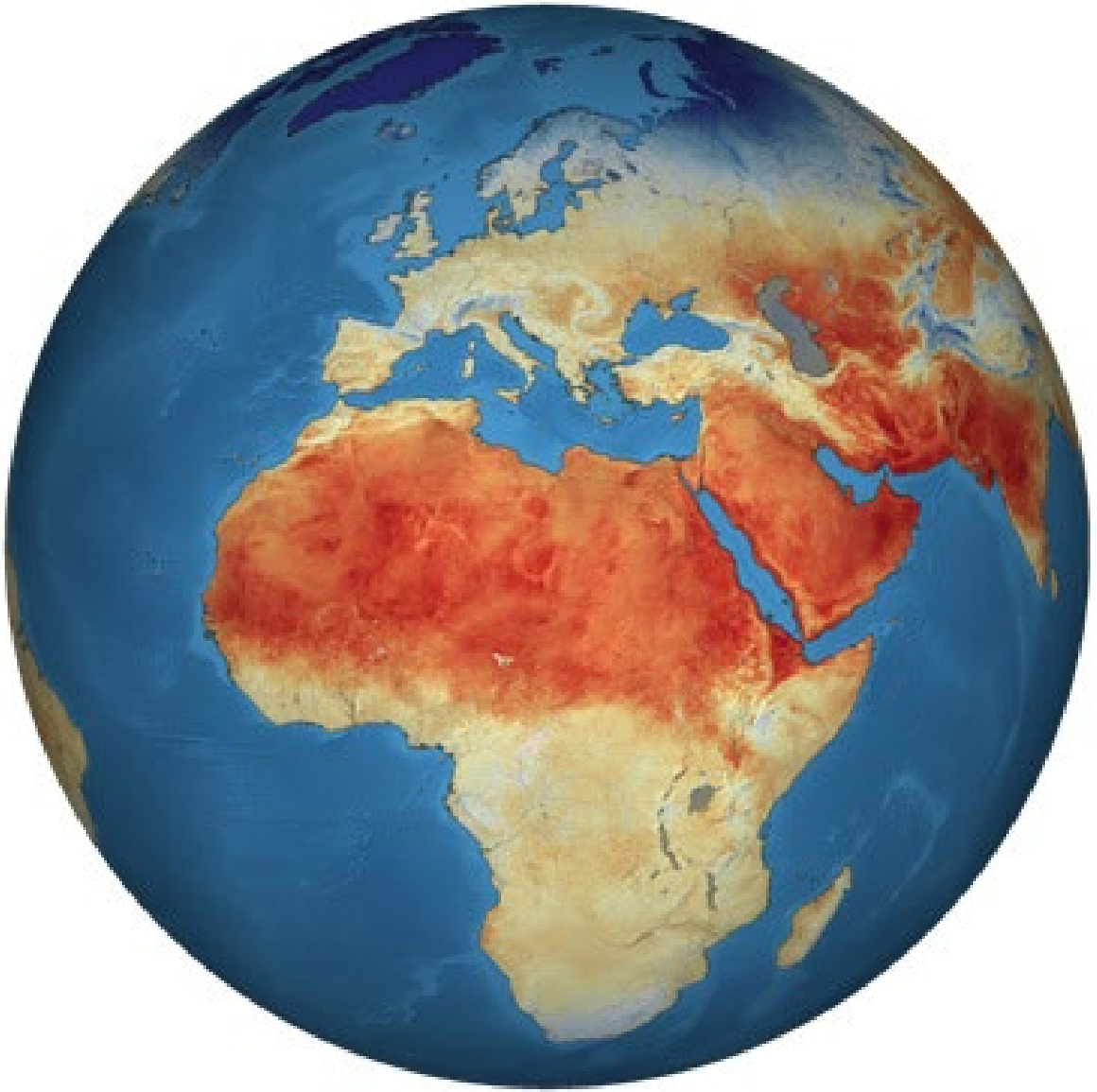

2010
2015
2020
2025
2030
ERS-1
ERS-2
MetOp-A
Envisat
Proba-1
SMOS
GOCE
CryoSat
Swarm
Proba-V
Meteosat 10 (MSG)
MetOp-B
Sentinel-1A
Sentinel-2A
Sentinel-3A
Sentinel-5P
Meteosat 11 (MSG)
Sentinel-1B
Sentinel-2B
Sentinel-3B
Sentinel-6 Michael Freilich
MetOp-C
Sentinel-1C
Sentinel-2C
Sentinel-3C
Aeolus
EarthCARE
Biomass
Phisat-2
HydroGNSS
ALTIUS
FLEX
FORUM
Harmony
TRUTHS
MAGIC
Earth Explorer-11
Earth Explorer-12
Sentinel-1D
Sentinel-2D
Sentinel-3D
Sentinel-6B
MTG-I1
Sentinel-4A MTG-S1
Arctic Weather Satellite
CO2M-A
CO2M-B
CO2M-C
CRISTAL-A
CIMR-A
ROSE-L-A
LSTM-A
CHIME-A
CRISTAL-B
CIMR-B
ROSE-L-B
LSTM-B
CHIME-B
Sentinel-5A MetOp-SG-A1
MTG-I2
MetOp-SG-B1
MTG-I3
Aeolus-2A
Sentinel-4B MTG-S2
Sentinel-5B MetOp-SG-A2
MetOp-SG-B2
Sentinel-1
Sentinel-2
Sentinel-3
Sentinel-6
Sentinel Next Generation Missions
Science
esa
Copernicus
European Union
Meteorology
EUMETSAT

Sentinel-3 SLSTR

Platform	Sentinel 3A/3B
Temporal coverage	2016-present (3A), 2018-present (3B)
TIR bands	10.45 - 11.24 11.57 - 12.48
GSD	1km
Temporal revisit	12 hours
Orbit	Polar
Crossing time	10 am/pm

- Extend ATSR instruments from ERS-1,2 and Envisat
- Produce both LST and SST
- Uses nadir-only split-window approach to correct for atmospheric effe using the differential absorption in IR bands within the same atmospheric window
- Provides per pixel uncertainties
- https://sentiwiki.copernicus.eu/web/s3-mission

Source:

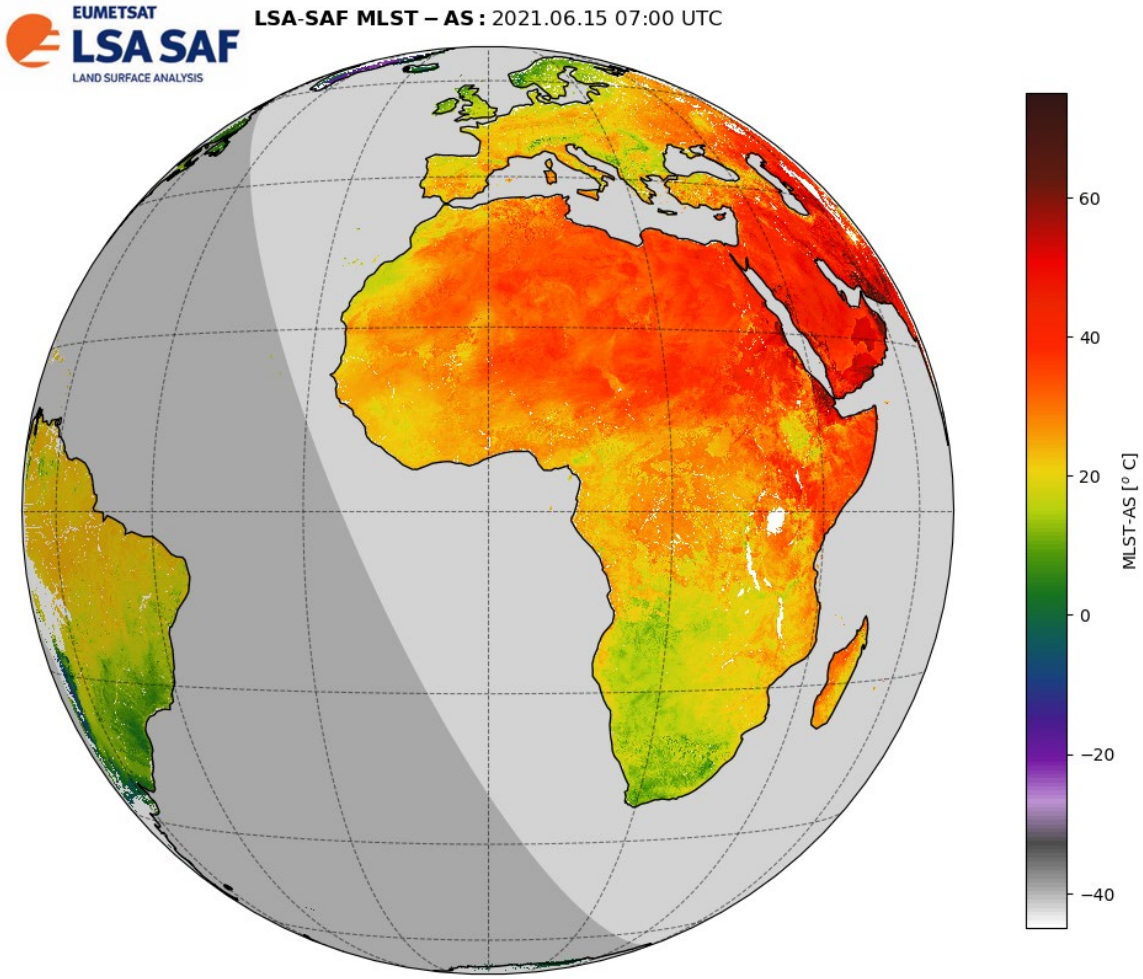


Global Land Surface Temperatures from Sentinel-3/SLSTR data (2018). [Credits: ESA]

MVIRI (MFG) / SEVIRI (MSG, MTG)

Platform	Meteosat 1st, 2nd 3rd Generation
Temporal coverage	1983-present
TIR bands	8.3-9.1, 9.38-9.95, 9.8-11.8, 11-13,12.5-14.4
GSD	3km
Temporal revisit	30 minutes
Orbit	Geostationary
Crossing time	-

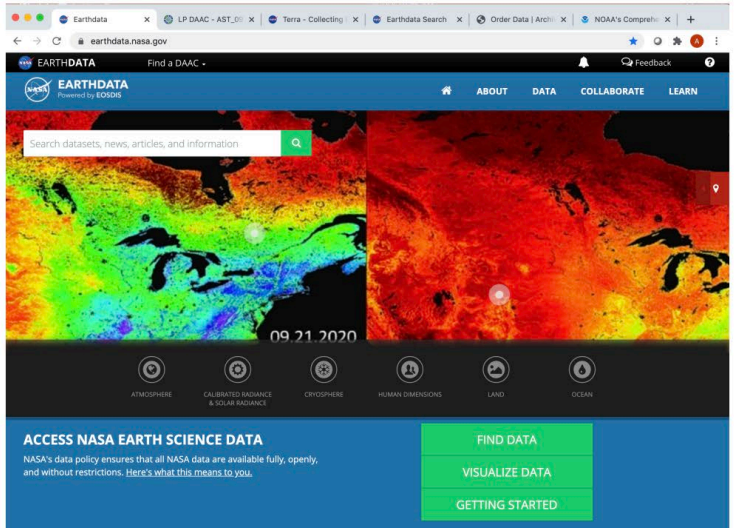
- https://navigator.eumetsat.int/product/EO:EUM:DAT:0367
- All-sky LST product provides skin temperature estimate every 30 min, for both clear and cloudy conditions
- Combines two operational algorithms (the clear sky component is derived from MSG level 2 product and cloudy sky component from the energy balance algorithm currently in use for the estimation of MSG 30-minute evapotranspiration



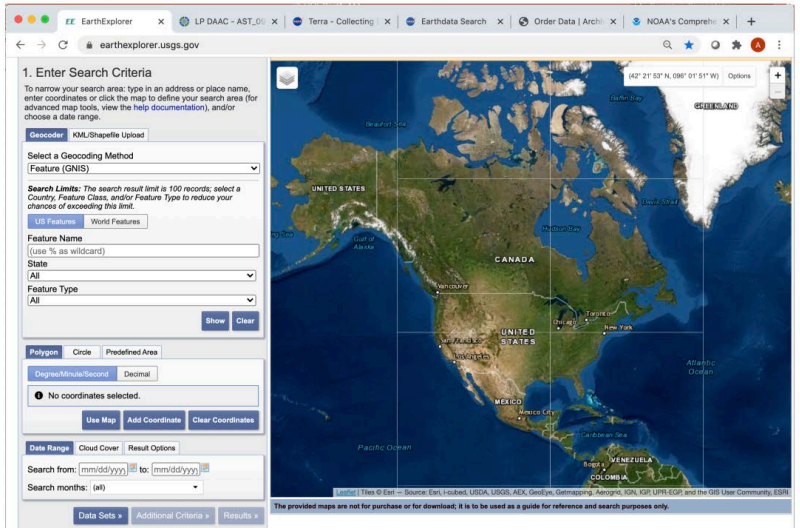
Source:

Data access

https://earthdata.nasa.gov/

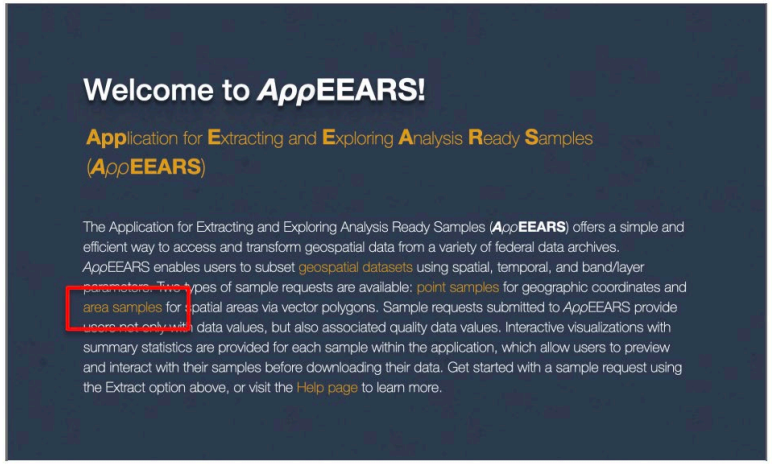


https://earthexplorer.usgs.gov/

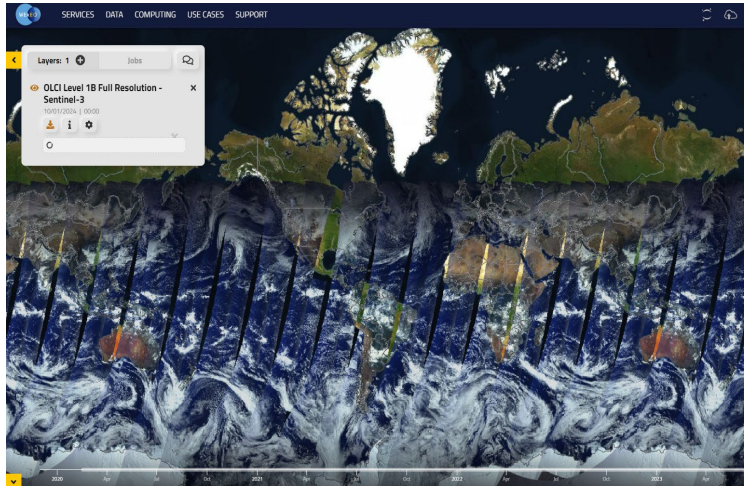


https://lpdaacsvc.cr.usgs.gov/appeears/

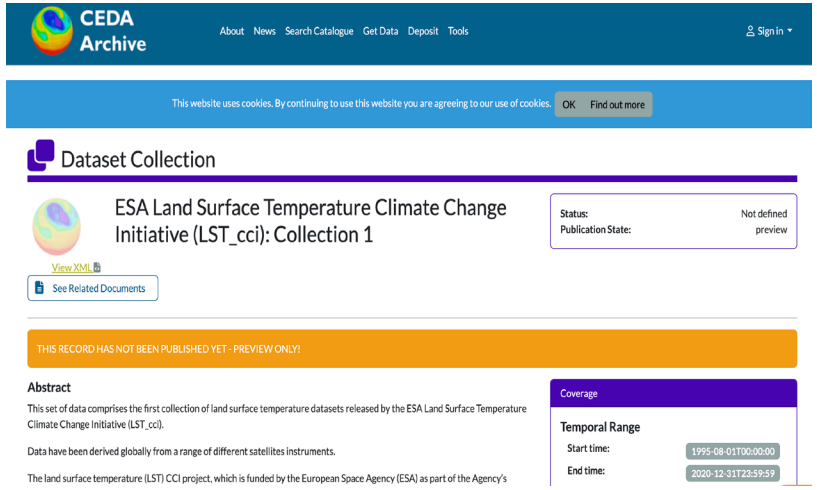
USGS AppEEARS



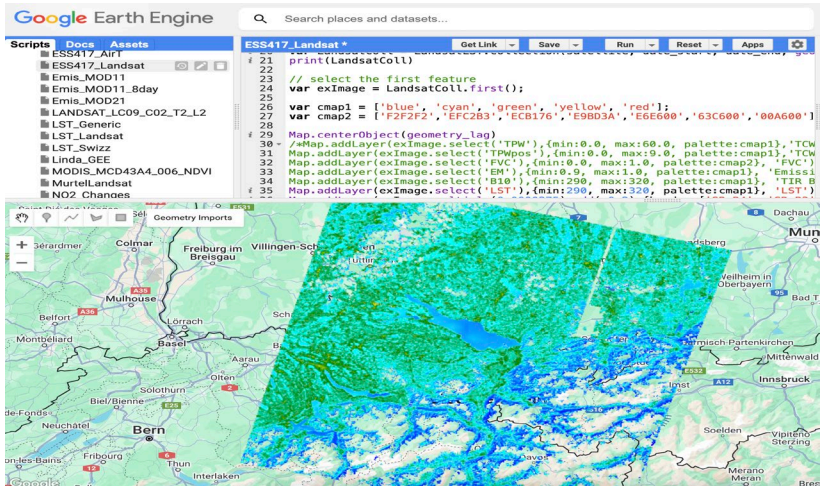
https://www.wekeo.eu/data



https://catalogue.ceda.ac.uk/uuid



https://developers.google.com/earth-engine/datasets



AISTECH
access to intelligent space technologies

ENABLER DATA PRODUCTS

Orbital Parameters	Precursor (25Q2)	Constellation
ORBIT TYPE	SUN-SYNCHRONOUS	SUN-SYNCHRONOUS
ALTITUDE	516 KM	500 KM
INCLINATION	97.5 DEG	POLAR
LTDN	1:00 PM	10 PLANES
REVISIT TIME	<1.5 DAYS	< 3H
MAX. OFF-NADIR ANGLE	+/-15 DEGREES	+/-30 DEGREES

Image Characteristics

NUMBER OF CHANNELS	RGB + NIR + 2 x LWIR	7x VNIR + 2x MWIR + 3x LWIR
SENSOR BANDS	BLUE 0.4-0.5 µm GREEN 0.5-0.57 µm RED 0.57-0.7 µm NIR 0.7-.09 µm LWIR1 10.5-11.5 µm LWIR2 11.5-12 µm	BLUE: 0.4-0.5 µm GREEN: 0.5-0.57 µm RED: 0.57-0.7 µm RED-EDGE: 0.725-0.755µm AEROSOLS: 0.421 - 0.463µm WATER VAPOUR: 0.925 -0.965µm NIR: 0.7-.0.9 µm MWIR1: 3.2 -3.6µm MWIR2: 4.2 - 4.8µm LWIR1: 10-11 µm* LWIR2: 11-12 µm* LWIR3: 8.7-9.1 µm
GRD AT NADIR	VIS 25 m NIR 30 m LWIR 100 m	VIS 3 m NIR 5 m MWIR 15 m LWIR 30 m
SWATH WIDTH (AT NADIR)	7 KM	20 KM (AT NADIR)

Products

L1: Top of atmosphere radiances per VNIR channel, Top of atmosphere brightness temperature per LWIR channel

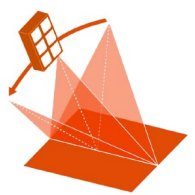
L2: Land Surface Temperature, Sea Surface Temperature, Land Surface Emissivity per TIR band, Bottom of atmosphere reflectance per VNIR band, Total column of water vapour, Cloud mask
L3: Evapotranspiration, Fire Radiative Power, etc.

Data Policy

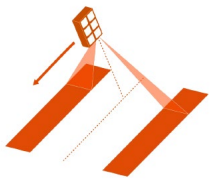
Accessibility:
Imagery will be available at low cost or free for researchers to promote scientific advancement

Tasking:
Tasked imagery will be followed by a sunset clause, ensuring eventual open access

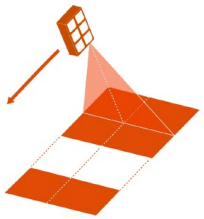
FOCUS



STEREO



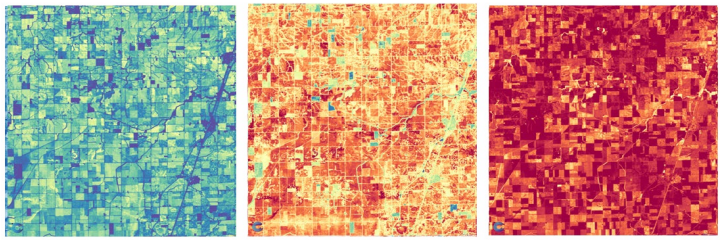
SNAPSHOT



constellr, a new space company providing surface temperature intelligence for better resource accountability

Target Sectors
Agriculture, Infrastructure, Water Monitoring...

Seasonal Drought, Illinois



3rd of May 23 10:30 am | 11th of May 23 10:30 am | 20th of June 23 10:30 am

Urban Heat Island, Melbourne

Product Portfolio

End of Q1 2025

LST*fusion*

- 30m spatial resolution
- Fused data sources
- Large area coverage
- Reliable data frequency (8days)

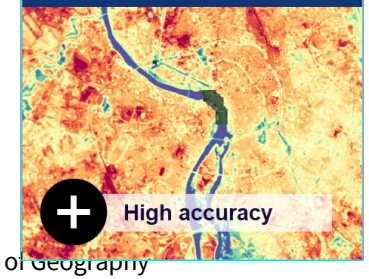
for reliable large scale monitoring

Q2 2025

LST*precision*

- 30m native resolution
- Proprietary data
- High temperature sensitivity
- Up to 4 day revisit

for high-value asset monitoring

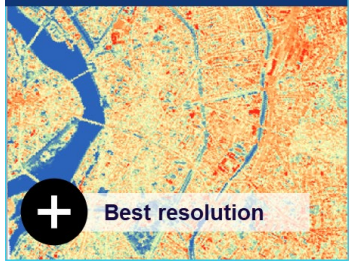


Q2 2025

LST*zoom*

- 10m spatial resolution
- Proprietary data – sharpened
- Visually best resolved
- Up to 4 day revisit

for zooming-in on anomalies



Deployment of the HiVE constellation

In-Orbit Demonstrator LisR
Payload on board ISS

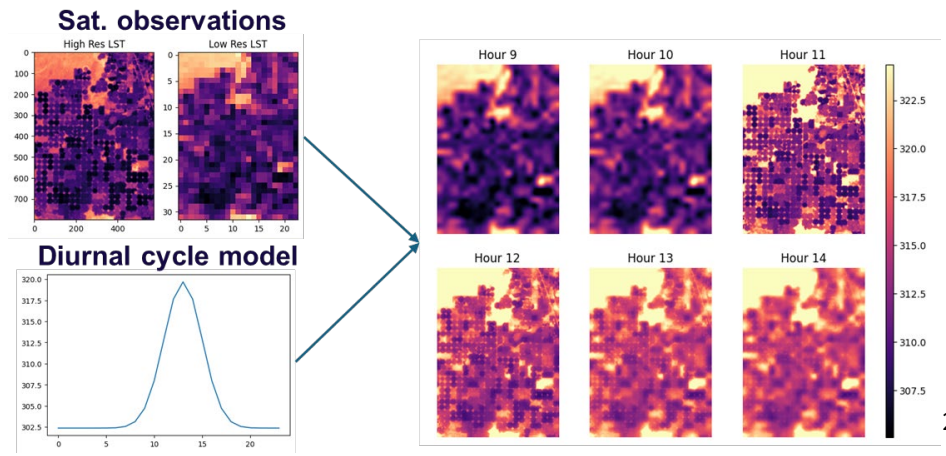
→ **HiVE Satellite #1 and #2**
First free-flying satellites

→ **HiVE Satellite #3, #4, #5**
Minimum viable constellation for daily revisit

→ **HiVE Constellation**
Operations at scale with up to 30 Satellites launched

Status	Launch:early 2025, data from mid 2025
Orbit	SSO, 540 km, LTDN 10:30 AM / 1:30PM
Technology	**Cryo-cooled**, four-band LWIR 10 band MS VNIR
Revisit time	From 4 days (1 sat) to daily (5 sat)
Swath	**18.5 km LWIR** / 20km VNIR
GSD (nadir)	**30 m LWIR** / 10 m VNIR
L2 LST uncertainty	**< 2.0 K**

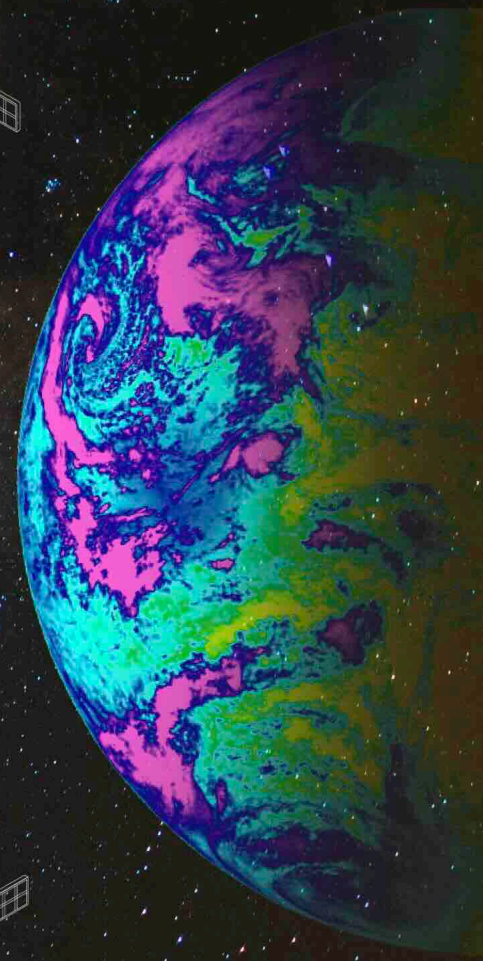
LST*fusion*



Hydrosat

Hydrosat Specifications

Requirement	VZ-1	Constellation (VZ-2 – 16)
Coverage	Global	Global
GSD	VNIR: 30 m; LWIR: 70 m	VNIR: 10 m; LWIR: 50 m
Revisit (0° latitude)	6 days (off-nadir; 20° pointing); 46 days (nadir)	Sub-Daily (nadir)
Spectral Wavelengths	~Landsat: 7-band VNIR; 2-band LWIR	>7-band VNIR; >2-band LWIR
Overpass Time	10:00 am	1:30 pm
LST Error	1.56 K	< Landsat
Products	L1 Brightness T; L2 ST&E; L3 ET; L4 soil moisture, crop info	L1 Brightness T; L2 ST&E; L3 ET; L4 soil moisture, crop info



Data availability: Early Adopter product available now; VZ-1 data available 2025Q1
Data policy: Free/open for non-commercial/academic use; market pricing for commercial use

Hi, we are OroraTech

200m

Ground Sampling Distance (GSD)

MWIR: 3.8 µm
LWIR 1: 8.7 µm
LWIR 2: 11.45 µm

Spectral Wavelengths

12 hours ~ 30 mins
OTC-P1/P3

Revisit Time

Data is currently available

Data availability

On-Orbit Fire Detection
Active Fire Product (Beta)
Land Surface Temperature (Beta)

Data Products

Case-Specific

Data policy

SatVu HotSat Instrument Specs and Product Offering

- HotSat is a mid-wave infrared (MWIR) single band high-resolution imager, capable of recording video sequences of up to 60 seconds at 25 frames/s.
- Our first satellite, HotSat-1, launched in June 2023, and collected 6 months of data.
- HotSat-2 is planned to launch end of 2025, followed shortly after by HotSat-3.
- Upcoming **ESA Third Party Mission (TPM)** Announcement of Opportunity, will give researchers access to the entire HotSat-1 archive.

Sensor type		Mercury Cadmium Telluride (MCT) array
Ground sampling distance		3.5 m (at 500 km orbit at nadir)
Sensor size		1280 x 1024 array with 8 µm pitch
Ground footprint		3.5 x 4.5 km at nadir
Spectral Range	Night	3.7 – 5.0 µm
	Day	4.2 – 5.0 µm
Revisit time		With 1 satellite, ~daily at up to 45° off nadir

PROTOTYPE AVAILABLE

All Frames Basic Product

Optimised for speed

- Pixel values delivered as Digital Numbers (DNs)
- 25 frames delivered
- Radiometrically corrected only
- Additional ancillary data delivered (AOCS, RPCs, UDM)

Value Proposition:

- Low latency delivery
- Processing flexibility

Use cases:

- Low latency required use cases like defence & intelligence and disaster response
- Use cases where tailored processing is required for advanced users

Visual Product

Optimised for photo-interpretation

- Pixel values delivered as Digital Numbers (DNs)
- Representing relative radiance differences within a scene
- Georeferenced 30 m CE90
- Ortho prototype available (including RPCs)

Value Proposition:

- Signal photo-interpretability
- Improved geometry
- Signal to asset detection

Use cases:

- High value industrial asset monitoring
- Anomaly detection
- Pattern of life interpretation

PROTOTYPE AVAILABLE

Night BOA Product

Optimised for analytics

- Pixel values delivered as surface radiance and brightness temperature
- Quantification of signal variability across the scene and inter scenes
- Georeferenced 30 m CE90
- Ortho prototype available (including RPCs)

Value Proposition:

- Analytics
- (Time series) comparability

Use cases:

- Signal change detection (asset operational capacity monitoring)
- Thermal in scene difference calculation