2023-2024

NamazuContest 2023-2024

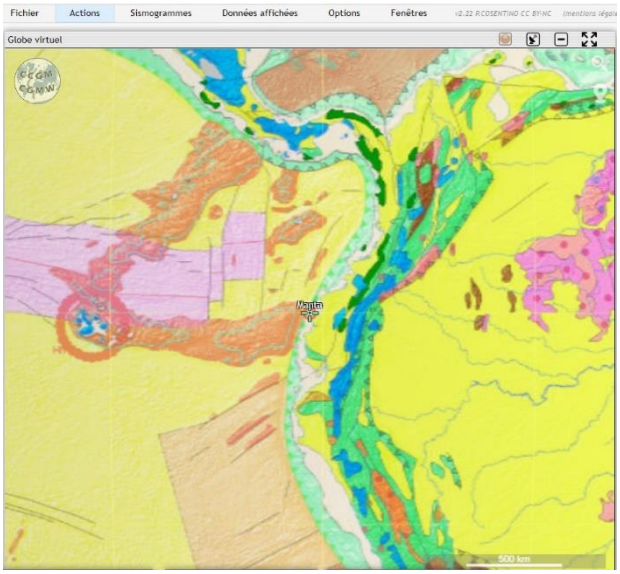
Episode 3 – RDV3

answers to
insight@geoazur.unice.fr

Level of difficulty

GPS data, a point technique for studying the movements of the lithosphere

As you were able to discover during the 1st RDV “Between earthquakes and volcanoes: Ecuador, land of study for geologists”, the study area is located in a geodynamic context of subduction: the Nazca plate to the west dives under the South American plate to the east.



Extract from the world geological map

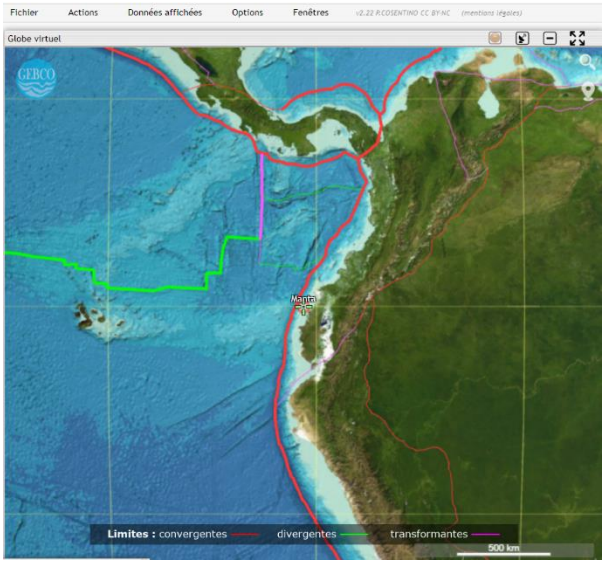
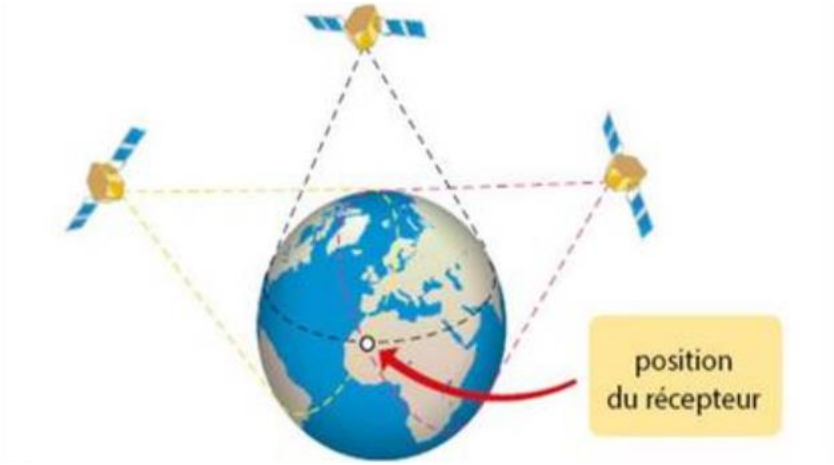


Plate boundaries near Manta

https://www.pedagogie.ac-nice.fr/svt/productions/tectoglob3d/

To study the movements of lithospheric plates very precisely, scientists use the **Global Positioning System** or **GPS**.

GPS is produced using around thirty satellites orbiting at an altitude of 20,000 km and arranged in such a way that at any given moment, at least four of them are clearly "visible" from any direction. point on the surface of the globe. Satellites emit radio waves at a known time.
Knowing the speed of propagation of electromagnetic waves, measuring the arrival time of the signal from a given satellite allows us to know the distance between the receiver and the satellite. By capturing the coded signals emitted by “visible” satellites, a receiver placed on the ground indicates in real time the geographic coordinates (latitude, longitude and altitude) of the point where it is located. GPS used for scientific measurements have an accuracy of a few millimeters.



Principle of GPS

Data from more than 2,000 receivers are analyzed by the California Institute of Technology, under contract with NASA. The American NASA site is therefore essential for obtaining geodetic measurements.

The pourquoi pas ? is obviously equipped with a GPS satellite positioning system, which makes it possible to track it!
https://www.flotteoceanographique.fr/La-Flotte-en-action/Ou-sont-les-navires#ship=POURQUOIPAS

Junior level:
Analyze the GPS data from the GPLS and QUI1 (or QUI2) stations, respectively located in the Galapagos Islands at the edge of the Nazca plate, and in Quito on the South American plate, to show the convergence of these two plates towards each other. the other.
On the site *https://sideshow.jpl.nasa.gov/post/series.html*, analyze the speed vectors plotted on the map.

intermediate level:
Analyze the GPS data from the GPLS and QUI1 (or QUI2) stations, respectively located in the Galapagos Islands at the edge of the Nazca plate, and in Quito on the South American plate, to show the convergence of these two plates towards each other. the other.
On the site *https://sideshow.jpl.nasa.gov/post/series.html*, click on the names of the desired stations, under the map, to obtain the latitude and longitude (and altitude) movements of each station depending on time.

Expert level:
By using the raw data (attached .xlsx file) with a spreadsheet, analyze the GPS data from the GPLS and QUI1 (or QUI2) stations, respectively located in the Galapagos Islands at the edge of the Nazca plate, and in Quito on the South American plate, to show the convergence of these two plates towards each other.
If necessary, raw data from GPS stations are available in the "Times Series" tab of the site https://sideshow.jpl.nasa.gov/post/series.html, and can be extracted according to the following procedure:
- click on a station to view the corresponding data,
- copy and paste the data into a .txt document,
- open the .txt file using the spreadsheet (select "all files" when choosing the type of file to open) and validate,
- only keep the data from the first 4 columns (date, movement in longitude, movement in latitude, vertical movement),
- using the features of the "edit" menu, replace all points with commas

With the help of GPS data :

The speed of movement of the station corresponds to the slope of the trend curve obtained.

For longitude:
- a negative movement speed reflects a movement of the GPS station towards the west,
- a positive movement speed reflects a movement of the GPS station towards the east.

For latitude:
- a negative movement speed reflects a movement of the GPS station towards the south,
- a positive movement speed reflects a movement of the GPS station towards the north.

For altitude:
- a negative movement speed reflects a downward movement of the GPS station and therefore a sinking,
- a positive movement speed reflects an upward movement of the GPS station and therefore an uplift.

We await for your results and discoveries on:
insight@geoazur.unice.fr

Enjoy the discoveries and until next time for the continuation of the adventure !