

Remote Sensing for Healthy Urban Systems

CIVIS BIP Healthy Urban Systems HUb4

Prof. Sébastien Gadal

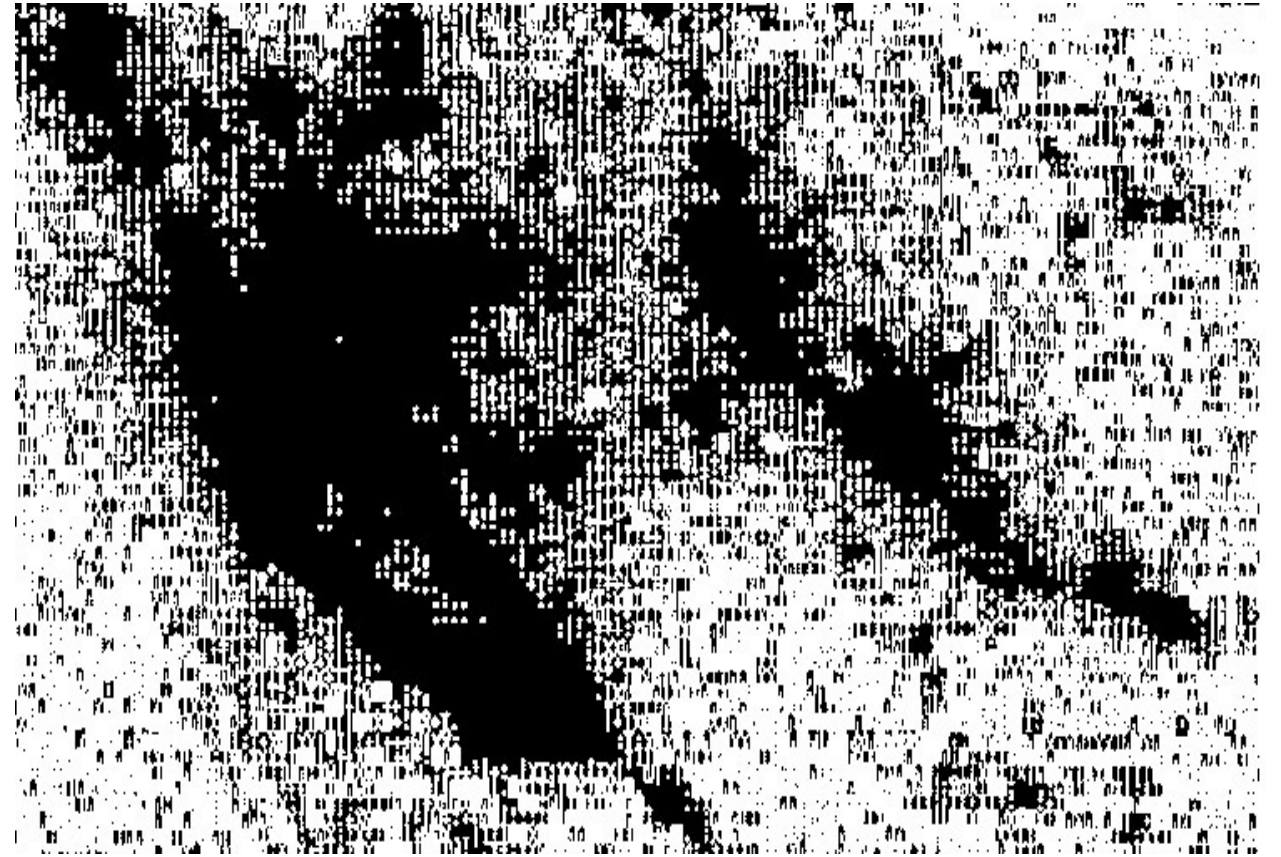
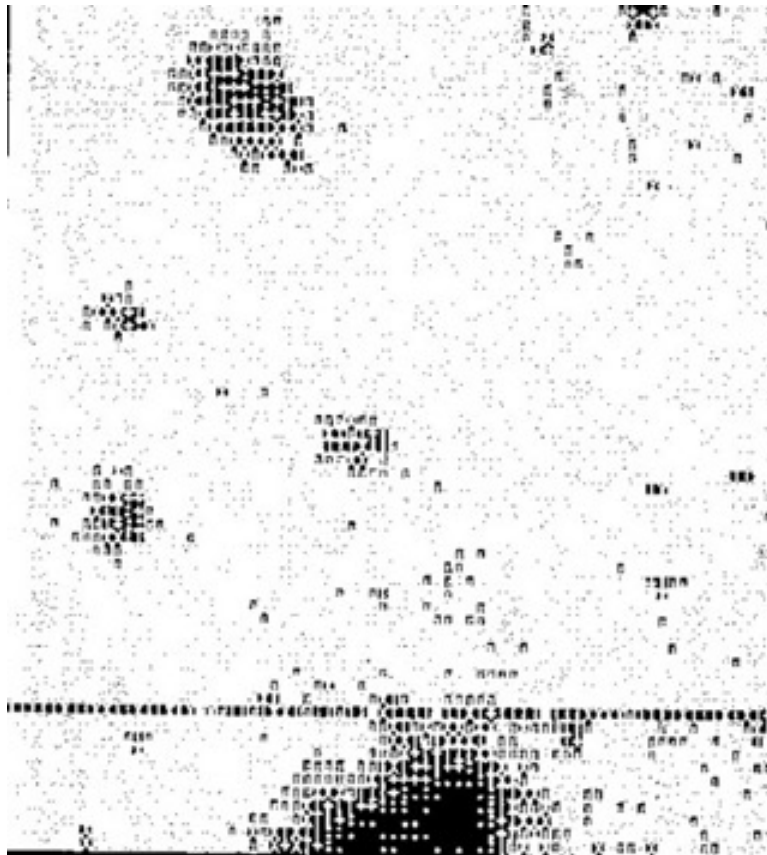
Aix-Marseille Univ., CNRS, ESPACE UMR 7300, Univ., Nice Sophia
Antipolis, Avignon Univ., 13545 Aix-en-Provence, France
sebastien.gadal@univ-amu.fr

What Remote Sensing is?

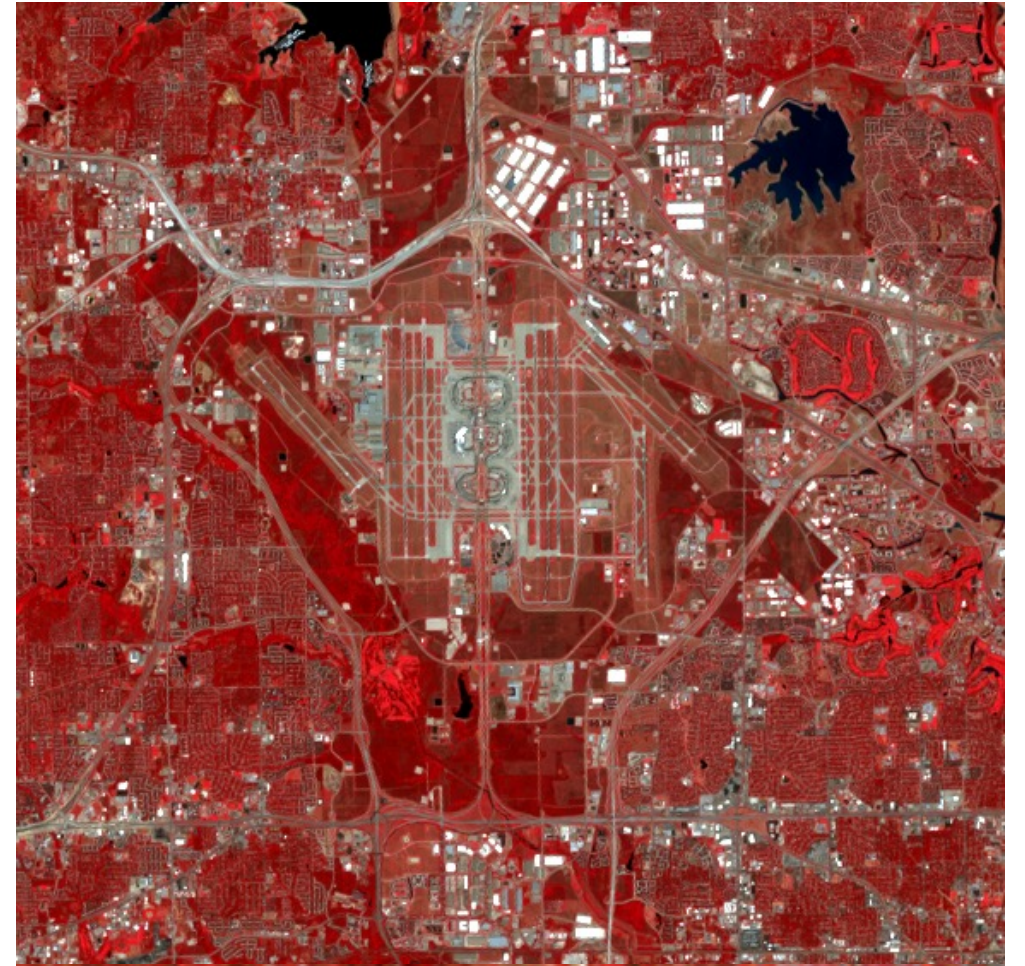
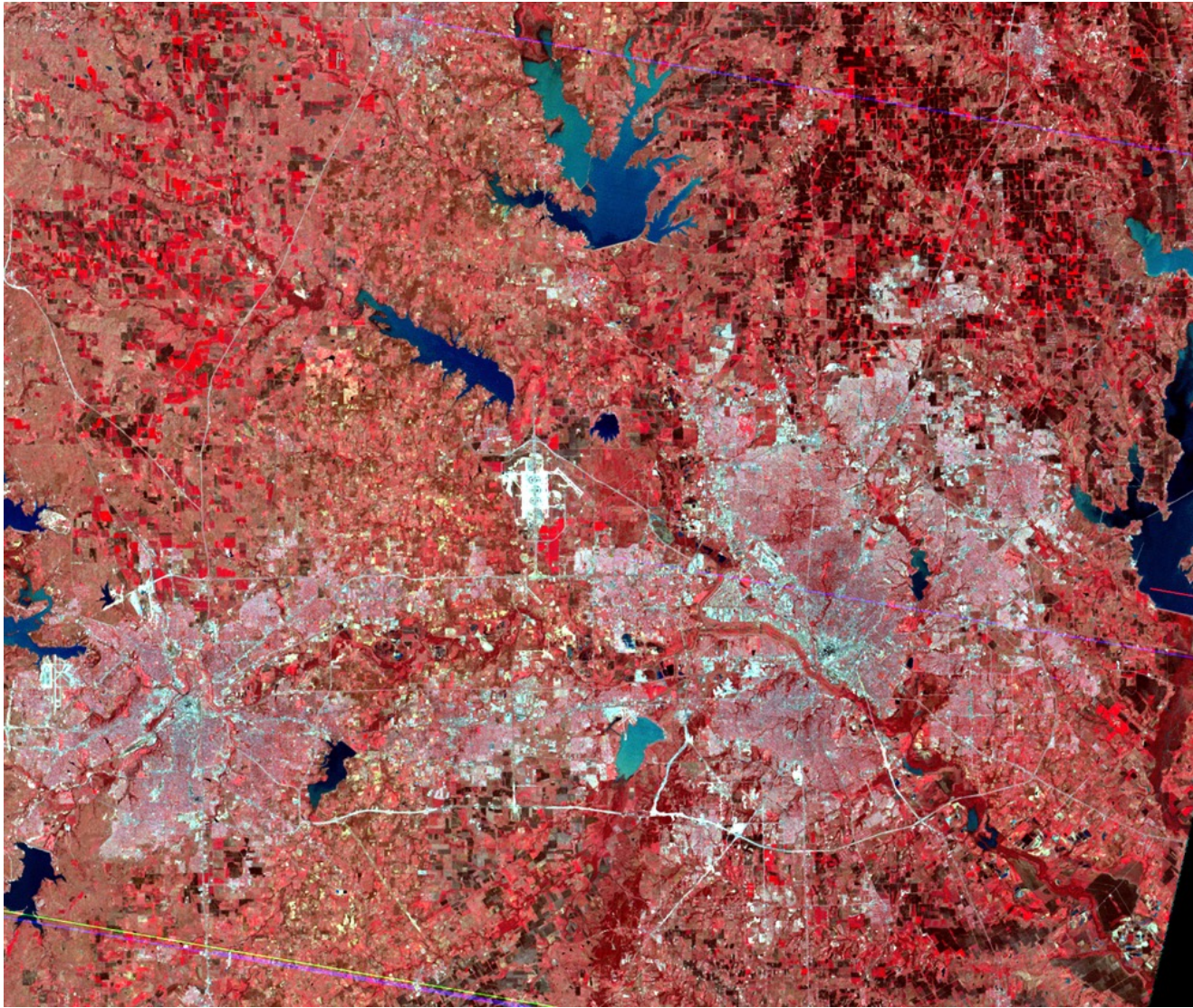


What Remote Sensing is?

1974: appearance of the first civilian and military digital images (Landsat 1 MSS) (DMSP) First DMSP images used for reconnaissance of North American metropolises (1974).



What Remote Sensing is?



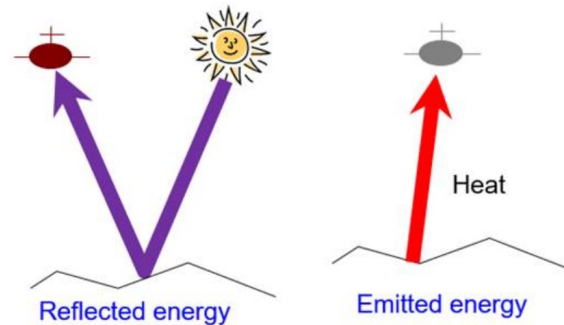
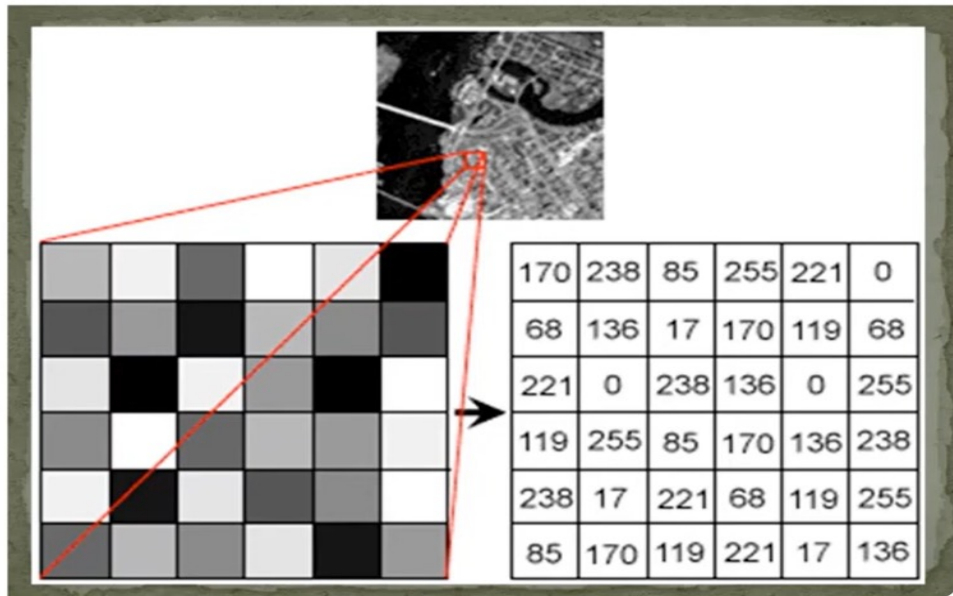
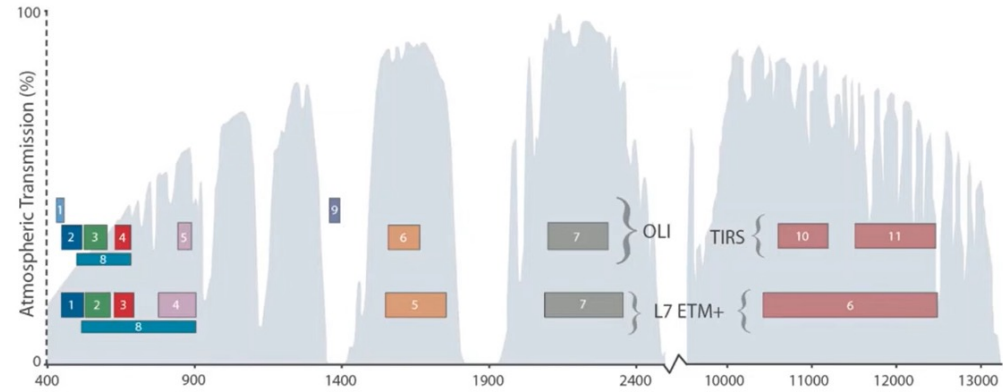
First Landsat 1 MSS image March 12, 1974 (color composition), Dallas airport
March 12, 1974 (color composite), Dallas August 31, 2013 (color composite, Dallas airport)

What Remote Sensing is?

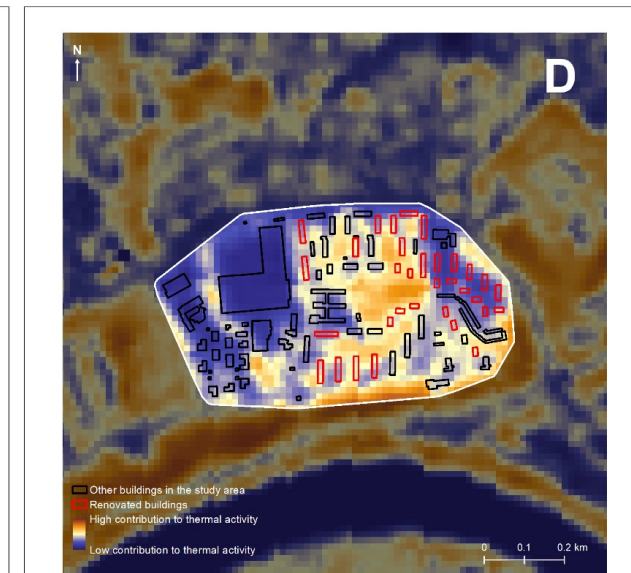
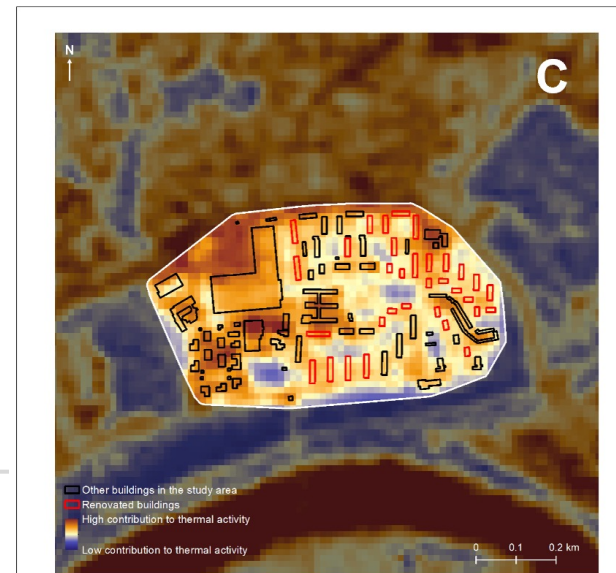
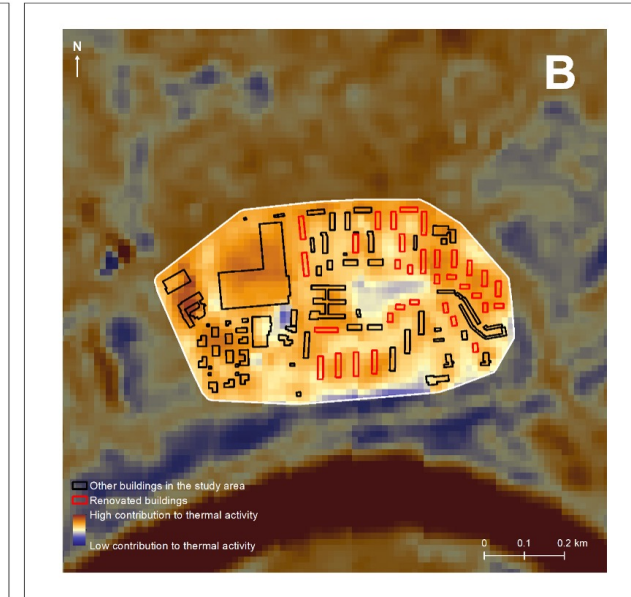
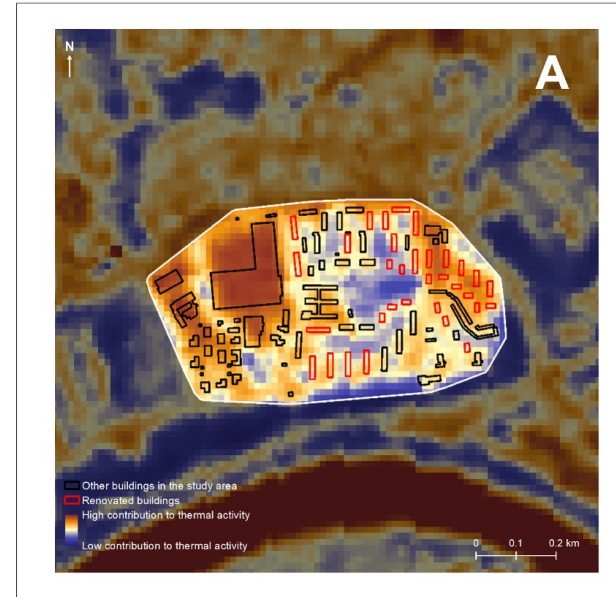
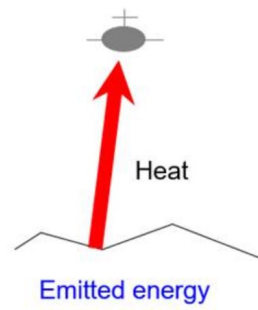
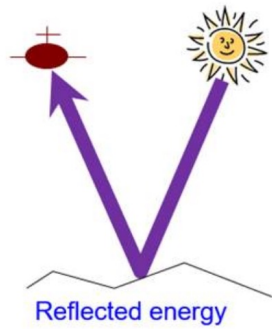
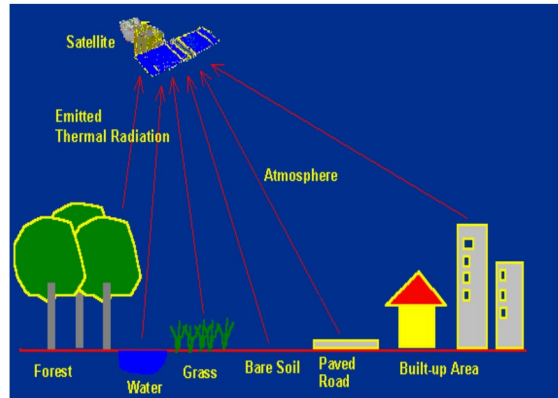
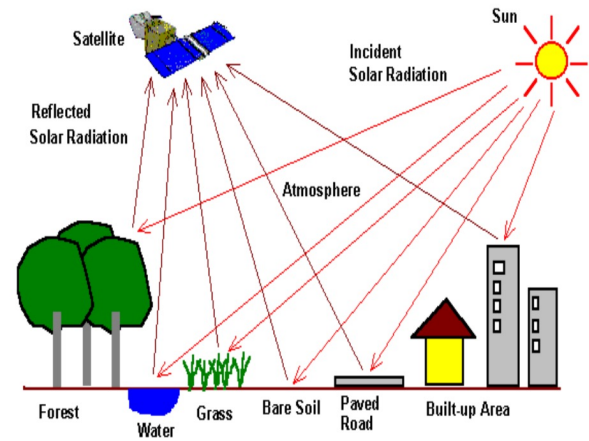


Multispectral remote sensing

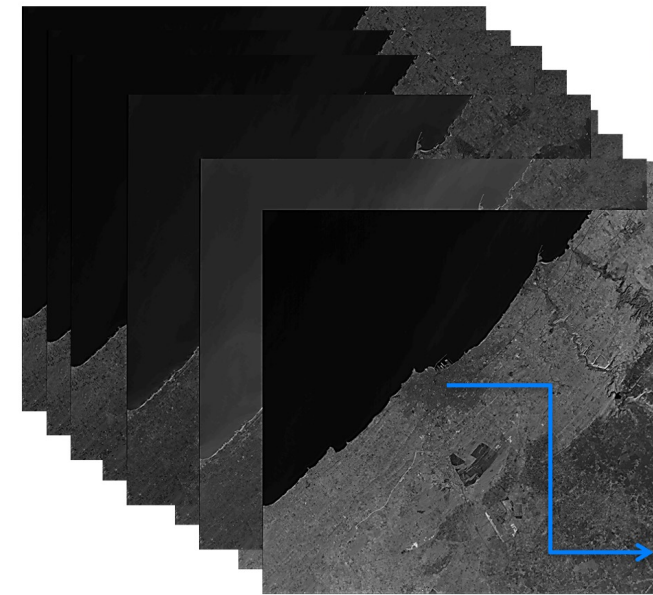
	Bands	Wavelength (micrometers)	Resolution (meters)
Landsat 8 Operational Land Imager (OLI) and Thermal Infrared Sensor (TIRS)	Band 1 - Coastal aerosol	0.43 - 0.45	30
	Band 2 - Blue	0.45 - 0.51	30
	Band 3 - Green	0.53 - 0.59	30
	Band 4 - Red	0.64 - 0.67	30
	Band 5 - Near Infrared (NIR)	0.85 - 0.88	30
	Band 6 - SWIR 1	1.57 - 1.65	30
	Band 7 - SWIR 2	2.11 - 2.29	30
	Band 8 - Panchromatic	0.50 - 0.68	15
	Band 9 - Cirrus	1.36 - 1.38	30
	Band 10 - Thermal Infrared (TIRS) 1	10.60 - 11.19	100
	Band 11 - Thermal Infrared (TIRS) 2	11.50 - 12.51	100
Launched February 11, 2013			



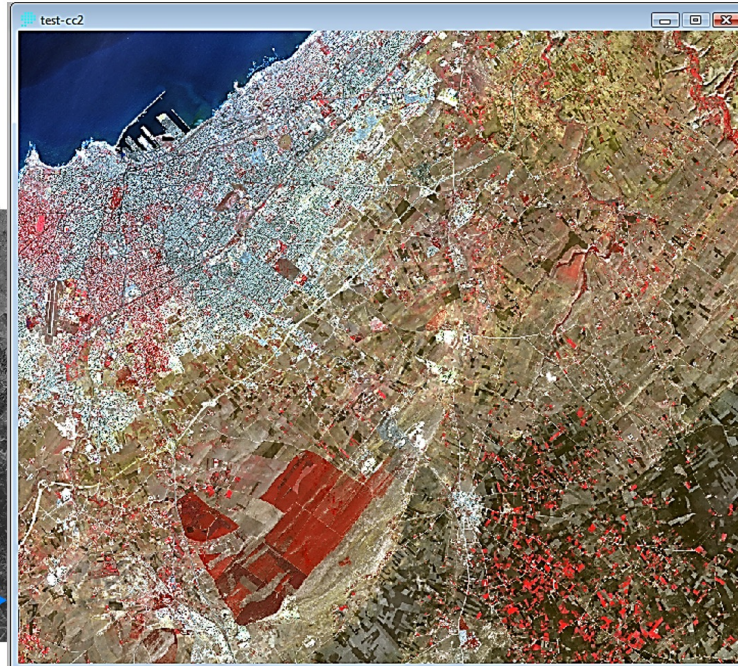
What Thermal Remote Sensing is?



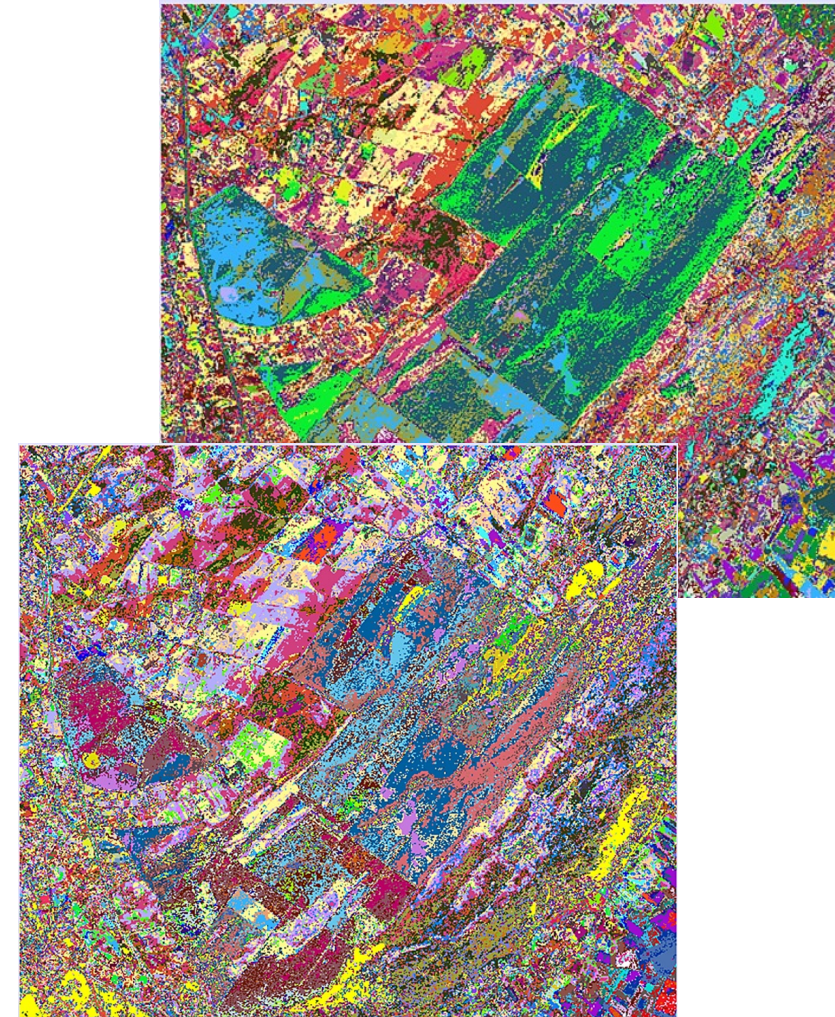
What Remote Sensing is: Spectral data processing




Multi-spectral Spot 5 data, Casablanca, Maroc ,
Sébastien Gadal, C3ED



Sébastien Gadal, C3ED,



Remote Sensing and Heat Health Systems



News & Events ▾ Learn ▾ Urban Heat Islands ▾ Centers of Excellence ▾ Tools Planning & Preparing ▾ Funding Opportunities About

Planning & Preparing

Extreme heat illness and death are largely preventable with proper planning and preparing at all levels.



- En Español
- For Decision Makers
- For Public Health Officials
- For Emergency Responders
- For Employers
- For Tribal Communities

Staying Safe During Extreme Heat

Heat related illnesses and deaths are largely preventable with proper planning and action. There are preventative actions that people can take before heat events occur, as well as actions to take while experiencing heat:

- During times of high temperatures, stay indoors in areas with access to air conditioning if possible. If you do not have access to air conditioning in your home, its recommended that you locate an open cooling center in your area, which could be your local mall, library, church, or other space.
- Make sure to hydrate with water throughout the day, and avoid sugary beverages or drinks with caffeine which can affect your body's ability to cool off.
- Take cool showers or baths.
- Do not rely on a fan as your primary cooling device. Fans create air flow and a false sense of comfort, but do not reduce body temperature or prevent heat-related illnesses.
- Avoid strenuous activities that can result in overexposure to the sun.
- If you are outdoors, make sure to wear light-colored clothing, a hat, sunglasses, and sunscreen.
- Never leave people or pets in a vehicle.

Remote Sensing and Heat Health Systems



GLOBAL **HEAT** HEALTH
INFORMATION NETWORK

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[Connect](#)

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World Health
Organization



WORLD
METEOROLOGICAL
ORGANIZATION

Extreme heat is a global health emergency.

Billions of people are at risk of preventable death and illness from extreme heat. The Global Heat Health Information Network is helping to increase awareness and capacity to better manage and adapt to the health risks of dangerously hot weather in a changing climate.

[LEARN MORE](#)



Remote Sensing and Heat Health Systems



The Indian-French TRISHNA mission Monitoring our ecosystem health from space



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 Corinne SALCEDO (CNES), Dheeraj ADLAKHA (ISRO/SAC), Laurence BUFFET (CNES), Thierry CARLIER (CNES), Jean-Louis RAYNAUD (CNES), Sébastien MARCO (CNES), Emille DÉLOGU (CNES), Renaud BINET (CNES)
 Mark IRVINE (INRAE), Gilles BOULET (IRD/CESBIO), Emmanuelle AUTRET (IFREMER), Laure ROUPOZ (ONERA), Ghislain PICARD (IGE), Pascal ALLEMAND (LGL)

TRISHNA: what for ?

+2 billions people by 2050

- Pressure on energy and food
- Pressure on transboundary basins
- Population in fluvial & coastal zones

Global freshwater use

Industry 19% Domestic 11% Agriculture 70%

Source: FAO, 2017

Biodiversity / pressure on the habitat

- In rivers, wetlands, coastal zones
- Modified by dams, pollution

Global warming +2.4°C by 2050

- Impact on Carbon and water cycles
- Extreme events: droughts, floods, storms, fires

Need for reliable metrics, homogeneous along time and on every scale from global to regional

Frequent AND high-resolution measurements of the surface temperature & its dynamics

Mission design

Full resolution coverage of continental surfaces and coastal areas

TRISHNA average revisit (days) as programmed

Mission datasheet

- ISRO/CNES cooperation, launch 2025, 5-year lifetime
- Scientific & operational applications
- Focus on **ecosystem stress and water use + coastal & inland waters**
- Global coverage of continental and coastal areas
- 60 meters nadir spatial resolution (VIS-NIR-SWIR-TIR)
- 5 VNIR bands + 2 SWIR bands + 4 LWIR 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
- Mean Overpass time : 1 PM (LTDN)
- NeDT 0.2K
- Indo-French⁽¹⁾ Joint Science Team (*) with other contributors
- Synergies with ECOSTRESS, SBG, LSTM science & application teams
- Free and open data policy for worldwide scientific community
- Level-2 products include reflectance, LST, LSE, EvapoTranspiration & Stress Index

TRISHNA Products

All products also include quality flags

Level 1C Top-of-atmosphere, Radiometrically and geometrically calibrated
Orthorectified and resampled on a uniform spatial grid (Sentinel-2 tiles, Copernicus DEM)

- TOA reflectances x7 VNIR/SWIR bands
- TOA radiances x4 LWIR bands
- Cloud mask

Urban microclimate monitoring

Urban Heat Island (UHI)

Air Temperature
Rugosity, Wind
Radiative trapping
Impermeability of the soils

Themes:
Hydrology, building heat model, urban climatology

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)

What TRISHNA brings:

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

Exogenous data + Remote Sensing data + urban microclimatology model

→ **Air Temperature**

UTCI : Universal thermal confort index www.utci.org

Cryosphere

Area

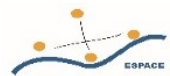
- Sea ice, Ice sheets
Ice caps
- Snow & Glaciers
- Permafrost
Seasonally frozen ground
- River & lake ice

What is at stake

- Snow-melt runoff and debris thickness estimation
- Snow cover change & metamorphism at sub-watershed scale
- Modelling snow energy fluxes
- Snow mass, Snow Water Equivalent (SWE), Snow depth

What TRISHNA brings

- TEMPERATURE (Day & Night)
- EMISSIVITY
- Snow and Ice Albedo
- Snow cover

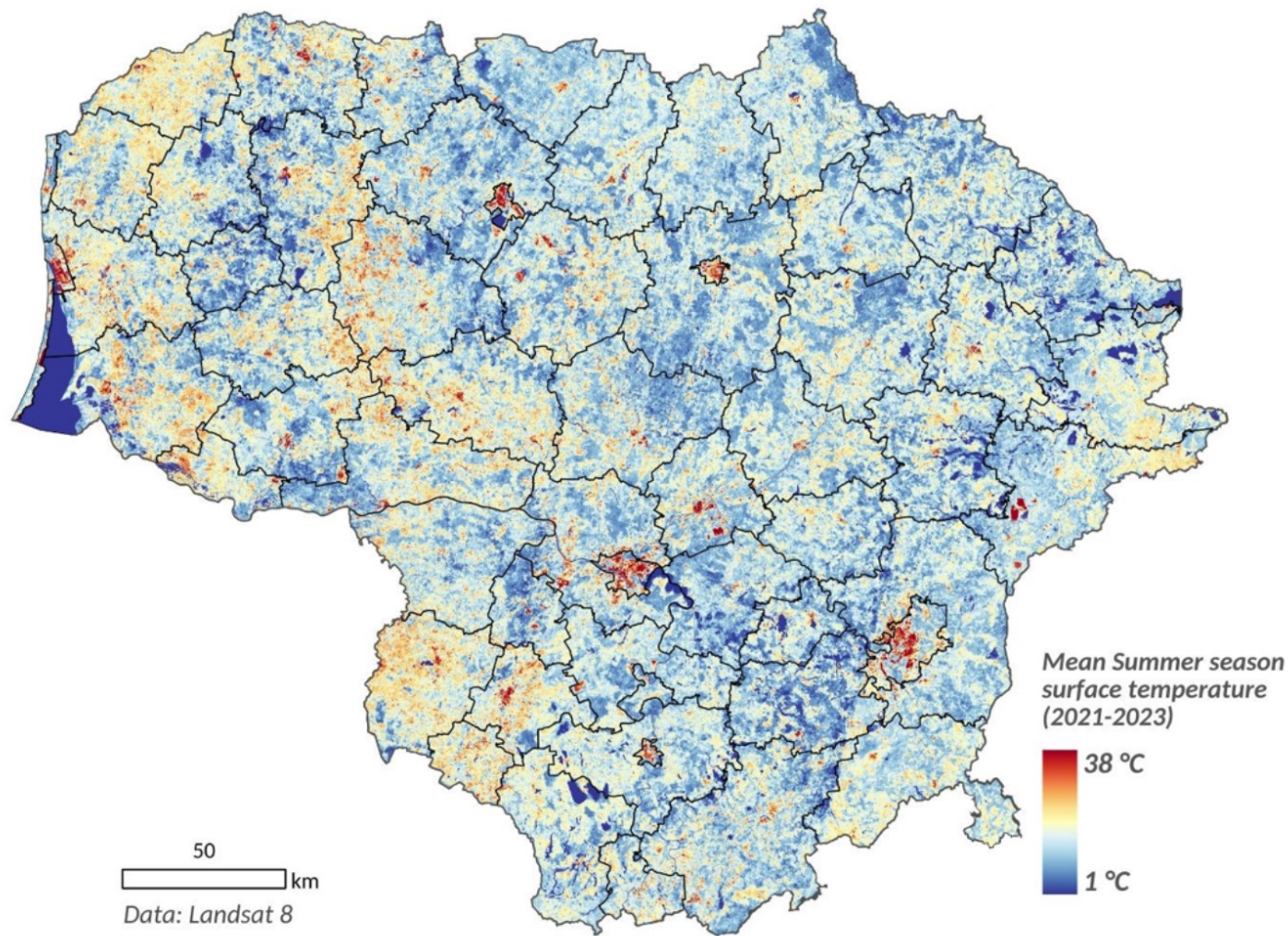
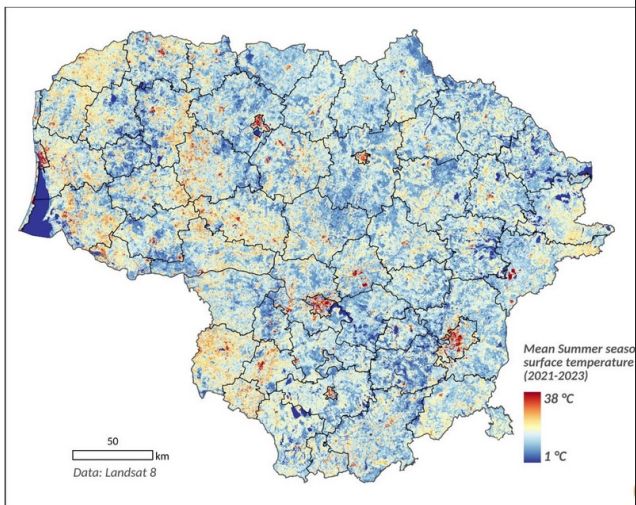


Remote Sensing and Heat Health Systems

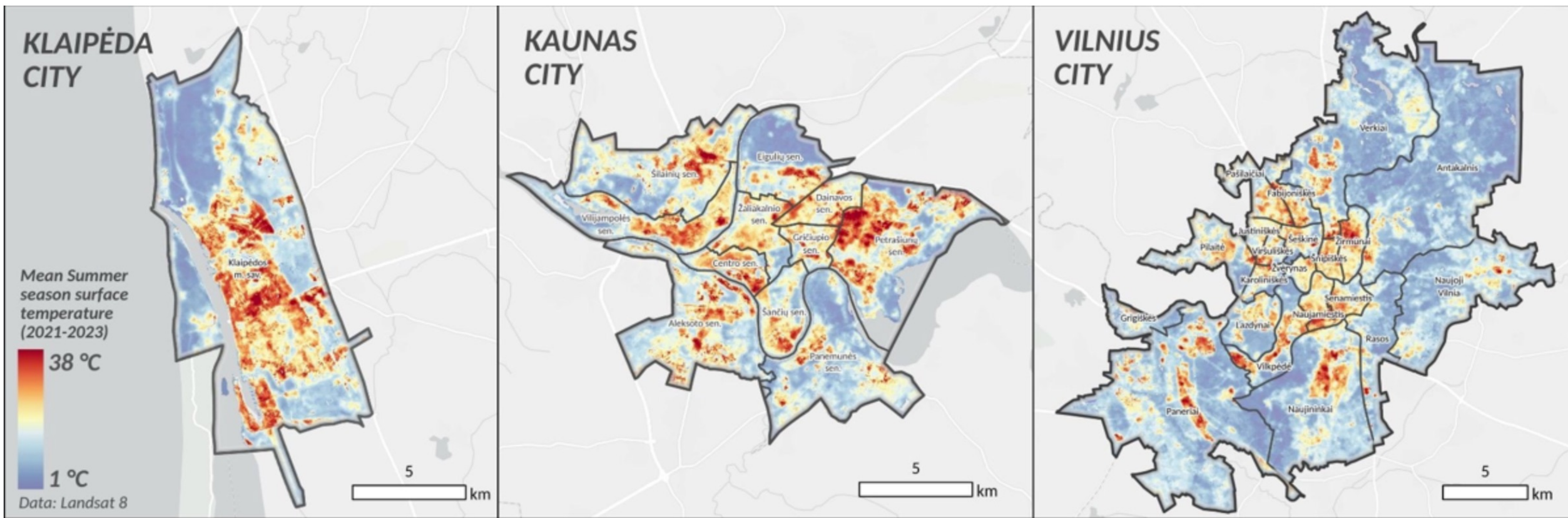
Monitoring urban heat islands from satellites

The formation of heat islands is usually monitored by meas
and their suburbs or by systematically using vehicle-based te

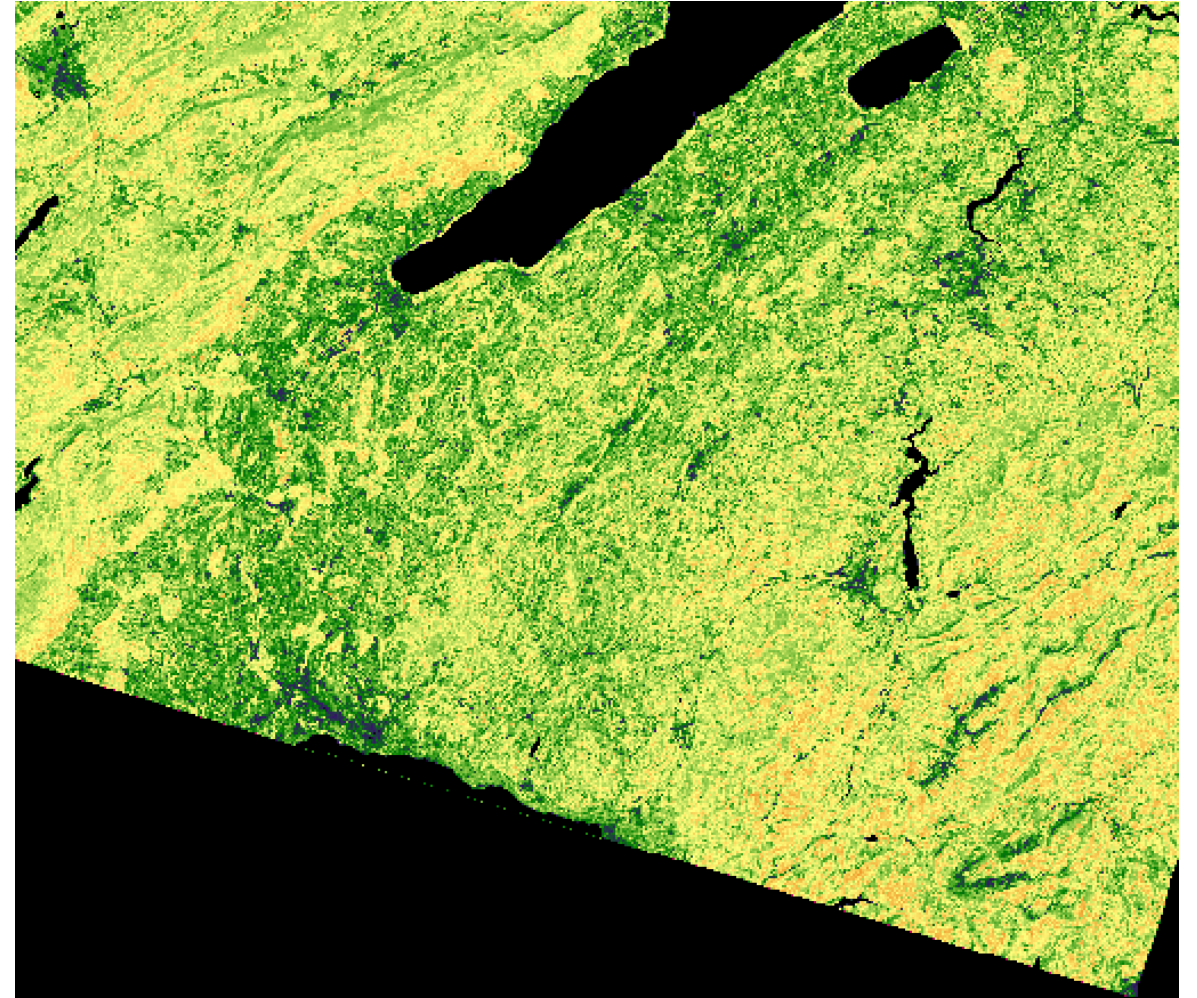
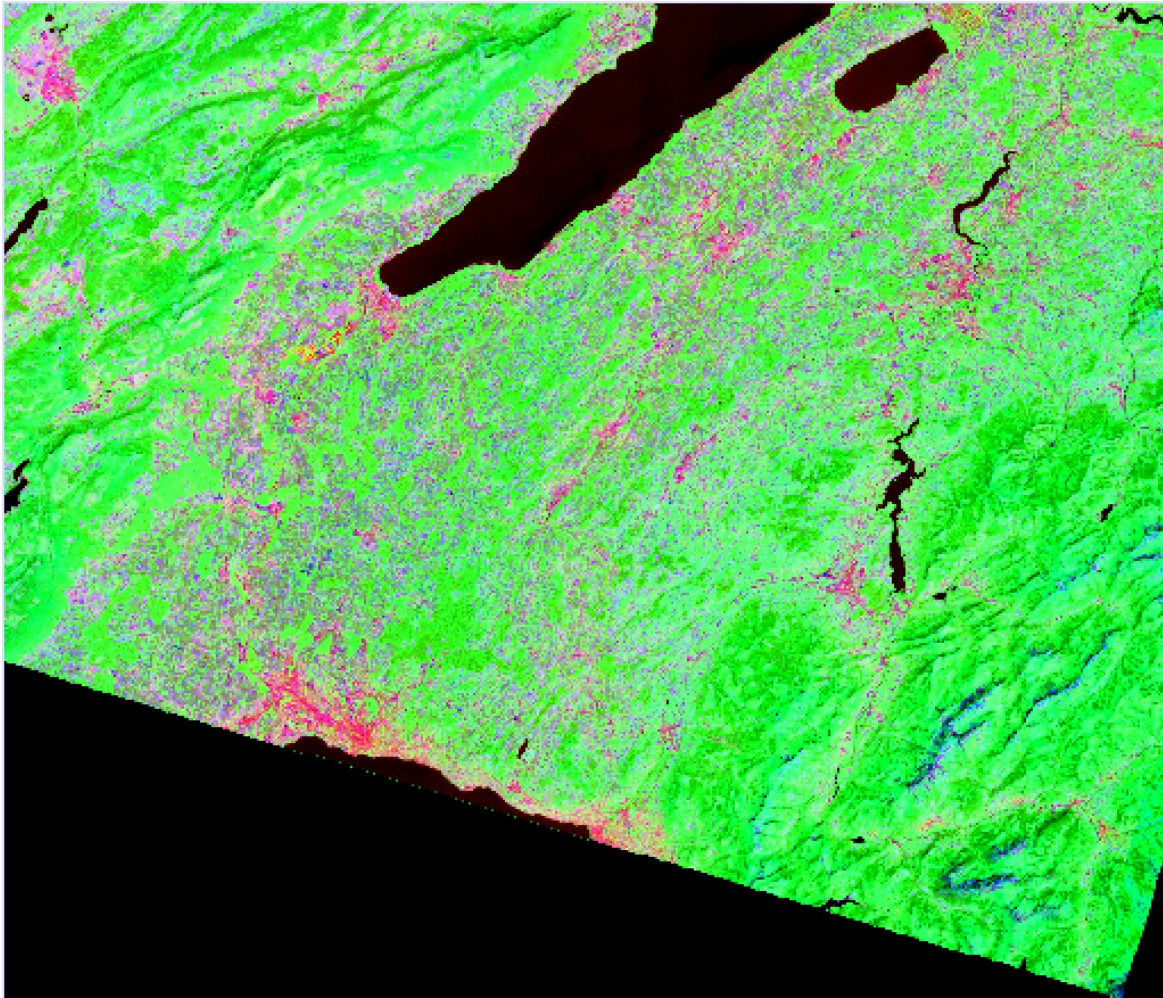
One of the newest methods for monitoring thermal distributi
island effect much easier, as they point to increasing near-su
far-infrared sensors installed on Earth observation satellites,
within these bands. For example, NASA Landsat's thermal inf
territory from 2021 to 2023: it is evident that the major cities –
surrounding areas are cooler on average.



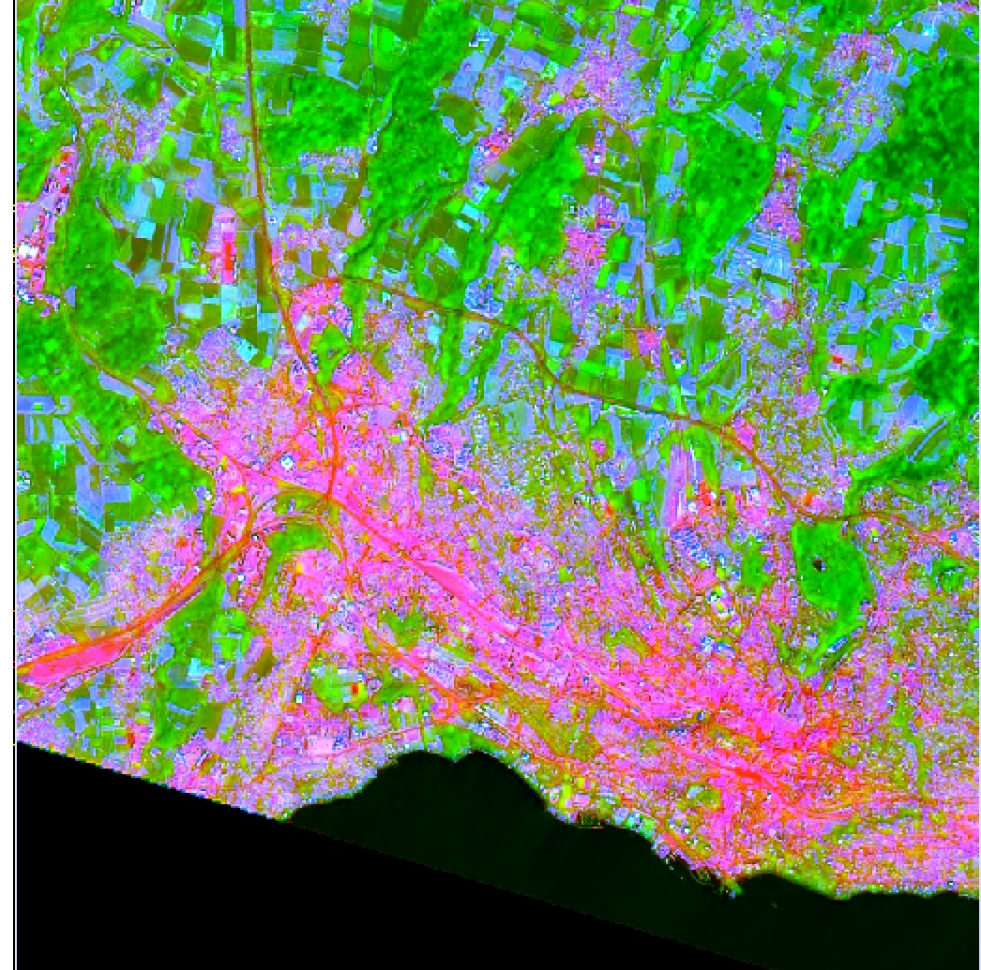
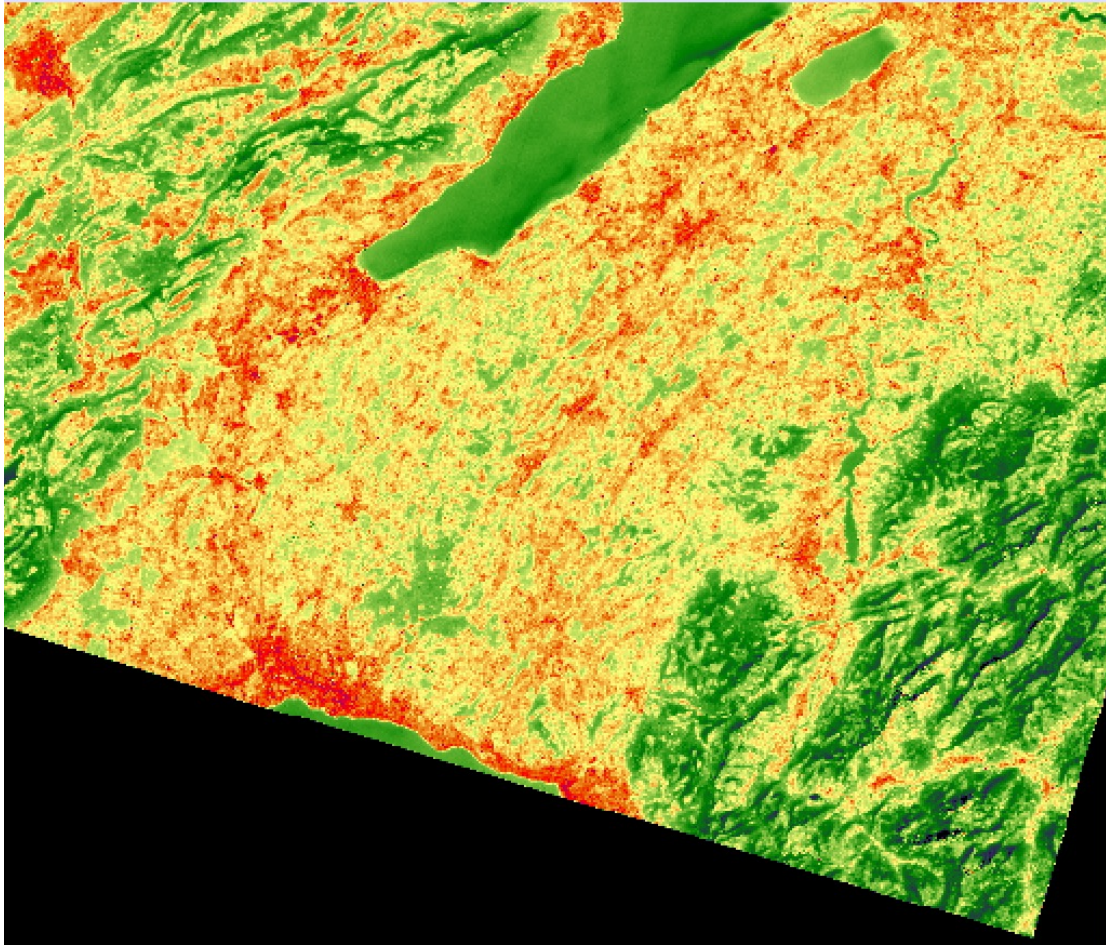
Remote Sensing and Heat Health Systems



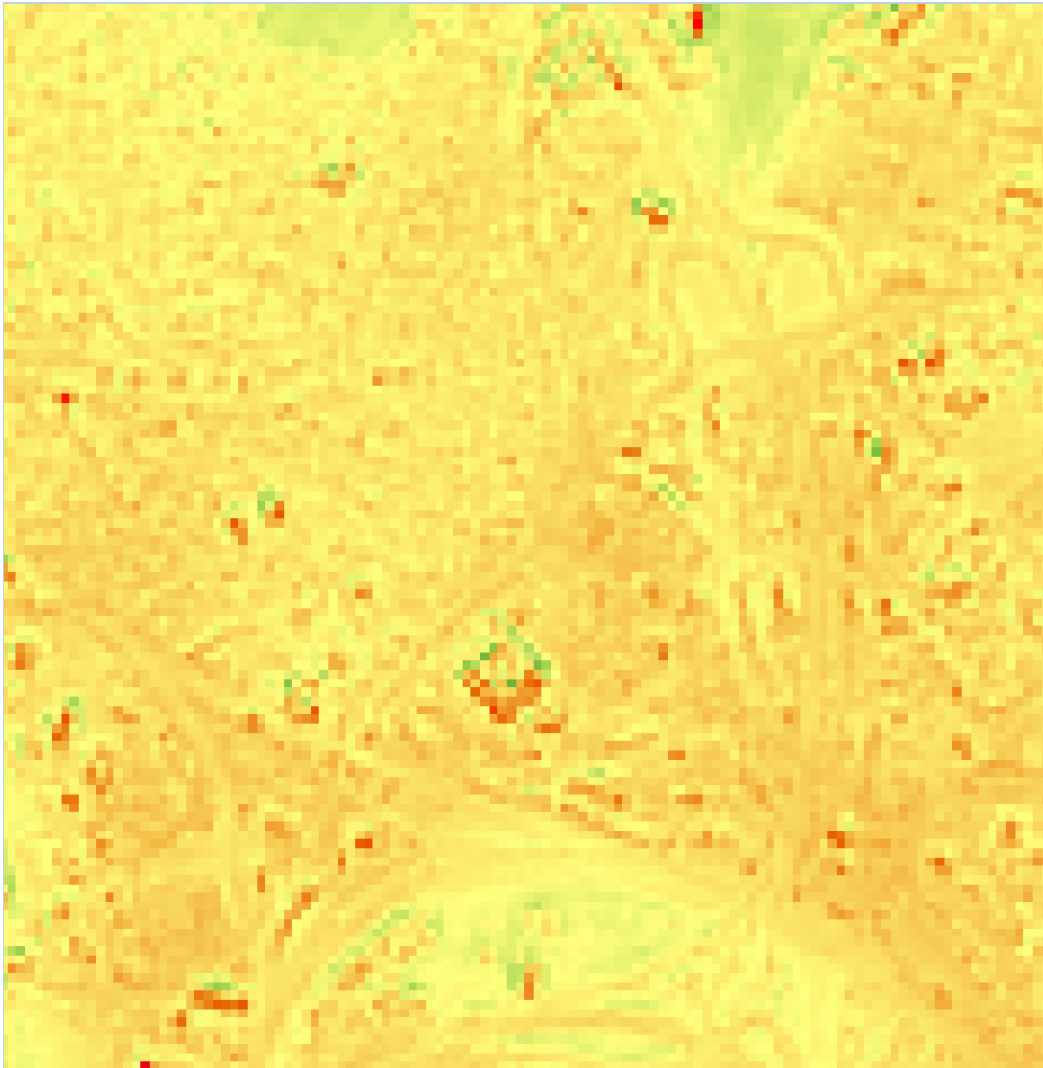
Remote Sensing Thermal Emissions of Lausanne



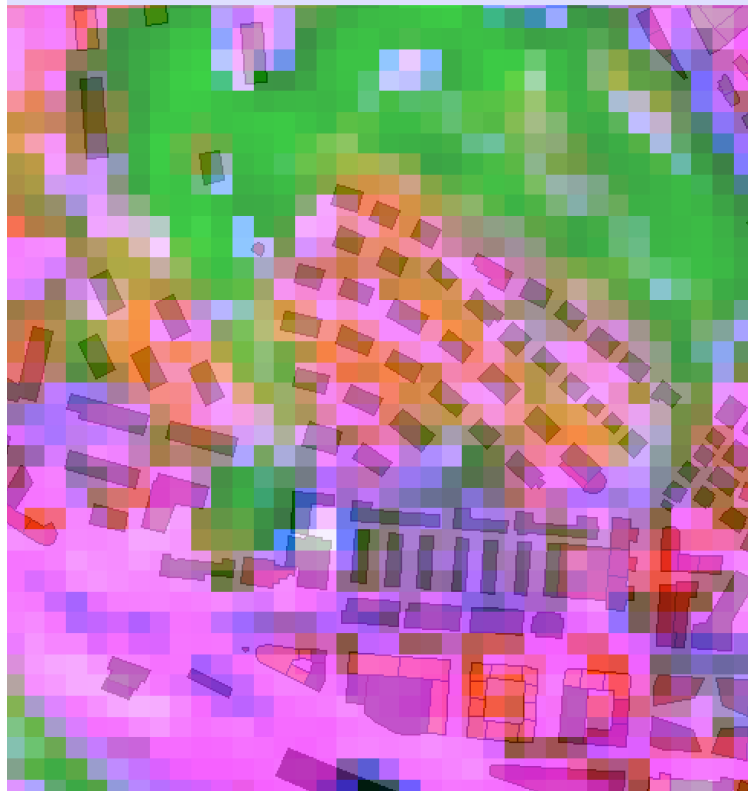
Remote Sensing Thermal Emissions of Lausanne



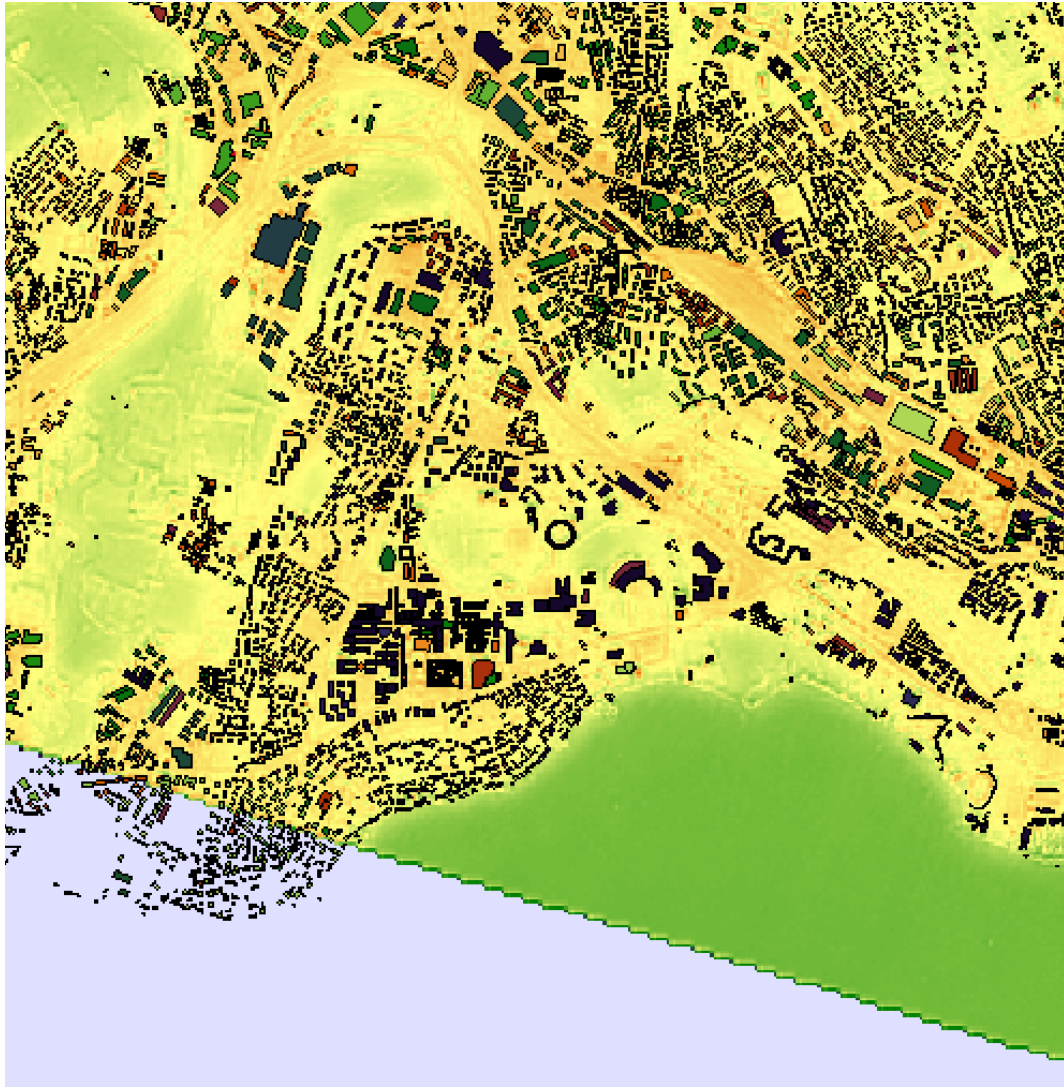
Remote Sensing Thermal Emissions of Chavanne



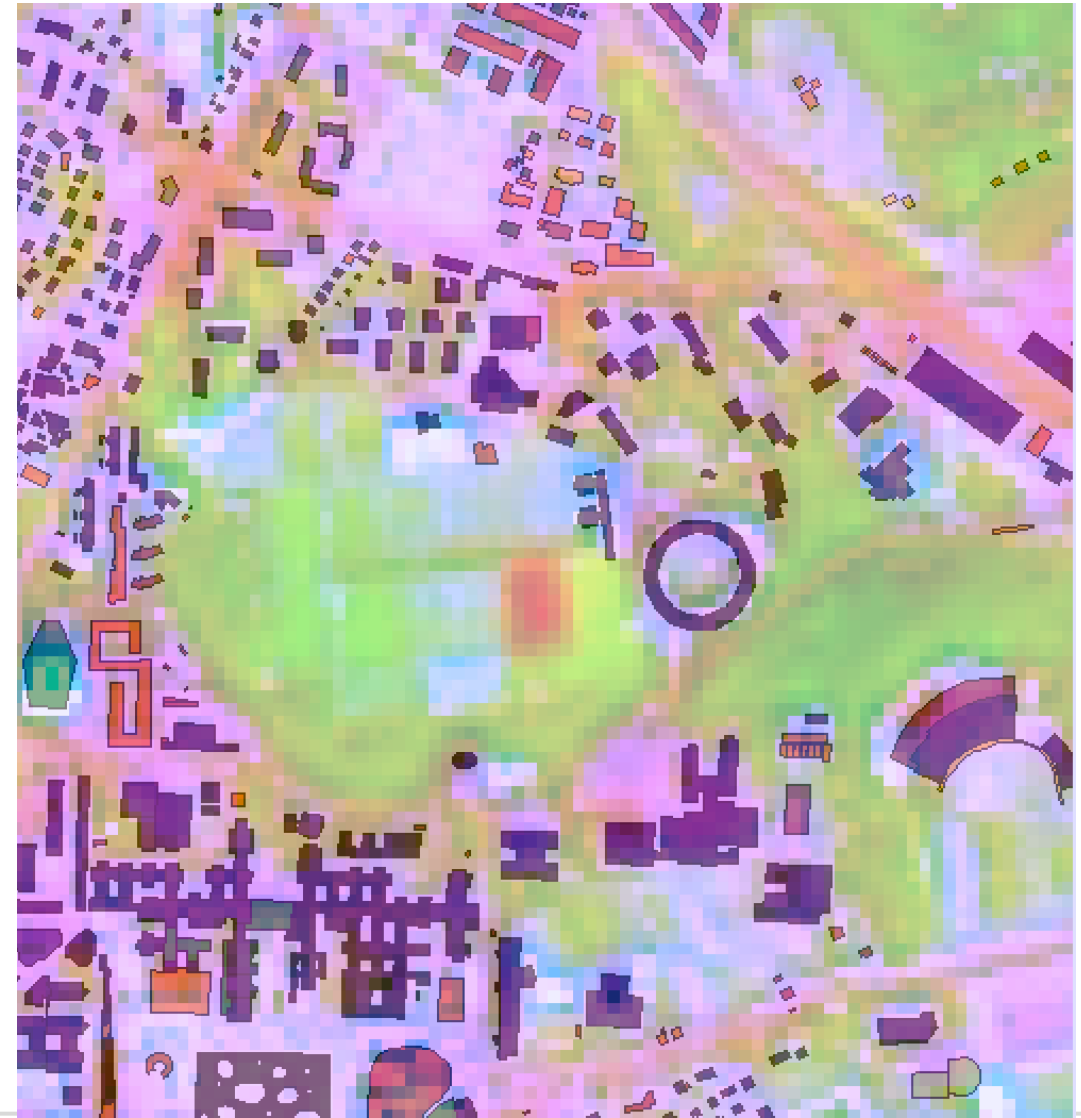
Heat Islands Thermal Emissions and Urban Morphologies



Heat Islands Thermal Emissions and Urban Morphologies

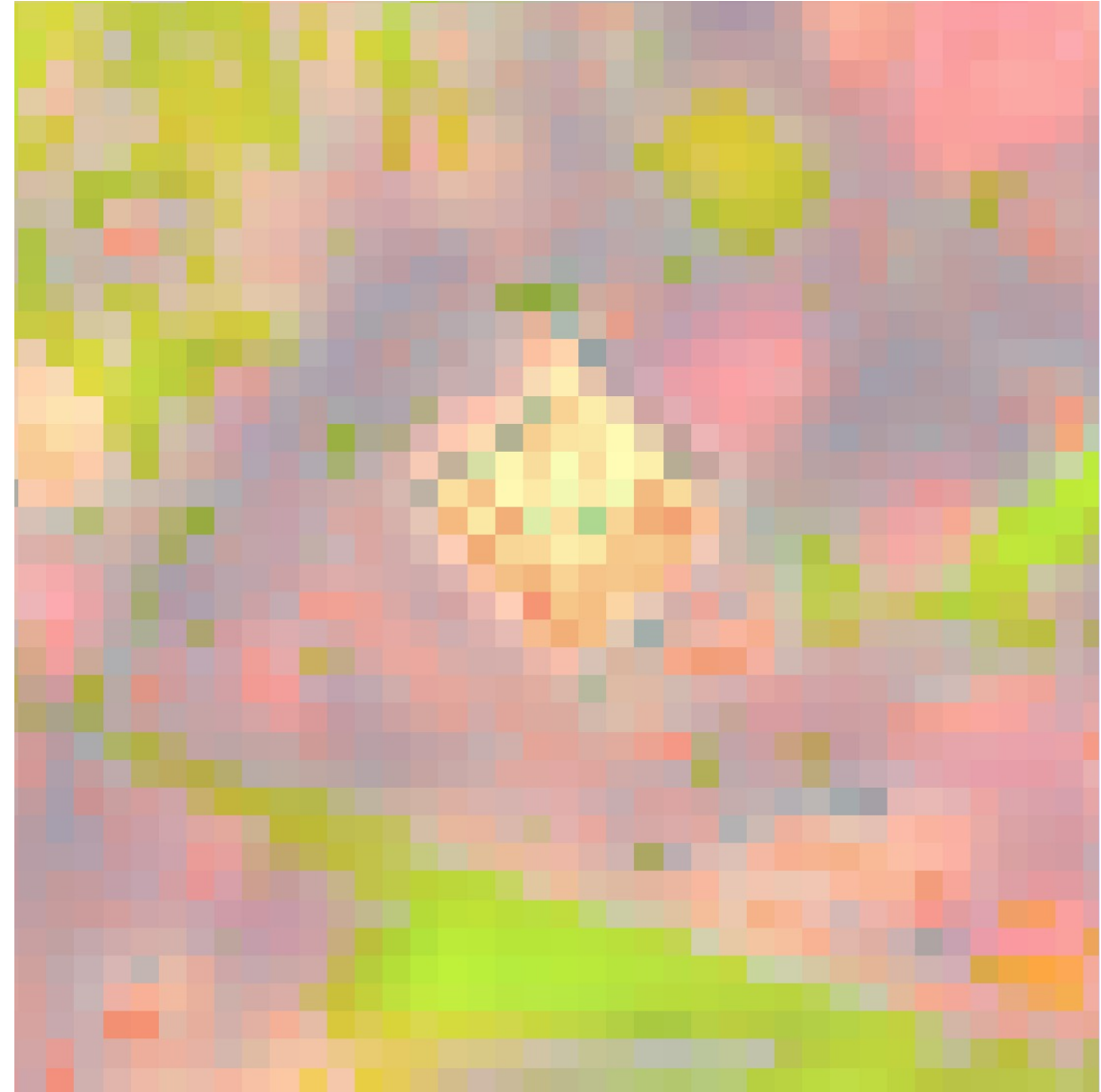


The Goose Game: Search for Heat Hot Spots Invisible to the Human Eye

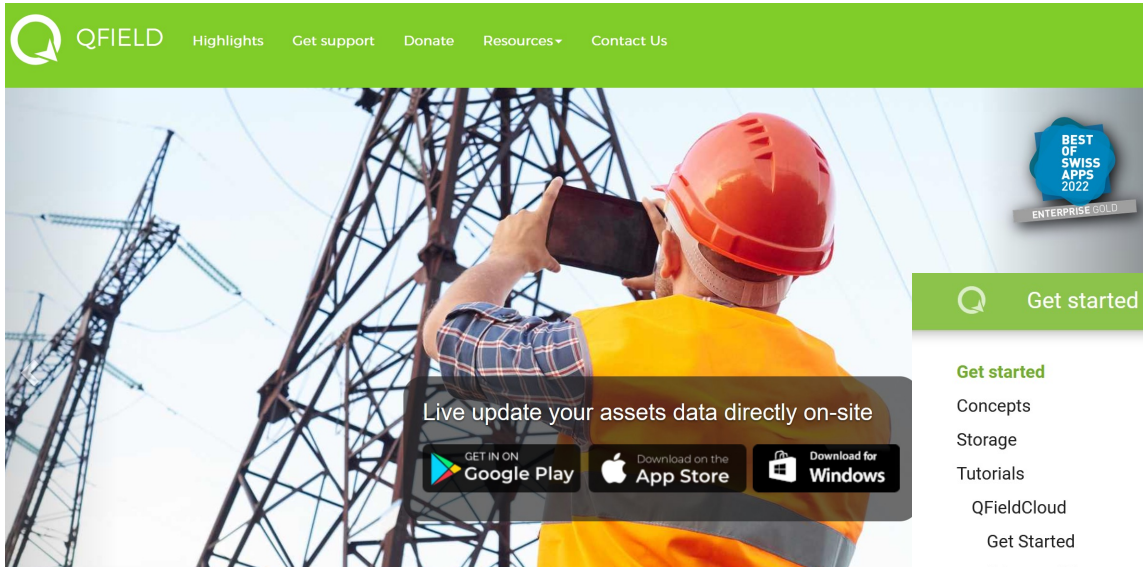


Population exposures of Chavanne's Heat Islands

- Measuring the thermal and temperatures
- Mapping thermal emissions
- Urban morphologies
- Population census
- Urban structures
- Vegetations
- On field data



Data on field acquisition



<https://vimeo.com/695452246>

<https://docs.qfield.org/get-started/>

Get started

Google Play

Back to top

QField allows you to efficiently work on your GIS data outdoor.

QField's optimized user interface hides the full power of QGIS under the hood.

QField 2.0 demo

OPENGIS.ch

2/2: David Signer - Apis Mellifera

General Picture Issues Review Consum

Photo

02:00

vimeo

Table of contents

- QField
- Installation
- QFieldCloud

https://docs.qfield.org

Data on field acquisition

Create a new project

A QFieldCloud project contains all project files and changes.

Name *

Chavanne



Only letters, numbers, underscores, hyphens and dots are allowed.

Only letters, numbers, underscores, hyphens and dots are allowed.

Description

UHI exposures modelling

Owner *

sgadal



The project owner can be either you or any of the organization you are member of.

Is public

Projects marked as public are visible to (but not editable by) anyone.

Overwrite conflicts

If enabled, QFieldCloud will automatically overwrite conflicts in this project. Disabling this will force the project manager to manually resolve all the conflicts.

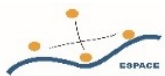
Create a project with a **.qgs** file with OpenStreetMap as a base layer

You can still add more layers and files in QGIS from a local directory on your PC and upload them via QFieldSync.

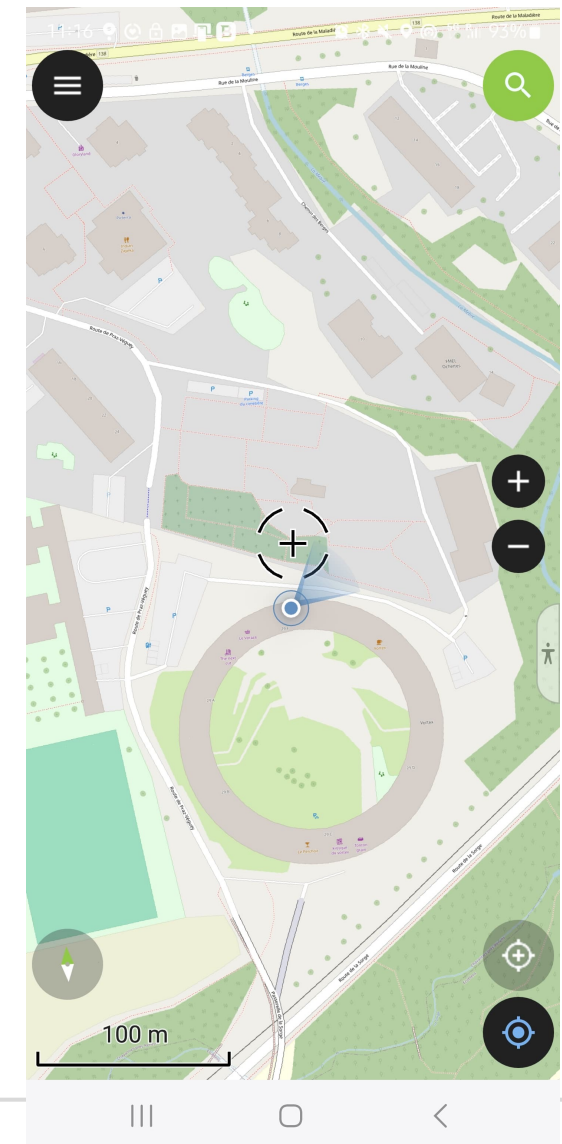
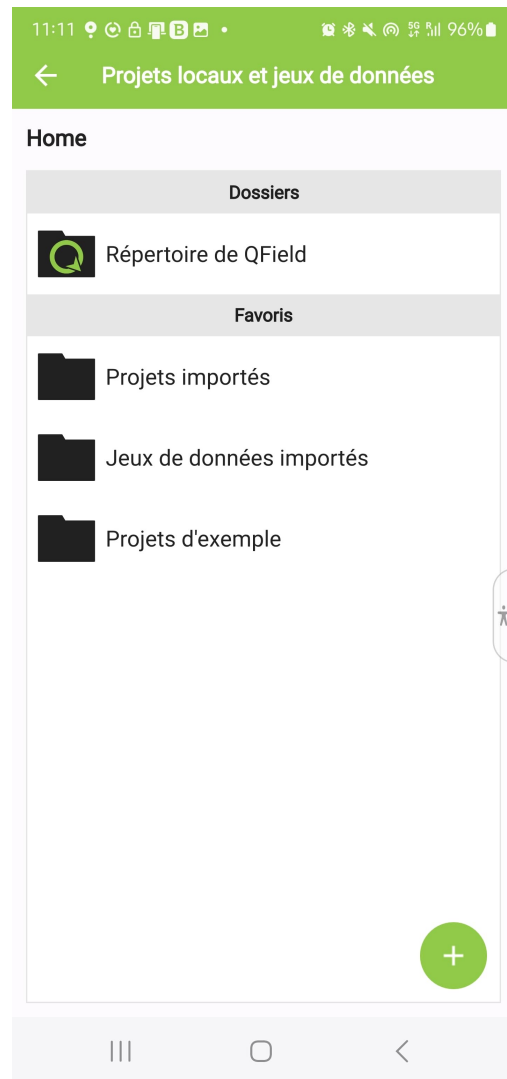
Create a new empty project

You will be responsible for moving all the project-related files within the selected local directory on your PC, with the project file at its root, and upload them via QFieldSync.

Create



Data on field acquisition



Data on field acquisition

https://app.qfield.cloud/accounts/signup/

ADAL Sebast... Aix-Marseille Universit... Отчетно-аналитичес... G Gmils-NEFU PAME Zoom



Registration
Already have an account? Proceed to the [sign-in form](#).

E-mail *

Username *

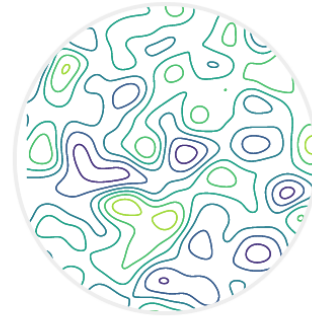
Password *

Password (again) *

Timezone *

Subscribe to the newsletter
By checking this checkbox you agree to receive our newsletter.

Accept terms of services *
By checking this checkbox, you agree with the QFieldCloud Terms of services available [here](#).



sgadal

[Edit profile](#)

Organizations

No public memberships

[Create organization](#)

My pro

Search...

Welcome to QFieldCloud, sgadal!

Seems you don't have any projects yet, but you can easily create projects by pressing the [Create project](#) button above, or in QGIS using the [QFieldSync](#) plugin. If you want to learn more please check the [documentation here](#).



Name ▲

Description

There are no projects yet.



Linking geographic databases among QGIS and QField

The screenshot displays the QGIS software interface with several windows open. The main window shows the 'Extensions | Toutes (1277)' panel with a search for 'qfi' and 'QField Sync' selected. A tooltip for 'QField Sync' is visible, stating: 'Sync your projects to QFieldCloud. This plugin facilitates packaging your projects for use in the field. It analyses the current project and lists the data needed to make the project available in the field. 212 évaluations'. The 'Liste des projets QFieldCloud' dialog is open, showing a table with one project: 'Chavanne' owned by 'sgadal'. A 'Se connecter à QFieldCloud' dialog is also present, showing the QFieldCloud logo and a 'S'identifier' button.

QField Sync

Sync your projects to QFieldCloud

This plugin facilitates packaging your projects for use in the field. It analyses the current project and lists the data needed to make the project available in the field.

★★★★☆ 212 évaluations

Liste des projets QFieldCloud

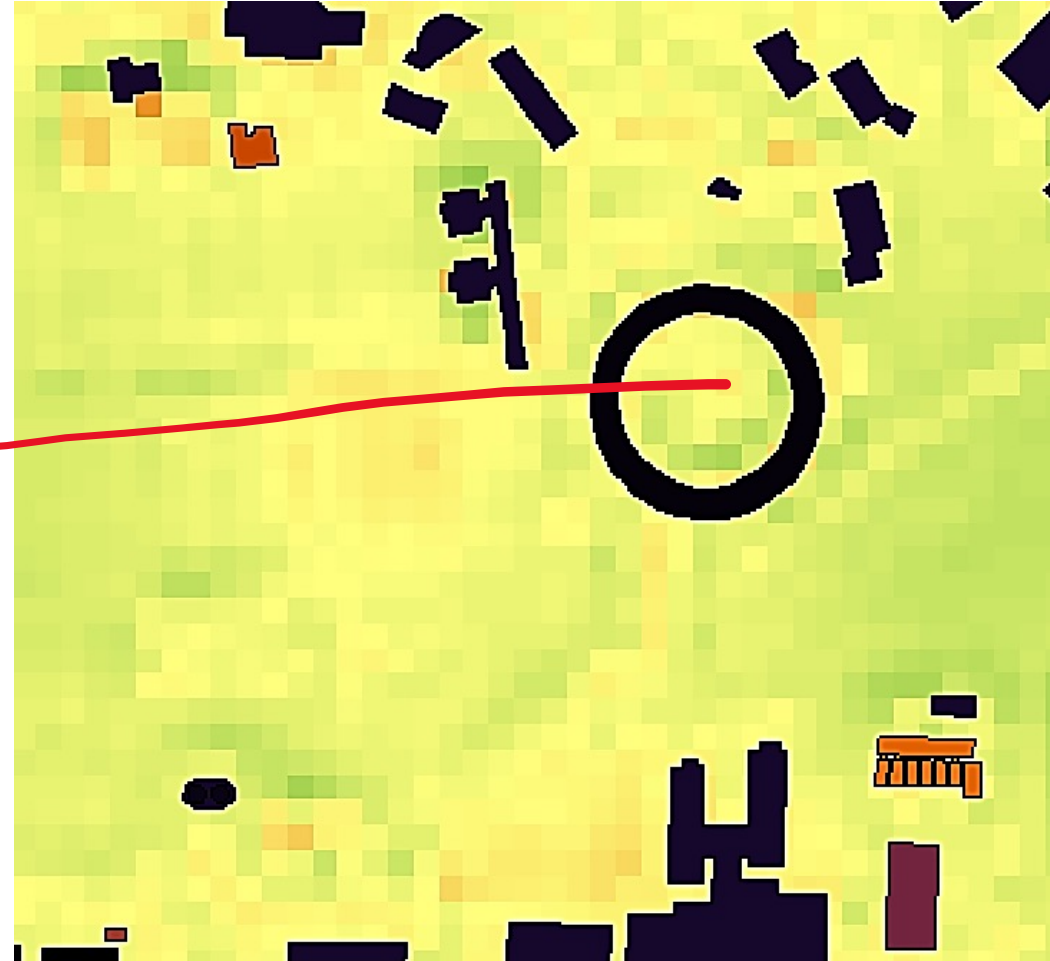
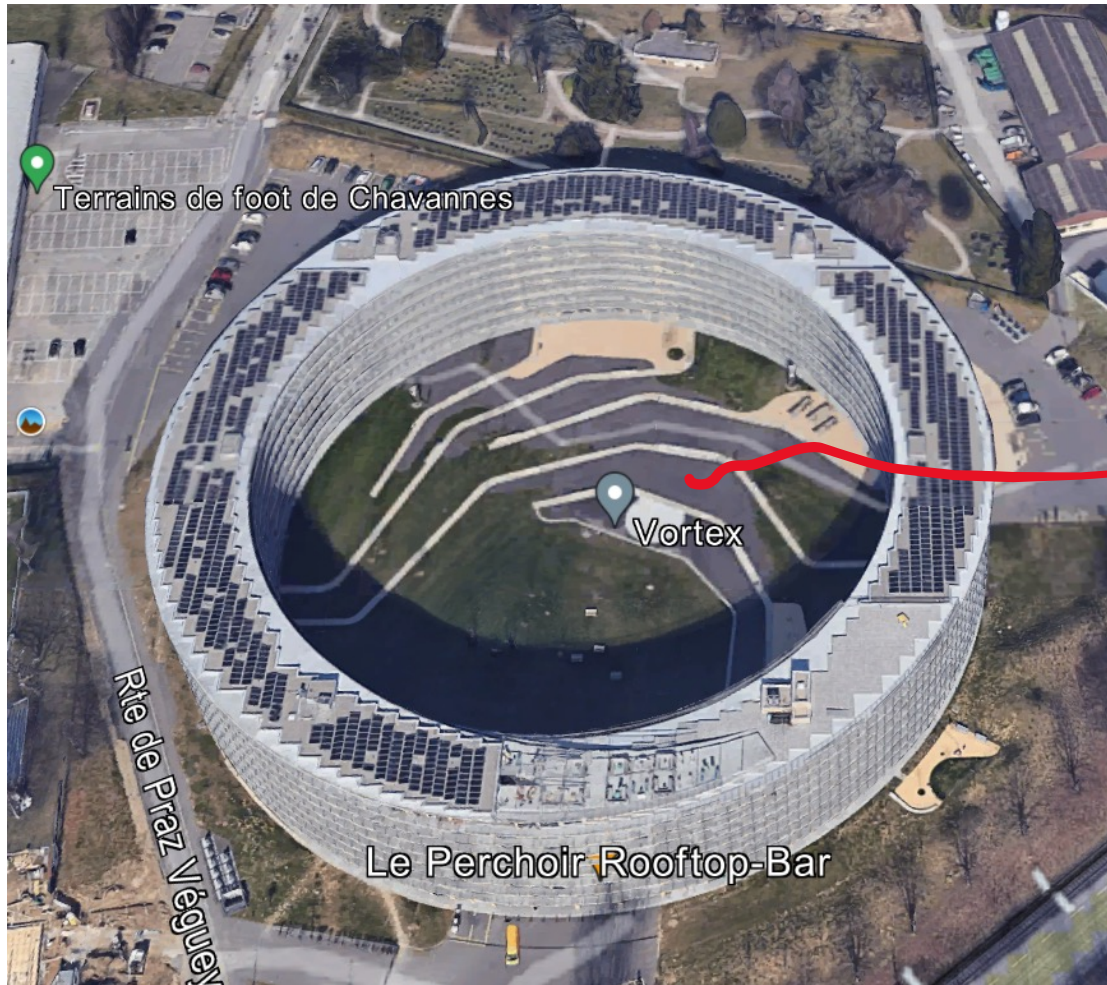
Bonjour, [sgadal](#).

	Nom	Propriétaire
1	Chavanne	sgadal

Se connecter à QFieldCloud

S'identifier Annuler

Go for it!



Prof. Habil. Dr. Sébastien Gadal

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<https://cv.hal.science/sebastien-gadal>

