#### **ThermoCorrection**

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Author: Bene Hiebl

An atmospheric and emissivity correction for georeferenced thermal infrared images from close range sensing based on Caselles et al. (1996), Kodimalar et al. (2020), Wiecek (2011) and Minkina et al. (2016).

## Input:

- Georeferenced thermo raster images (.tif) + timeinfo (.csv)
- DSM (.tif)
- FVC (.tif)
- Red Band (optional) (.tif)
- Cam location
- Vertical gradients air temperature and humidity (.csv)
- Emissivity for soil/vegetation
- Radiance air, downwelling radiance (optional)

#### **Output:**

- LSE map
- Corrected thermo raster images

#### Two files:

ThermoCorrection.py

## Correction\_Parameters.txt

```
Datei Bearbeiten Format Ansicht Hilfe
### Input Parameters for Correction.py
### atmospheric and emissivity Correction of Thermo Images (.asc)
### this file has to be within the same directory as Correction.py
UTPUT_LOC = C:\Users\beneh\Desktop\DataThermo\Correction\OUTPUT
THERMO_FOLDER = C:\Users\beneh\Desktop\DataThermo\MonoTest\210811AC\210811AC
THE_INFO = C:\Users\beneh\Desktop\DataThermo\MonoTest\210811AC\timeinfo_210811AC.csv

DSM_INPUT = C:\Users\beneh\Desktop\DataThermo\DOM_small\small-DOM_65_25832.tif

FV_INPUT = C:\Users\beneh\Desktop\DataThermo\ExGreen\wannenkogel-2021-08-11\ExGreen-wannenkogel-2021-08-11.tif

RED_INPUT = NA
### filenames of DSM and Image (has to be format .tif and .asc)
### Camera location coordinates (same projection as DSM)
CAMLOCATION_X = CAMLOCATION_Y =
                           657771
                           5209864
CAMLOCATION_Z
### Station data (Meteo)
                           C:\Users\beneh\Desktop\DataThermo\MeteoRaw\meteostations_20210812_gradients.csv
VERTICAL GRAD
### Parameters for Correction
EM CONST
LSE_VEGETATION =
LSE_SOIL
                           0.95
### Radiance Parameters
RADIANCE_AIR =
RADIANCE_DOWN =
```

# Python requirements

Os, math, matplotlib.pyplot, numpy, rasterio, pandas

## **USAGE PARAMETER FILE**

DONT CHANGE FILE FORMATTING!!

# OUTPUT\_LOC

Full path to directory where output should be stored in

New folder will be created containing:

- Corrected Thermo Images
- LSE map

## THERMO\_FOLDER

Full path to directory where uncorrected georeferenced thermo images are stored in (.tif)

## TIME\_INFO

Full path to time information about thermo images

As the georeferenced raster images usually contain no information about time, a additional .csv file is necessary for connection to station data.

Name of the image, date and time (dd.mm.YYYY hh:mm)

	Α	В
1	Name,Datetime	
2	AC081100,11.	08.2021 18:00
3	AC081101,11.	08.2021 18:15
4	AC081102,11.	08.2021 18:30
5	AC081103,11.	08.2021 18:45
6	AC081104,11.	08.2021 19:00
7	AC081105,11.	08.2021 19:15

## **DSM\_INPUT**

Full path to DSM/DEM (.tif), clipped tot he same extent and same coordinate system as thermo images

## **FV\_INPUT**

Full path to Fractional Vegetation Cover Map.

At the moment only one raster (.tif) can be chosen (which is sufficient for a multiday measurement, but not for longer periods).

## **RED INPUT**

As snow has high emissivity values (0.99) but low VI values a simple snow detection via threshold in the red band of the image was implemented. Set to NA if not necessary.

# CAMLOCATION\_...

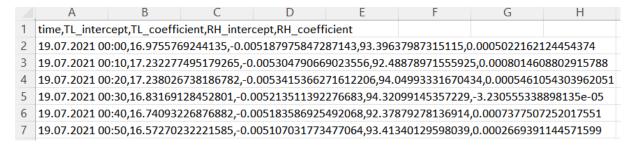
XYZ Coordinates of camera location

#### VERTICAL\_GRAD

Full path to .csv file with information about air temperature and relative humidity gradients.

The gradients for air temperature and relative humidity are used to calculate air temperature and relative humidity for each raster cell on the DSM. A linear regression from several stations near the study area can be used. Please name the columns as following:

time, TL\_intercept, TL\_ coefficient, RH\_intercept, RH\_coefficient



<u>Note</u>: The timesteps do not have to match the thermo timesteps. The coefficent and intercept values will be interpolated within the script.

## **EM\_CONST**

EM\_CONST is a constant that describes cavity effects within the vegetation. 0.005 is the value suggested by Kodimalar et al. (2020). If NA default value is 0.005.

#### **LSE VEGETATION**

Land Surface Emissivity for areas with full vegetation cover (in most studies values between 0.98 and 0.99 are suggested)

# LSE\_SOIL

Land Surface Emissivity for areas with bare soil (in most studies values between 0.94 and 0.95 are suggested)

#### **Radiance Parameters**

These are additional radiation information that are usually hard to obtain. If set to NA default values are 0 and 324. Both values have very little to no influence on the correction for pathlengths of a few kilometres and emissivity values between 0.9 and 1.