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Numerical Weather Prediction in Portugal 2021: Surface-Atmosphere Interaction

A Google Earth Engine application to retrieve high resolution Land Surface Temperature from Landsat imagery

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**Motivation**

- Study the urban heat island effect over Coimbra, Portugal

**Why use the GEE?**
- Easy to learn
- Doesn’t require resources
- Analysis of large volumes of data
- Fully independent
The LST algorithm

Statistical Mono-Window algorithm

\[ LST = A_i \frac{Tb_i}{\varepsilon} + B_i \frac{1}{\varepsilon} + C_i \]

\( Tb \) = Brightness Temperature  
\( \varepsilon \) = Emissivity

Algorithm Calibration:

Radiative Transfer Model: RTTOV (v12)

Atmospheric profile data: Borbas et al. (2005)
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The code

https://code.earthengine.google.com/?accept_repo=users/sofiaermida/landsat_smw_lst

https://github.com/sofiaermida/Landsat_SMW_LST
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The GEE platform
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Code structure

User selection:
- Date range
- Landsat number
- Region of interest
- NDVI flag

Start process Landsat_LST

Load Surface Reflectance collection
LANDSAT/L***/C01/T1_SR

Load TOA Brightness Temperature collection
LANDSAT/L***/C01/T1_TOA

Load ASTER GED
NASA/ASTER_GED/AG100_003

Load TCWV data (time interpolation)
NCEP_TPW
NCEP_RE/surface_wv

Mask clouds cloudmask

Compute ASTER FVC; Compute bare ground emissivity
ASTER_FVC; ASTER_bare_emiss

Compute TIR Emissivity
compute_emissivity

Compute LST (map coefficients using the TCWV) SMWalgorithm

Compute NDVI
compute_NDVI

Compute FVC
compute_FVC

User selection:
11 November 2021

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Emissivity

11 November 2021

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17 May 2018
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Land Surface Temperature

17 May 2018
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Quality assessment
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Applications: time-series
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Applications: Image analysis
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Thank you

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