Python for Oceanography course

Universidad de Cádiz
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Context

During a meeting about Sea Level in Palma de Mallorca in June 2015, Irene Laiz, PhD in Oceanography and working at the Applied Physics department of the University of Cádiz (UCA), proposed to organise a course on *Python in Oceanography.*

We suggested to have 2 instructors (E. Mason, IMEDEA, and myself) in order to be more efficient during the preparation and the execution of the course.

The main dates for the preparation of the course were:

25 June - 1 July 2015: preparation of the application.
2 July 2015: the application was sent to "CONVOCATORIA DE ACTUACIONES AVALADAS PARA LA FORMACIÓN DEL PROFESORADO".
5 November 2015: the application was approved and the budget accepted.

Objectives

The main objectives were:

1. To familiarise the participants to the use of Python and explaining the differences with respect to other programming languages frequently used in ocean sciences (Octave, Matlab, Fortran).
2. To show how to read and represent oceanographic data from various sources (i.e., multi-platform).
3. To find the resources (web, tutorials, documentations) to face specific problems in oceanography and data visualisation.

Content

A general introduction was focused on the following topics:

- Presentación general: qué es el Python y qué ventajas ofrece sobre otros lenguajes de programación
- El entorno de trabajo de Python: escritorio, command window, path, editor, notebook
- Acceso a y descarga de librerías específicas: Seawater Library, etc
- Paquetes para desarrollos científicos: numpy, scipy, matplotlib, basemap, netcdf4, …
- Tipos de datos: vectors, matrices, tuples, lists, dictionaries.

After this introduction, the course was made up of 4 modules.

Programación en Python 1

- Ficheros de comandos (scripts).
- Importación y exportación de datos, lectura y escritura de ficheros en diferentes formatos: ascii, netcdf, images.
- Acceso de datos a través de protocolo OPeNDAP.

Programación en Python 2

- Representación gráfica de series temporales de datos: dibujo de líneas (plot), scatter plot.
- Comando subplot, control de los ejes.
- Ejemplos de datos: nivel del mar, temperatura de un estación fija.

Programación en Python 3

- Representación de campos bidimensionales y representación gráfica sobre mapas: pseudo-color (pcolor) plots, scatter plots, contours y filled contours.
- Ejemplo de datos: salida de modelo numérico, batimetría, datos de satélites, velocidades de radar alta frecuencia

Programación en Python 4

Creación de funciones y módulos especializados.

Note: this program describes what was written in the proposal and in its majority, what was presented during the course. However, small differences may exist and adaptations have been made between November 2015 and January 2016.

In addition to the presencial part of the course, 2 exercises were proposed. The evaluation of the 4 students registered to the courses will be done during the week following the course, based on the way the solved the exercises.

Organisation

The course took place from 27 to 29 February, 2016 at the University of Cádiz.

It was divided into 3 sessions of 4 hours (from 4 PM to 8 PM).

Computer room

The room was equipped with 20-25 laptops with an internet connexion. Python and its main packages were installed in a virtual machine to which the participants could connect using NoMachine NX client (https://www.nomachine.com/download). We had superuser privileges (*sudo*) to install missing packages or tools, for example *pip*. Unfortunately after the disconnection of the NX client, all the installations had to be done again.

Material

The course was based on a presentation (Latex) and Python notebooks (same format as what was presented during the CMEMS User Regional Meetings).

All the resource were made available though a github repository: https://github.com/ctroupin/PythonCourseCadiz2016. The content was updated following the comments received during the course.

Note: it is planned to modify the name of the repository to PythonCourseOceanography.

Most of the notebooks use real data obtained either from SOCIB thredds server, or from Puertos del Estado server.

Communication with the participants

A *moodle* was set up in the UCA intranet. It was proposed to upload the training material to that moodle, but since the material was already available and updated frequently on github, it was decided not to upload the intranet.

Participants

15 participants, among which:

- Staff of IEO Cádiz (2).
- Staff of CSIC-ICMAN.
- PhD Students.
- Profesors of the UCA.

Feedback

The feedback during the course was very positive, many participants were surprised of the capabilities of Python. We had numerous questions and comments during and after the courses.

The exercises were positively seen and all the participants were keen to try to solve it as soon as possible.

The organiser plans a similar course for 2017, with the possibility to have a course for intermediate user.

Conclusions

Overall the course was perceived as very fruitful, both for the participants and the teachers.

Python is a good alternative to proprietary software often used in universities, and this could result in a decrease in expenses.

The materiel created and uploaded to github could be used for other courses or even in the frame of European projects where SOCIB is responsible of tasks related to training.