Data Visualization and Analysis

BINF4245

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Exercise and Homework Completion Requirements

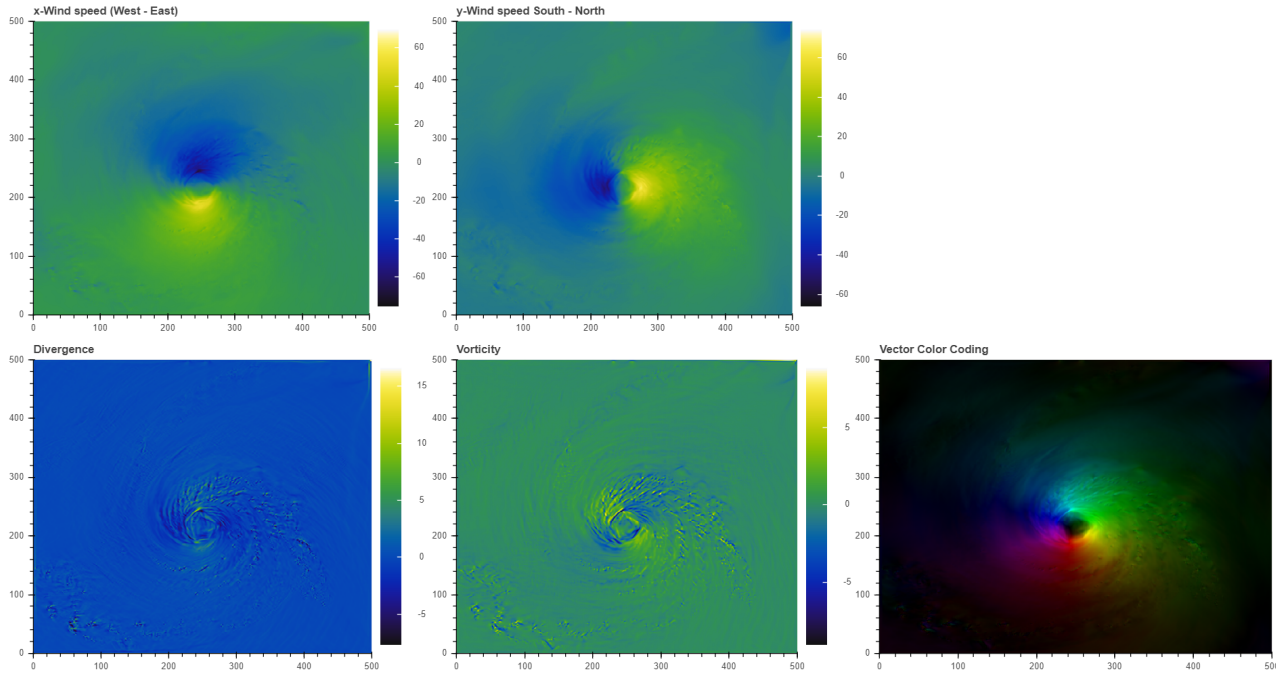
- Exercises and reading assignments are **mandatory** and they must be completed successfully to finish the course and get a sufficient passing final grade.
- Exercises are graded coarsely into categories **pass** or **fail**.
  - *A **fail** is given to failed submissions and partial solutions, and no points are awarded.*
  - *A **pass** indicates that the exercise is sufficiently good to receive the corresponding points.*
  - *Late submissions (up to one day) will result in "-1" point.*
- The four exercises are allocated to the following point distribution: 2 – 3 – 5 – 5
  - A **minimum of 7 points** must be achieved to pass the module.
  - Thus, at least two exercises must be solved correctly, including at least one from the advanced ones.
  - *Failure to achieve this minimum will result in a failing grade for the entire module*
- We award **bonus points** for students who have collected more than 8 points from all the exercises.
  - Thus, **7 points** from the exercises is required, **8 points** is still normal passing, **9 and above** would give 1 or more extra bonus points.
  - Only the bonus points can and will be added directly to the final grade.
- Do not copy assignments, tools to detect copying and plagiarism will be used.
  - *The exercise results are an integral part of the final course grade and therefore the handed in attempts and solutions to the exercises **must be your personal work**.*

Submission Rules

- Submitted code must run without errors using the indicated Python environment, included libraries, packages and frameworks. If additional libraries/packages are needed, please specify these in a *readme.txt* file together with your submission.
- The whole project source code must be zipped and submitted before the given deadline, including exactly the files indicated in the exercise.
- Submit your .zip archive named *dva_ex4_Firstname_Lastname_MATRIKELNUMBER.zip* (e.g. dva_ex1_Hans_Muster_01234567.zip) through the OLAT course page.
- **Deadline is Monday, 21 December 2020 at 23:59h**

Exercise 4

In this exercise, we will get some practical experience with the processing and visualization of a 2D vector field dataset, which is extracted from a multivariate dataset that simulates a hurricane from the National Center for Atmospheric Research (NCAR) in the United States. The original data consists of several time-varying scalar and vector variables over large dynamic ranges; more details about it can be found from the following link: http://vis.computer.org/vis2004contest/data.html. In this exercise, we will only deal with the "wind speed" in a certain time step and compute the divergence, curl and vector color mapping for a specific height slice using Python.



Final result: Five plots showing x- and y-wind speed, Divergence, Vorticity and Vector Color Coding

Task 1: Calculate the divergence of the wind vector field and visualize it in a plot.

Task 2: Calculate the vorticity of the wind vector field and visualize it in a plot. Use the signed value of the magnitude for the visualization, since this allows the expression of the rotation direction. Have a look at the tutorial slides for more information.

Task 3: Calculate the Vector Color Coding of the wind vector field. For the HSV to RGB conversion, either use pythons colorsys library or implement it on your own using the following formula:

https://www.rapidtables.com/convert/color/hsv-to-rgb.html

For all tasks, additional explanations can be found in the lecture slides about vector fields, the slides from the tutorial session and in the skeleton comments.

Important: All deliverables of this exercise must be submitted before the deadline. The absence of any required files will automatically lead to a **FAIL**.

Submission:

- clean version of your code file with proper comments (**.py** format. **No** .ipynb files!) that runs without any errors.

- readme.txt – Use this file for your comments or remarks (if necessary). If you used any additional libraries that are not imported in the skeleton explain why and for what in this file. This file may be empty, but **not** absent, if you have no comments and if you used only the provided libraries.

- An export of the final dashboard in .pdf, .jpg or .png format. (A screenshot is also accepted.)

- Put all required files into a .zip archive using the naming scheme detailed on the first page of this document. Put the files directly into the archive and do not package your working directory.