GABELLINI PIETRO (pietro.gabellini@unifi.it)
Morphometric characterization of clastic materials through image analysis (16 ore)
(periodo luglio-settembre 2022)
Il corso è strutturato per essere erogato in 2 giornate (di 8 ore ciascuna).
E' possibile posticipare o frazionare in modo differente le ore a disposizione, previo accordo, con il docente.

The course provides an introduction to the most used techniques available for the digital image processing and analysis.
It is focused to train the students on the extraction of quantitative information from 2D and 3D images (es. SEM images) and on the morphometrical characterization of several types of natural, clastic materials (eg. volcanic ash, solid atmospheric particulate, sand or loose sediments).
The course involves a first unit dedicated to the theory of the image analysis, with a brief review of the parameters used to quantify the morphometrical aspects of irregular shapes in 2D and 3D. Then, the students will be introduced and trained to the use of the software ImageJ (Fiji; open domain), using various test images and real-life examples. Finally, students will be guided through the analysis of a granular deposit using the automatic particle analyzer (Malvern Morphologi G3s) available in the labs of the University of Florence.

CATERINA GOZZI (1) (caterina.gozzi@unifi.it)
Introduction & Basics of R (8 ore)
(6-7 Giugno 2022)

R is both a programming language and an interactive environment for statistics with an extensive catalog of statistical and graphical methods. Its flexibility, power, sophistication, have made it an invaluable tool for scientists around the world. The aim of the course is to provide the basics to start using the R software. The course is organized in 2 lessons of 4 hours each and will be held at the Department of Earth Science of the University of Florence.
Lesson 1: An Introduction to R: How to install R and RStudio, launching RStudio, overview of the key components and features available, commands, operators and functions, help window.
Lesson 2: R applications to Earth Sciences: practical exercises in R using a geochemical dataset: reading data into the software, basics of research statistics, exploratory data analysis and production of different types of plots in ggplot2 and plotly packages (e.g. histograms, box-plots, bubble plots and correlations matrices)

CATERINA GOZZI (2) (caterina.gozzi@unifi.it)
Writing the PhD Thesis in LaTeX (4 ore)
(23-24 Maggio 2022)

LaTeX is a powerful document preparation system for high-quality typesetting. It is most often used for medium-to-large technical or scientific documents but it can be used for almost any form of publishing. It was created by scientists for scientists and it has a large and active community of users. The aim of the course is to provide the basic knowledge to start typesetting a PhD thesis using LaTeX. The course is organized in 2 lessons of 2 hours each and will be held at the Department of Earth Science of the University of Florence.

Lesson 1: An Introduction to LaTeX: The advantages of using LaTeX, typesetting text, font types, LaTeX environments, packages and templates.
Lesson 2: How to Write the Thesis in LaTeX: basic structure, sectioning, crossreferences, tables and figures, bibliography generation with Bibdesk.

1) Name and surname of Prof./Dr: Prof. Axel Kleidon
-Affiliation: Max Planck Institute for Biogeochemistry - Biospheric Theory and Modeling
E-mail: axel.kleidon@bgc-jena.mpg.de
- For details see CV https://www.bgc-jena.mpg.de/index.php/BTM/AxelKleidon
2) Title of the course: Thermodynamics and Optimality of the Earth system
3) Course content detailed per lesson of 2 h (room real: Sala Strozzi, DST UNIFI and virtual):
4) Course program

Water flows downhill, mountains erode, and wood burns into ashes. If nothing else happened, sooner or later, water would collect in the world's oceans, mountains would be eroded down to the seafloor, and wood would decompose to its raw ingredients. The outcome would constitute a "dead" state of the Earth system, without atmospheric dynamics, hydrologic and biogeochemical cycling, and it would be unable to sustain life. The present Earth is nowhere near such a "dead" state, and thermodynamics provides the key answer to understand why the Earth is not in such a "dead" state and how processes perform work to keep the Earth in an active state.
This short course provides the basics to understand how dynamics are maintained in Earth systems from a thermodynamic perspective. It provides the basics for a comparatively non-technical description of the thermodynamic foundations, illustrate quantitatively how these apply to the various processes of the Earth system, describe how thermodynamics links with organization of flows in space and time (such as turbulent structures and fractal networks), and how these shape the interactions with other processes and their boundary conditions within the system. These descriptions are illustrated with examples that apply these concepts to climate and global warming, hydrology, and limits of renewable energy. The course consists of a mix of lectures, exercises, and discussions.
5) Suggested reading: research articles provided by the teacher
6) Learning Objectives: The course has the primary objective to introduce to thermodynamic foundations of the Earth System.
7) Knowledge and skills to be acquired: How thermodynamics applies to the Earth system. It is less about thermodynamics itself, but rather about how it applies to Earth system processes, their interactions, and the operation of the Earth system as a whole.
8) Prerequisites: Master's degree in scientific disciplines
9) Teaching Methods: frontal lessons using slides
10) Further information: discussion welcome
11) Type of Assessment: written test (multiple choice)
Total hours must be: 12h frontal lessons
Period: September 19th-September 21st 2022
The lessons will be delivered both online and in presence. The lessons will be recorded and available to all the students that cannot take part to the lessons in streaming.
The Webex platform will be used.