Sensing and Spatial Modeling for Earth Observation

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EPFL

École polytechnique fédérale de Lausanne

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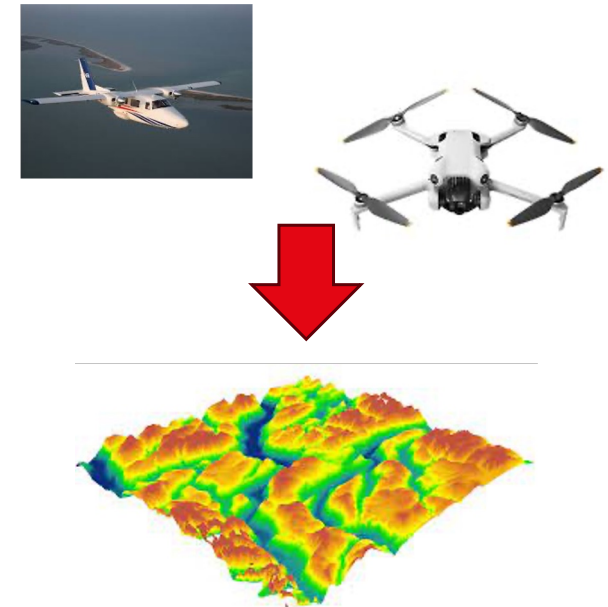
1. **3D reconstruction from images**
   - How to match images acquired by drones / planes
   - How to create a 3D model from there

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
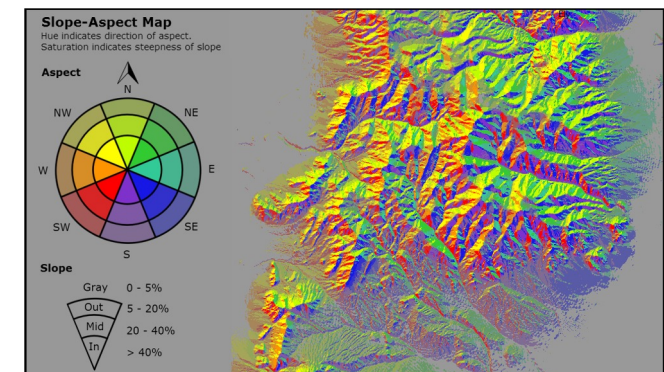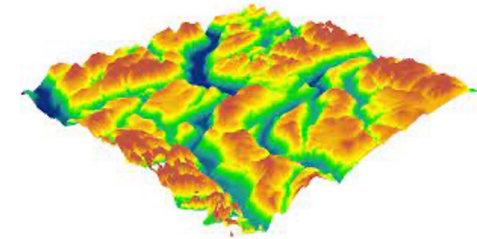   - How to interpolated spatialised measurements

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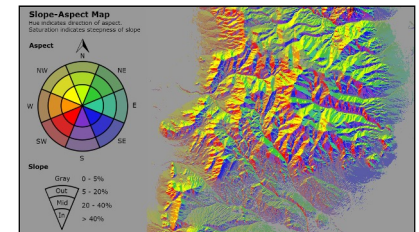This translates into three rough big chapters

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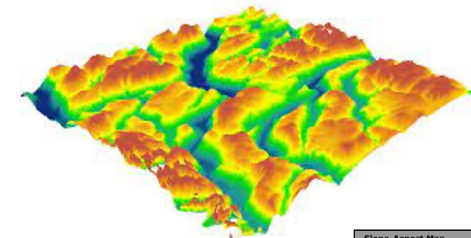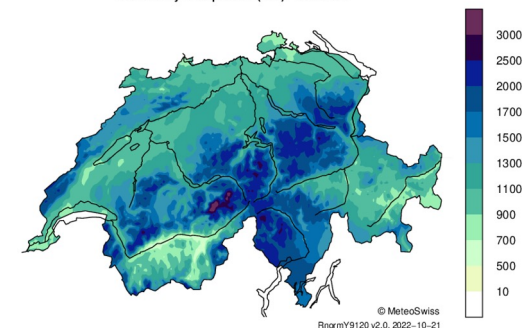
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Slope-Aspect Map

Mean Yearly Precipitation (mm) 1991–2020

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The three parts are tightly related, we walk you through the entire processing chain

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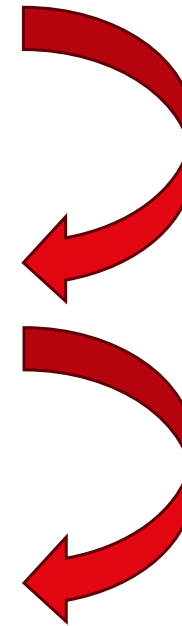
You need the 3D model to move to this step

You will extend the AI models with geographical explicit approaches

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 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		Intro	devis	1	
			Image creation	jan	1	3
2	29.02.2024	Images to Ortho-DEM	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		Features from a DEM	devis	2	no ex (vacances)
	04.04.2024	Machine learning			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		General intro - Structural analysis 1	alexis	2	3
10	02.05.2024		Structural analysis 2	alexis	2	3
11	09.05.2024	Geostat	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?