WuMapPy - an open-source software for geophysical prospection data processing

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Wumap is the outcome of successive software developments achieved by the archaeological prospection group (Centre de Recherche Géophysique de Garchy and UMR 7619 Sisyphe, now Métis) for processing and interpretation of archaeological surveys (and also other Near Surface Geophysics observations or measurements). It is devoted mainly to the processing of magnetic, electromagnetic (EM) and resistivity data. A first software, "TGP", had been developed at the beginning of the 1980s for the PC/DOS environment. The Windows version was initiated in the mid 1990s and regularly adapted until its "stabilized" WumapN version (2002) was developed together with its English version, WumapA (both using FORTRAN in the Windows environment).

Wumap integrates a large number of features for visualizing and processing geophysical prospection data (Fig. 1):
  - data can be imported in several file formats.
  - different map visualization options:

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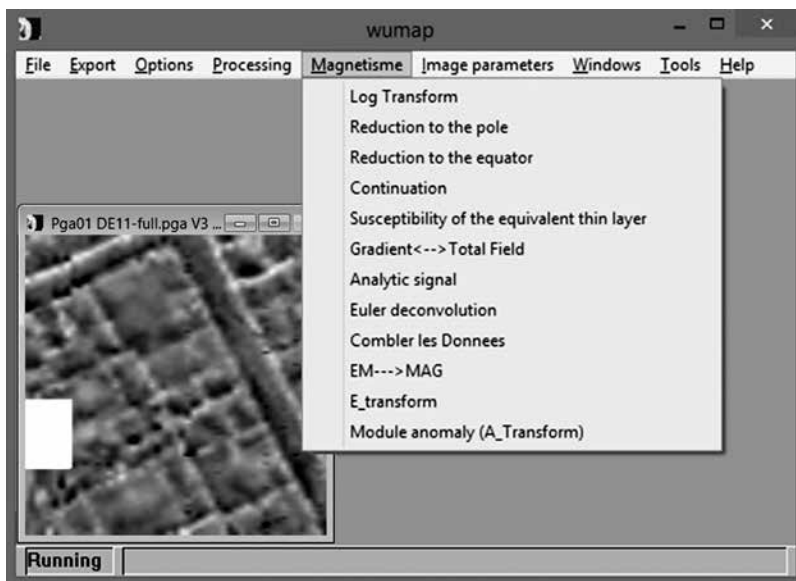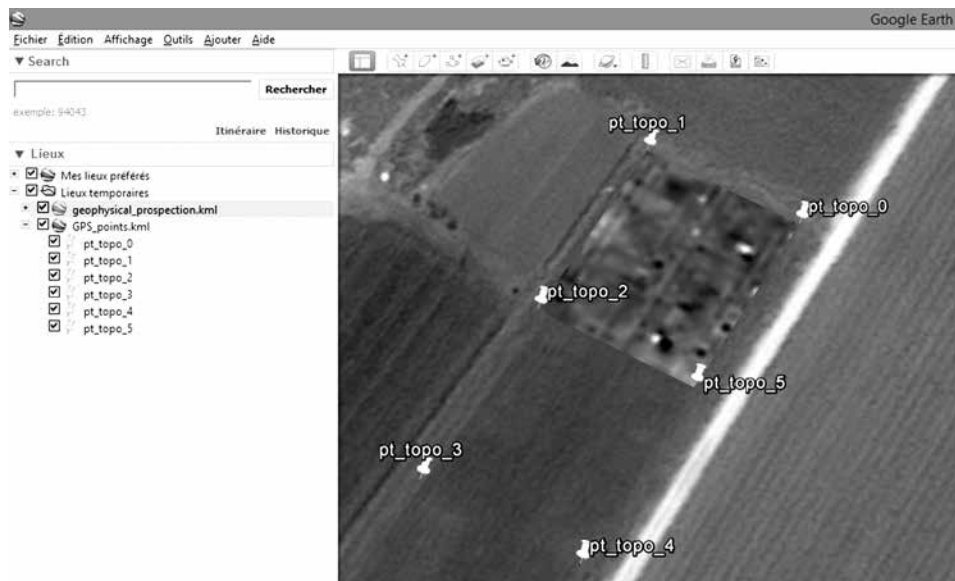
Fig. 1. Wumap menu screenshot

Fig. 2. WuMapPy to Google Earth integration example

  º 15 colour scales
  º adjusting of the minimal and maximal data values to the scales
  º application of logarithmic or arithmetic scale
  º trimming
  º adjustment of areas
- numerous data and image processing functions:
  º median filtering
  º outlier removal
  º elimination of regional drift
  º destriping
  º wallis filtering (increasing contrast)
  º directionnal filtering
  º FFT
  º zigzag (festoon) correction
- Magnetic data interpretation (both magnetics and EM):
  º magnetic pole/equator reduction
  º continuation
  º gradient – total field conversion
  º euler deconvolution
  º conversion of magnetic prospection data to EM susceptibility and vice versa
- Simultaneous processing of several surveys or several parameters of a single survey.
- Different export options of the processed data in various formats, including image file (bmp, grd, dat).

With time, software maintenance started to be difficult as the programming language and graphic interface became obsolete. Hence, in order to keep these functionalities working, and to facilitate maintenance and update efforts, a deep re-engineering of Wumap in modern computing language was vital.

Why Python?
- It is a programming language with open-source development environments.
- More and more scientists and engineers are computing under a variety of operating systems, motivating the choice of a multi-platform language (Windows, Linux, MacOS …).
- Many drivers are being developed by a large "Python community" and are freely distributed on the *http://pypi.python.org* website.
- WuMapPy will also be freely distributed on the "pypi.python.org".
While still featuring all functionalities present in Wumap, WuMapPy will be enriched with other functionalities:
- 1D to 3D resistivity interpretation/inversion algorithms for data acquired with miscellaneous types of DC electrical resistivity arrays and EMI devices.
- Transform raw EM data into soil physical properties (electrical conductivity, magnetic susceptibility, magnetic viscosity)
- Build a dataset directly from several geophysics prospection data files.
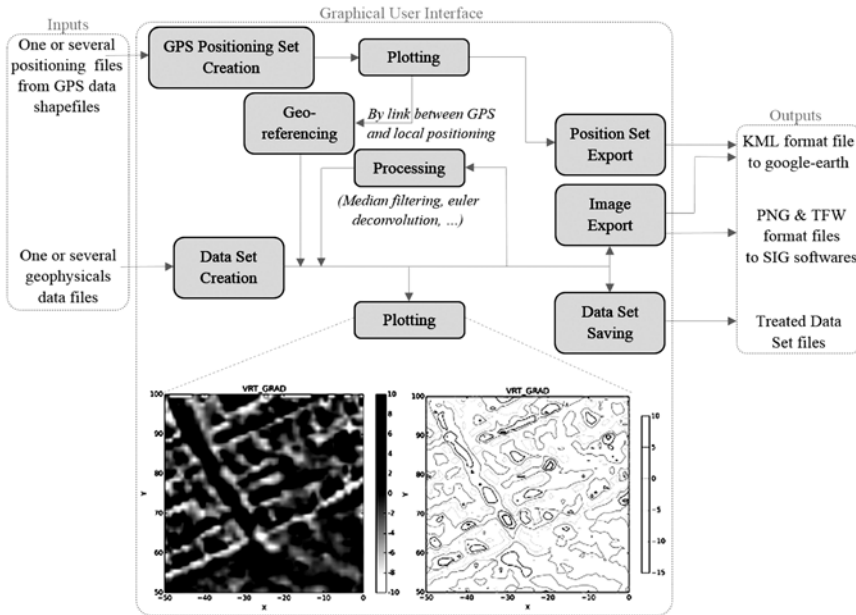
Fig. 3. WuMapPy workflow

- Select among several data interpolation algorithms (linear, cubic …).
- Select among several data display options (surface, contour …).
- Georeference prospection data with GPS points issued from several file formats.
- Export geophysical post-processed prospection data in the kml, png+tfw, grd, asc or other raster formats, allowing easy import within GoogleEarth or GIS software (ArcGis, Qgis … cf. Fig. 2) without requiring third-party application.

Finally, WuMapPy workflow can be summarized as in Fig. 3.

WuMapPy is an open-source and multi-platform software project to user-friendly display, processing and georeference surface and sub-surface geophysical survey data. It can be used by anyone wishing to post-process geophysical datasets or just perform basic processing and display of the geophysical image in a mapping application.

A short description and tutorial of the former Wumap, as well as an English version of the software are still available at the following address: *http://www.sisyphe.jussieu.fr/~jtabbagh/wumap.htm*

The new WuMaPy software development is being documented at the following address: *http://134.157.44.234/*