EPFL

Welcome to the SSMEO course!

You will learn foundations in:

- Sensing "metricity"
  - How to <u>convert camera-data into a mapping product</u> of a certain quality?

- Geo-information extraction
  - How to <u>extract information from a geo-rectified image</u> & <u>3D digital model</u>?

- Geostatistical phenomena analysis & modelling
  - How to <u>analyze and model geographically related variables</u> in space and time?

Welcome to the SSMEO course!

▪ This translates into three rough big chapters

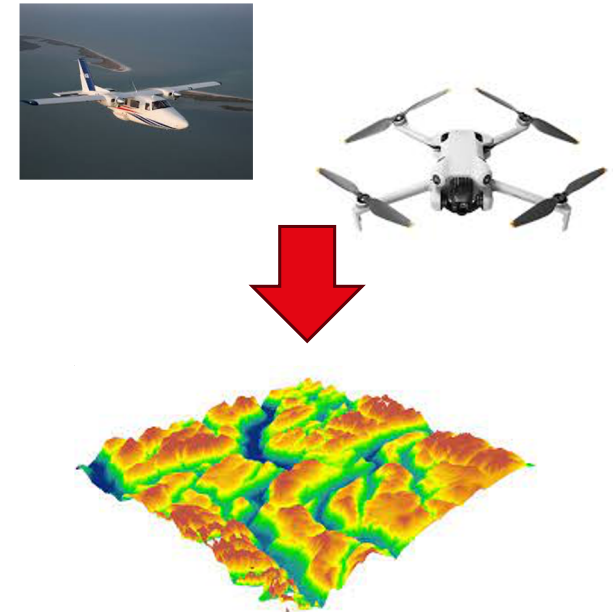1. 3D reconstruction from images
   - How to match images acquired by drones / planes
   - How to create a 3D model from there

2. Feature extraction and learning
   - How to extract variables of interest from said them
   - How to build machine learning models to predict environmental targets

3. Geostatistics
   - How to model spatially correlated processes
   - How to interpolated spatialised measurements

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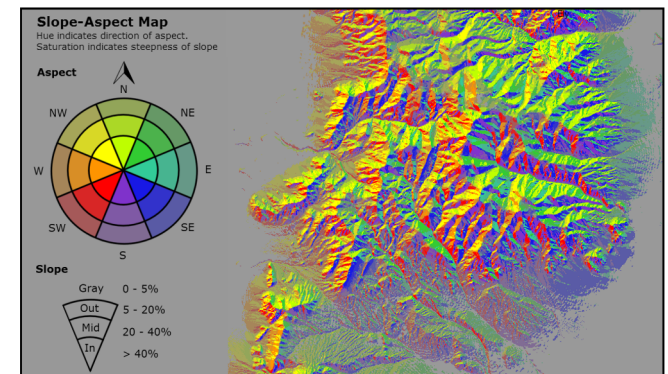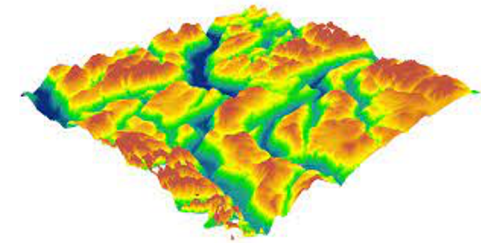1. 3D reconstruction from images
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Slope-Aspect Map
Hue indicates direction of aspect.
Saturation indicates steepness of slope

Aspect

N
NW   NE
W   E
SW   SE
S

Slope

Gray   0 - 5%
Out   5 - 20%
Mid   20 - 40%
In   > 40%

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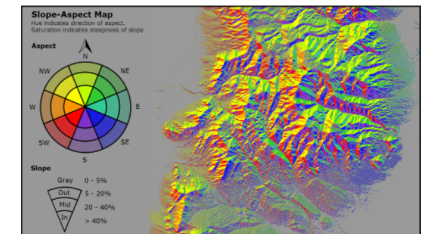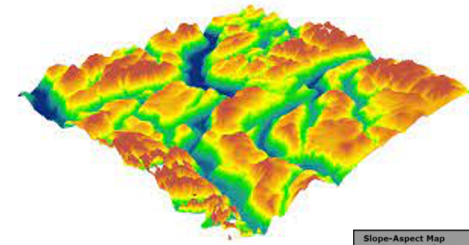1. 3D reconstruction from images
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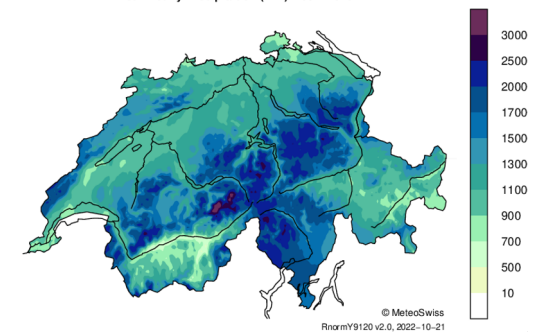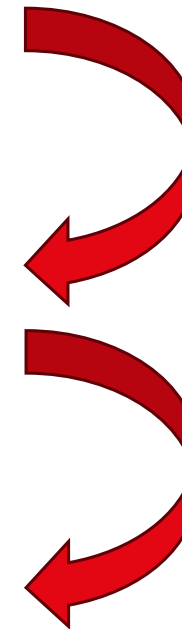2. Feature extraction and learning
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▪ The three parts are tightly related, we walk you through the entire processing chain

1. **3D reconstruction from images**
   - How to match images acquired by drones / planes
   - How to create a 3D model from there

   You need the 3D model to move to this step

2. **Feature extraction and learning**
   - How to extract variables of interest from said them
   - How to build machine learning models to predict environmental targets

   You will extend the AI models with geographical explicit approaches

3. **Geostatistics**
   - How to model spatially correlated processes
   - How to interpolated spatialised measurements

Some admin about ENV-408

- Core course

- 5 credits ECTS

- 5h / week,

  ~40% lectures: Thursday afternoon 16h-18h

  ~60%   exercises (mostly Python-based, a bit of R): Friday morning 9h-12h

About the exercises

- Key for <u>understanding</u> the content of the lectures!

- They follow each other, and often you need the result of one as the input to the next!

- Come <u>prepared</u> and be <u>regular</u>!

- Do it <u>yourself</u> & right! (self-control possible)

- No formal evaluation, <u>but they will be</u> part of the first mid-term

About the exercises (2)

- Tools

  - Python programming, Jupiter Notebooks (parts 1 and 2)

  - R for geostat exercices (part 3)

  - Professional photogrammetry/CV software (part 1)

- The TA-s are there to help and we will provide solutions (in data and/or code) before the following week's one.

Evaluation

- Mid-term #1: 15%:
  - Evaluate understanding of exercises of part I (images-to-DEM)
  - The mid term requires to have running pipelines from the exercises
  - We will ask you to run your code and answer questions with it

- Mid-term #2: 15%
  - Theoretical about geostatistics (pen and paper!)

- Final exam: 70%
  - Theoretical exam covering all content

Schedule

Week	Date for lecture (Thursday)	Block	Exact topic	Teacher	Hours lecture (Thursday)	Hours exercise (Friday)
1	22.02.2024	Images to Ortho-DEM	Intro	devis	1	
			Image creation	jan	1	3
2	29.02.2024		Keypoint generation & matching	devis	2	3
3	07.03.2024		Orientation absolute	jan	2	3
4	14.03.2024		Orientation relative	jan	2	3
5	21.03.2024		Orthophoto and DEM creation	jan	2	3
6	28.03.2024	Machine learning	Features from a DEM	devis	2	no ex (vacances)
	04.04.2024				EASTER	EASTER
7	11.04.2024		mid-term + intro ML	devis	2	3
8	18.04.2024		Regression with linear models, random forest	devis	2	3
9	25.04.2024	Geostat	General intro - Structural analysis 1	alexis	2	3
10	02.05.2024		Structural analysis 2	alexis	2	3
11	09.05.2024		Kriging - 1	alexis	2	3
12	16.05.2024				Ascension	
13	23.05.2024		mid-term + Kriging - 2	alexis	2	3
14	30.05.2024		Kriging - 3	alexis	2	3

Questions?