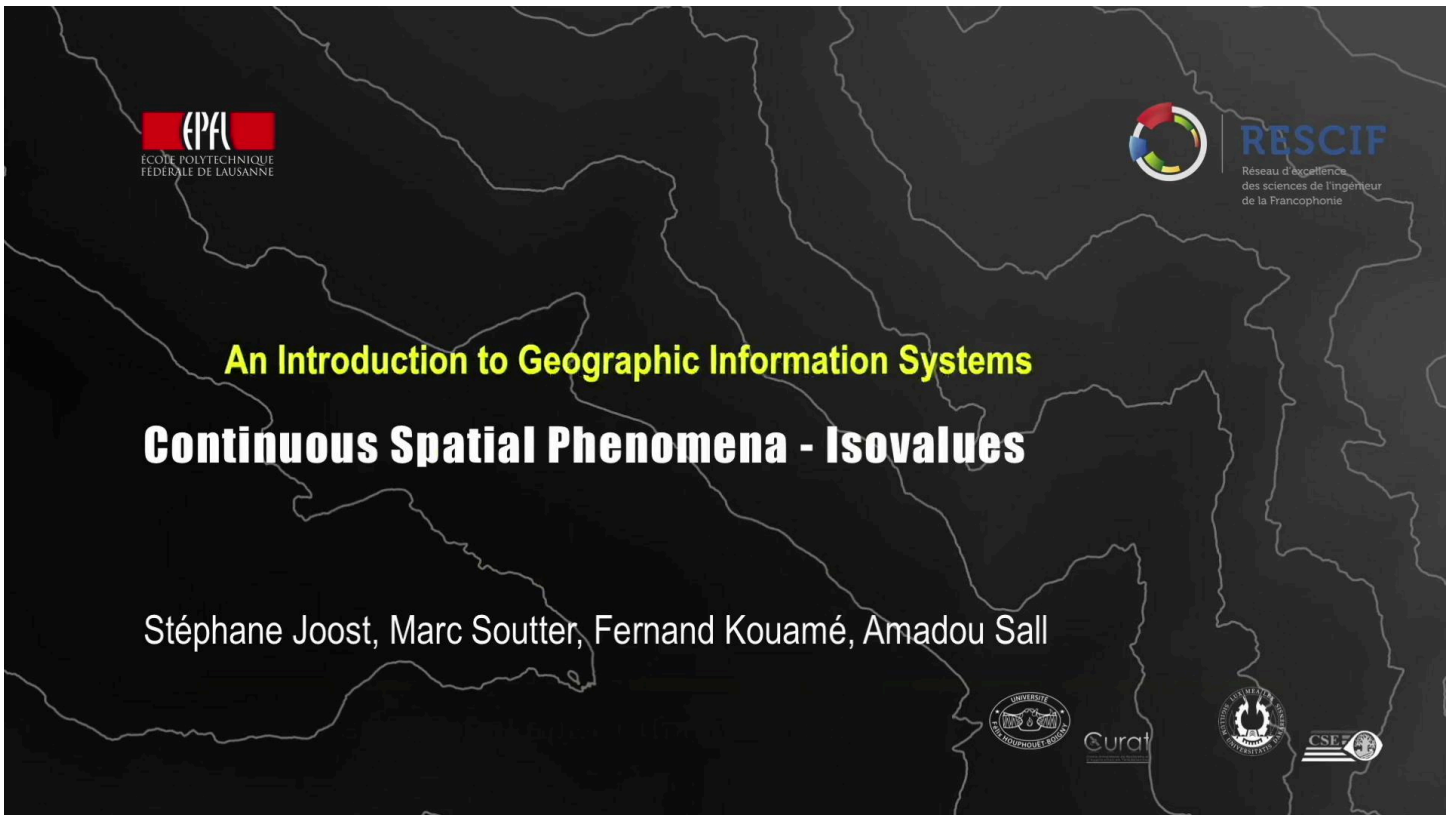

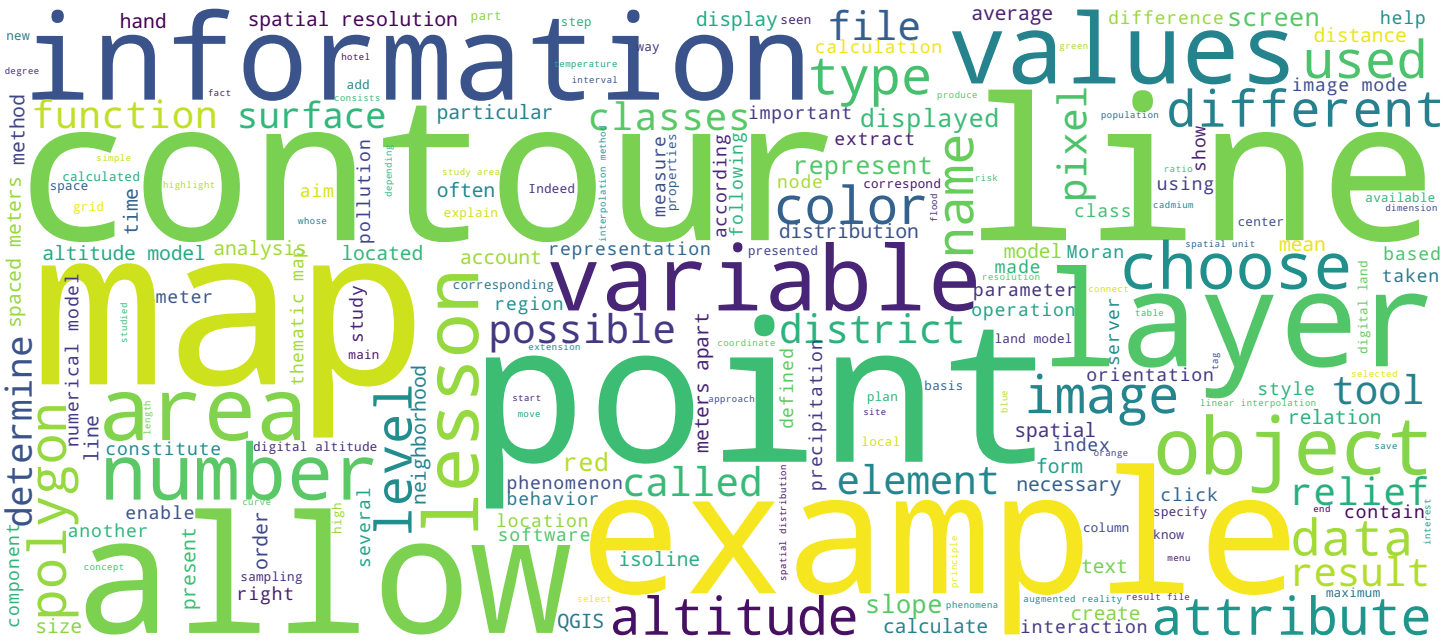

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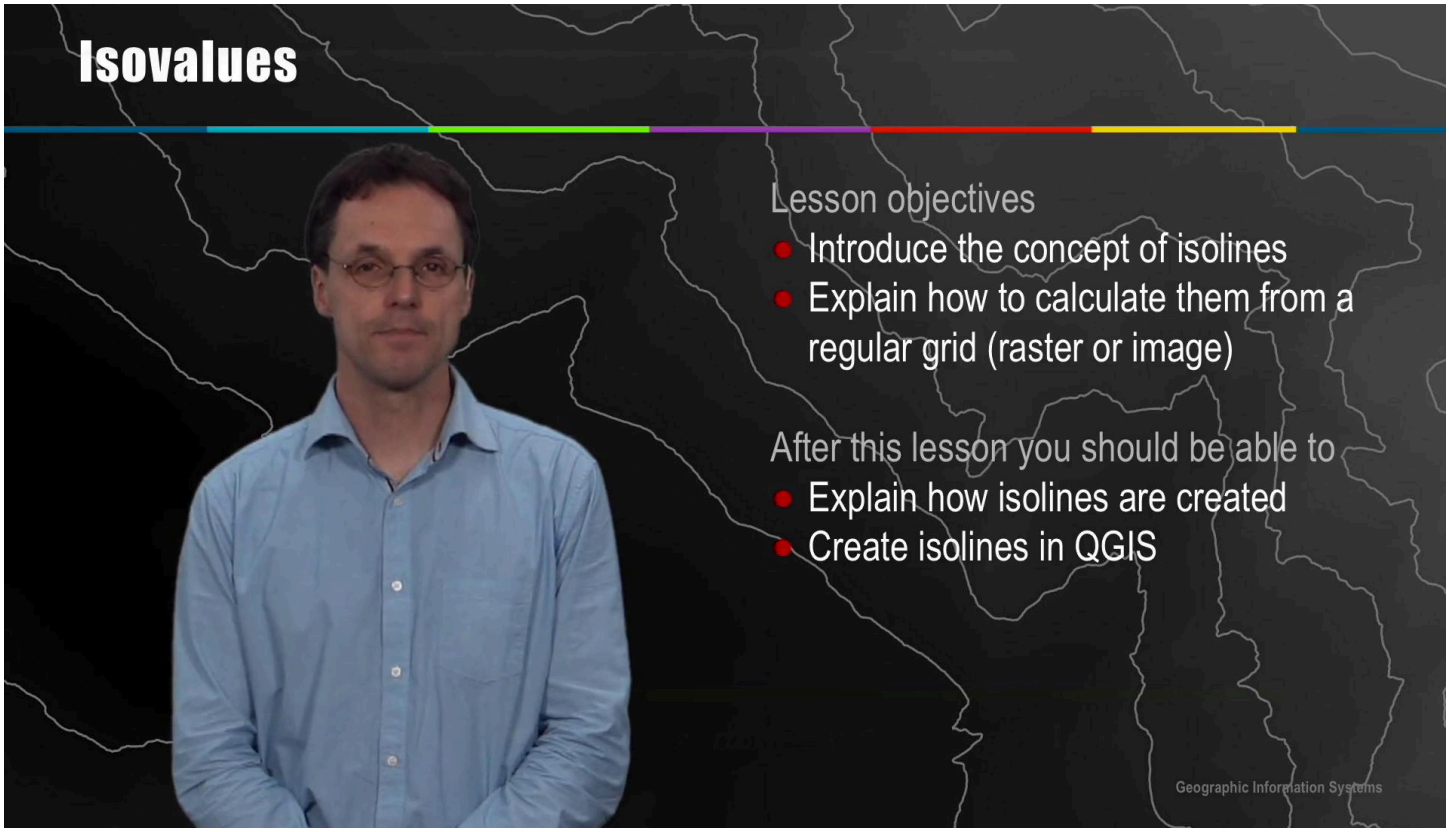


Welcome to this lesson on isovalues curves. These curves allow to connect all the points that have identical values on the territory. Indeed, an isoline or an isopleth is a line that connects points of equal value in a layer of information stored most often in image mode and which represents a continuous phenomenon. The production of isolines generally follows the interpolation step for a clearly cartographic purpose. The aim is to highlight on the map some areas where at time t, the temperature is similar for example, or again where the amount of precipitation is the same. The aims of this lesson are to present the concept of isolines and to explain how we determine the line from a layer of information in image mode. After following these explanations, you will be able on one hand to restore the method which allows to draw isovalue curves, and, on the other hand, to produce isolines with the help of QGIS software.

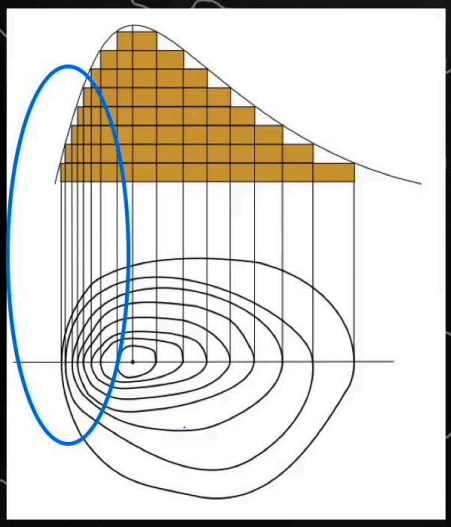
Notes

Summary

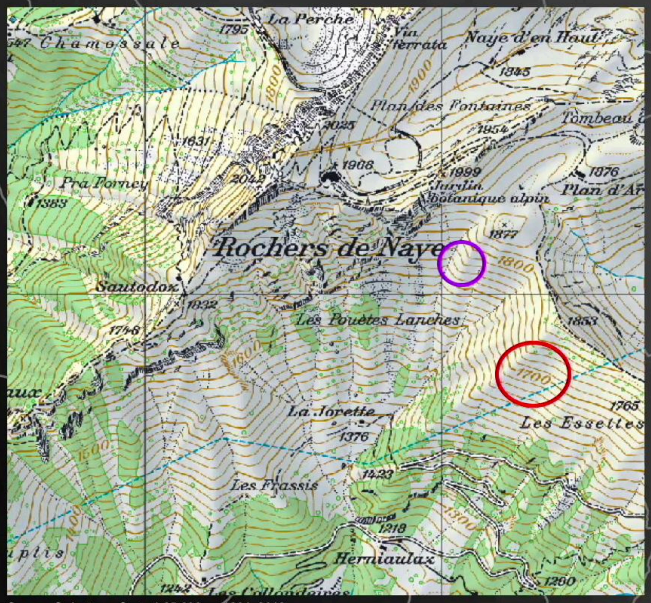
0m 31s

Isoline Examples – Relief

Contour lines



Source: wikipedia.org



Source: Swisstopo, Carte 1:25 000 no 1264, 2010

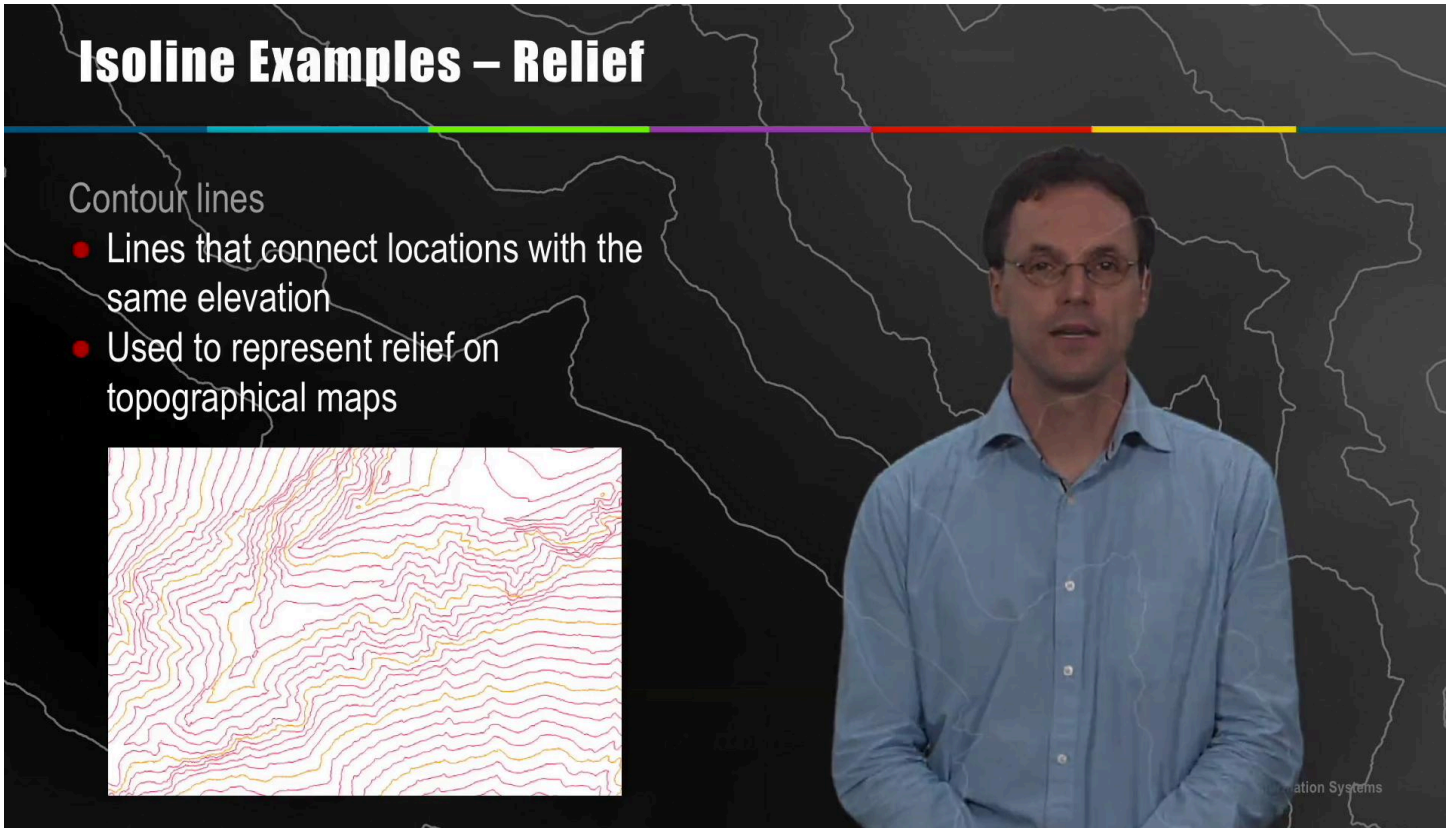
Geographic Information Systems

Here are some examples of common uses of isolines. To start with, we will evoke the contour line which constitutes a line formed by the points of the relief situated at the same altitude. It is the intersection line of a horizontal plan with the relief of the ground. As we see here in blue, the closer the contour lines, the steeper the slope. Between two successive contour lines, we assume that the slope is regular. The vertical distance which separates two contour lines is called the equidistance. On a topographic map, there are two types of contour lines. The guiding curves, shown here in red, which are also called main curves or master curves. They are represented by a thick and continuous line. They are also described by an altitude indication. Their purpose is to facilitate the reading of altitudes. We also have standard curves, some of which are highlighted here in purple on the screen, and which are drawn in continuous fine lines.

Notes

Summary

1m 40s



The contour lines can be used to visualize the topography from a two-dimensional model. On the left, the contour lines generated from a digital land model with a resolution of 25 meters, and on the right, the plan of contour lines of the Parc des Buttes Chaumont in Paris.

Notes

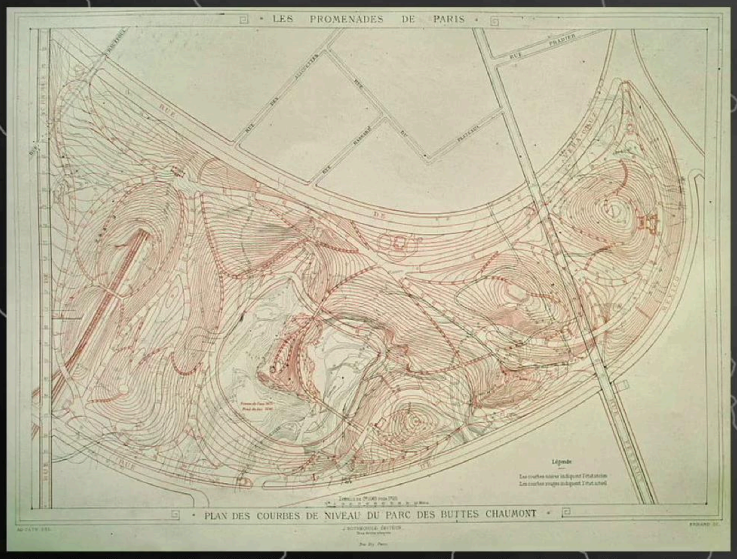
Summary

2m 44s

Isoline Examples – Relief

Contour lines

- Lines that connect locations with the same elevation
- Used to represent relief on topographical maps



Alphand, Jean-Charles-Adolphe (1817–1891): *Plan des Courbes de Niveau du Parc des Buttes Chaumont.* In: *Les Promenades de Paris.* Planches. Les Promenades intérieures de Paris. Rothschild Éditeurs. Paris 1867-1873.

Geographic Information Systems

Without other visual support, it is the spacing between contour lines only which enables to account for the relief.

Notes

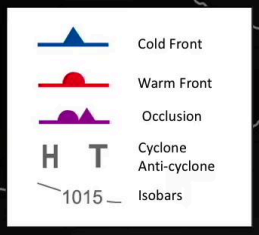
Summary

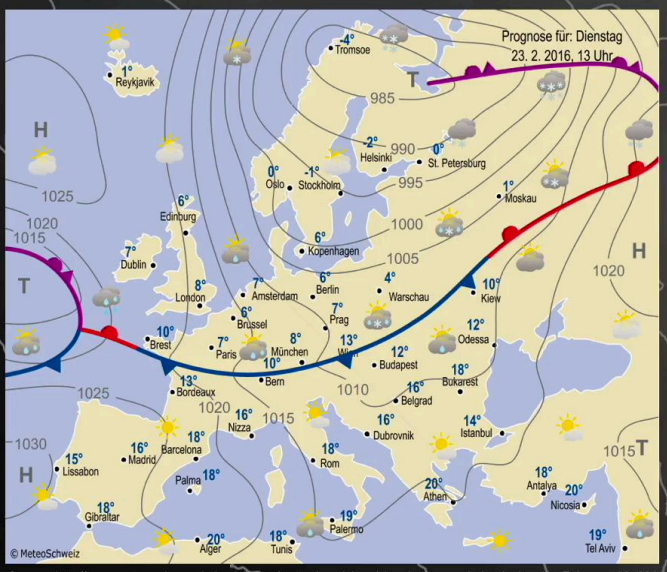
3m 01s

Isoline Examples – Atmospheric Pressure

Isobars

- Lines that connect locations with the same atmospheric pressure
- Used in meteorological maps to indicate areas of high (H) and low (T) pressure





Source: http://www.meteosuisse.admin.ch/home/meteo/previsions/situation-generale.html, situation February 22, 2016

Geographic Information Systems

In another area, we often have the opportunity in the weather bulletins, to follow the path of the isobars, these lines which connect points of equal atmospheric pressure. The isobar line allows to identify meteorological systems, depressions or anticyclones, and their movements in time.

Notes

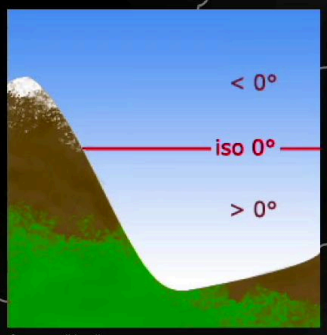
Summary

3m 10s

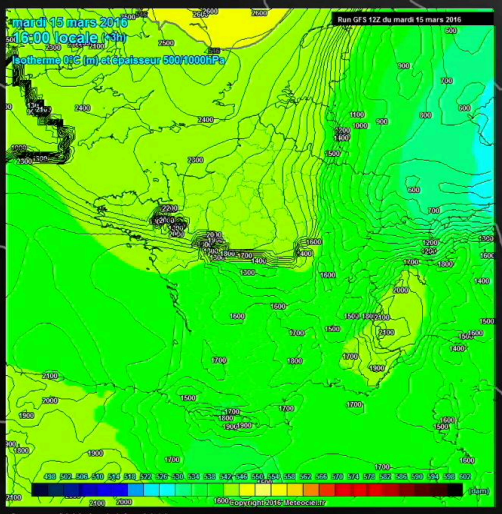
Isoline Examples – Temperature

Isotherms

- Lines that connect locations with the same temperature
- 0° isotherm



Source: wikipedia.org



Source: ©Météociel.fr - 2016

Source: Wikimedia.org, ligne de l'isotherme de 10 degrés Celsius en été

Geographic Information Systems

In the same weather reports, we often mention the altitude of the 0 degree isotherm or the level of freezing. In France, these maps are made from raw data of the US Global Focus System, GFS, with a spatial resolution of 0.25 degrees. We see here on the weather map, the spatial variation of the 0 degree isotherm on French territory. And on the right, the map shows in red the isotherm 10 degrees the value below which the temperature does not drop during the hottest month, here in July, in the definition of the Arctic region.

Notes

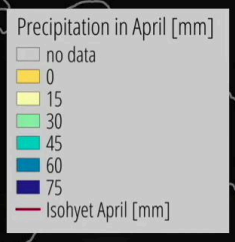
Summary

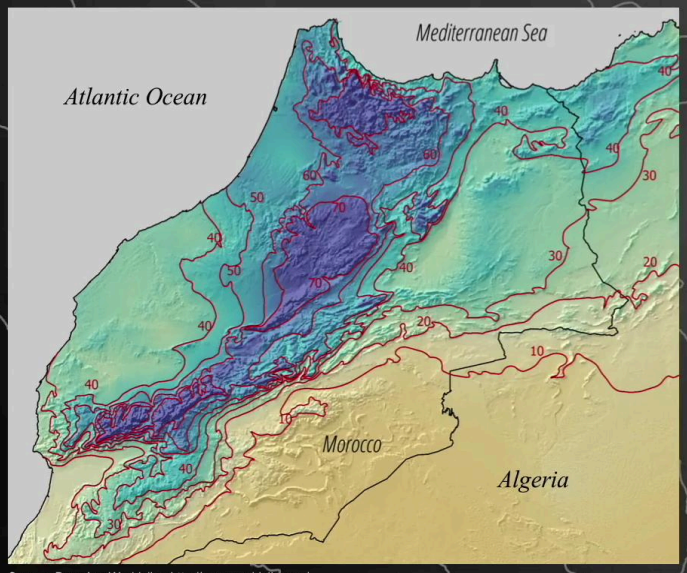
3m 28s

Isoline Examples – Precipitation

Isohyets

- Lines that connect locations with the same precipitation levels
- Used to create hydrological or meterological maps





Source: Données Worldclim: http://www.worldclim.org/

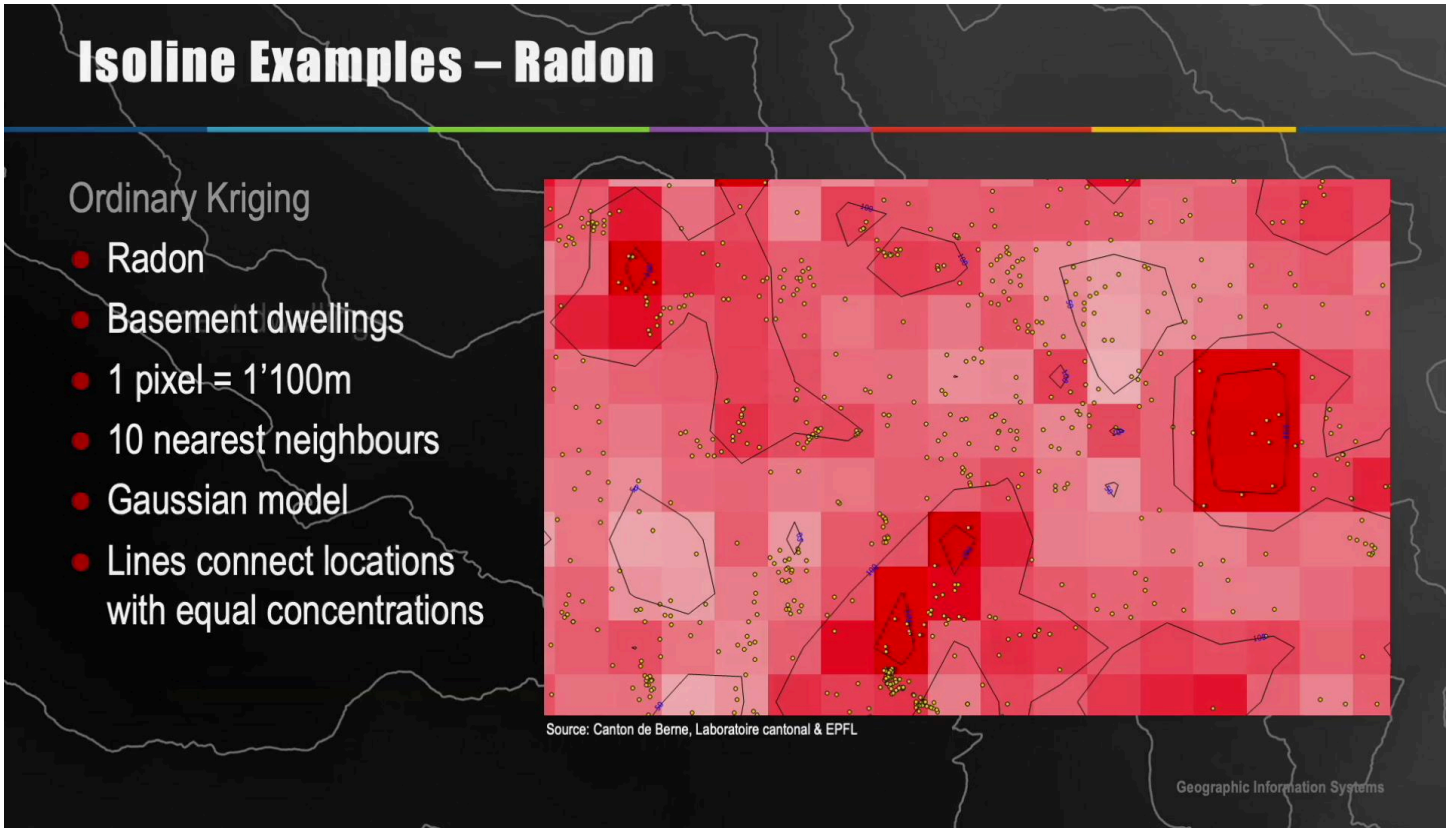
Geographic Information Systems

The isohyets are imaginary lines which connect the points which have equal amounts of precipitation during a specified period.

Notes

Summary

4m 04s

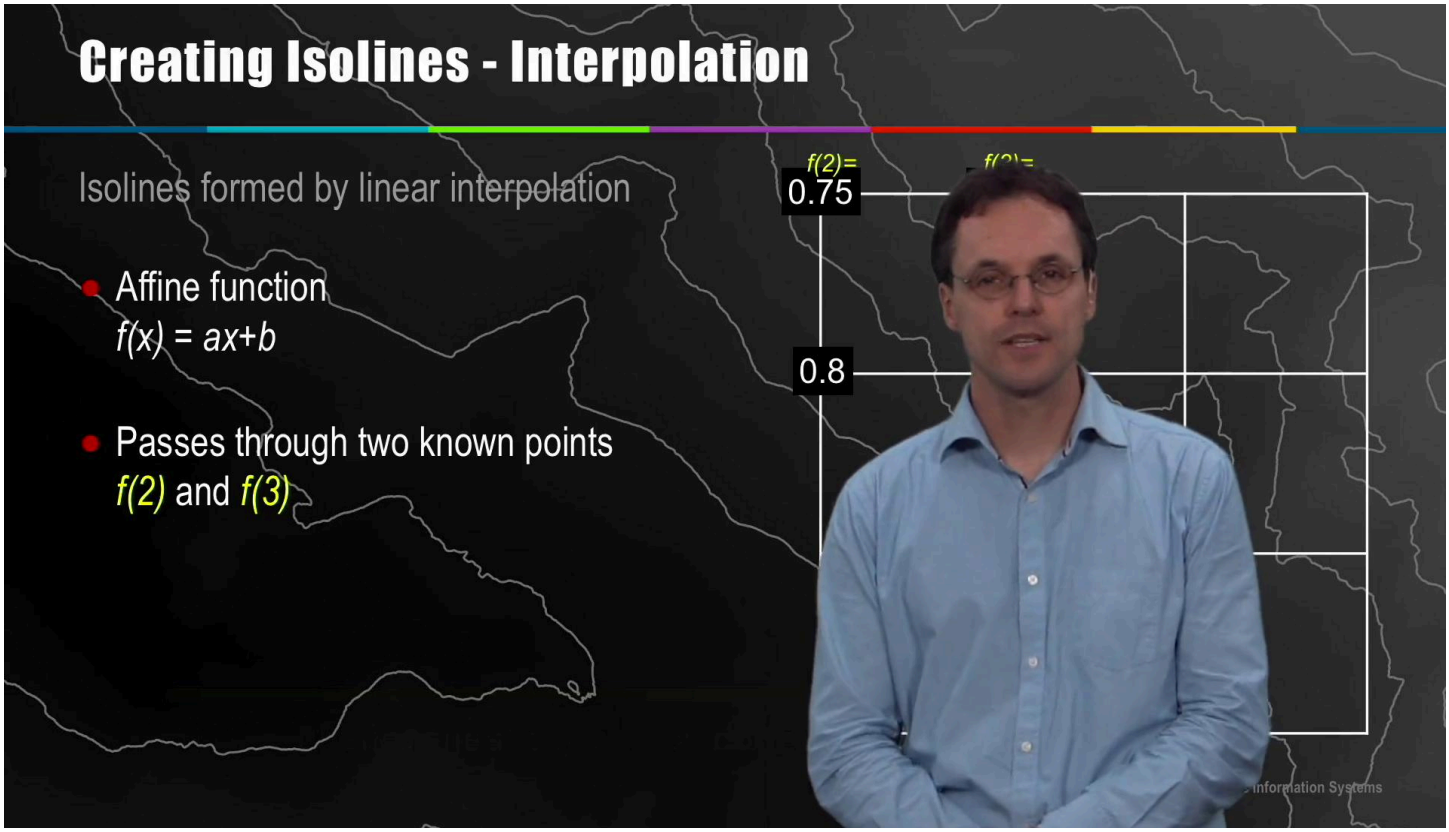


And to finish with the examples, let's mention the geostatistics which we studied in the last lessons. On the example shown on the screen, the points are houses in the basement of which measures of the radon content were made. The pixels have a spatial resolution of 1,100 meters. The ten closest neighbors have been taken into account for the inference and the theoretical model adjusted to the experimental variogram is Gaussian. The displayed values express the becquerel content per cubic meter.

Notes

Summary

4m 15s

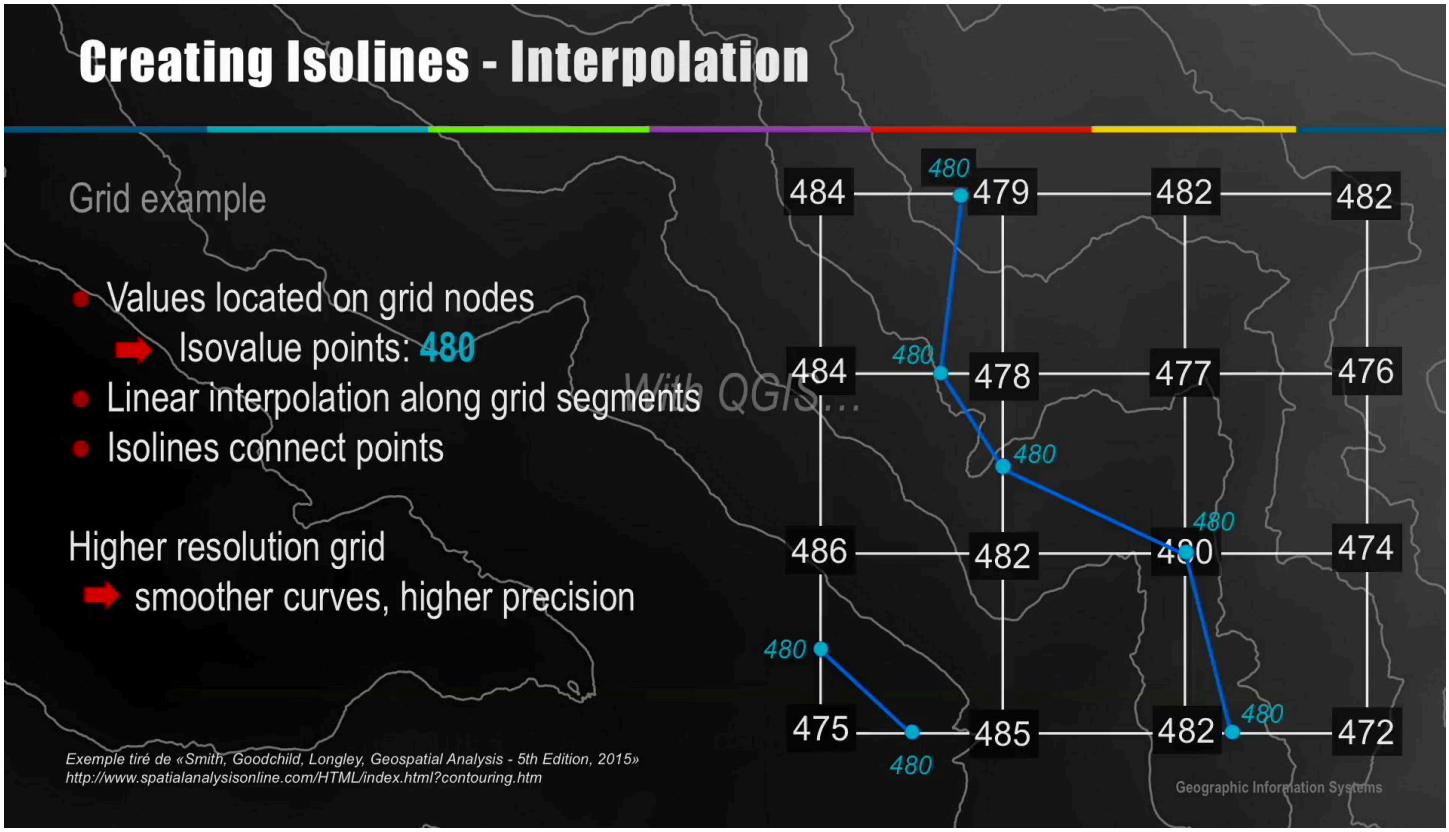


The isolines can be produced from grids of measured values, or interpolated as we have seen with the example of the radon, or then from a triangulated model. In any case, the isovalue curves were generated using the linear interpolation method. The linear interpolation is the simplest method to estimate the value taken by a continuous function between two points. It consists in using an affine function of the form f (x) = ax + b going through the two determined points.

Notes

Summary

4m 56s

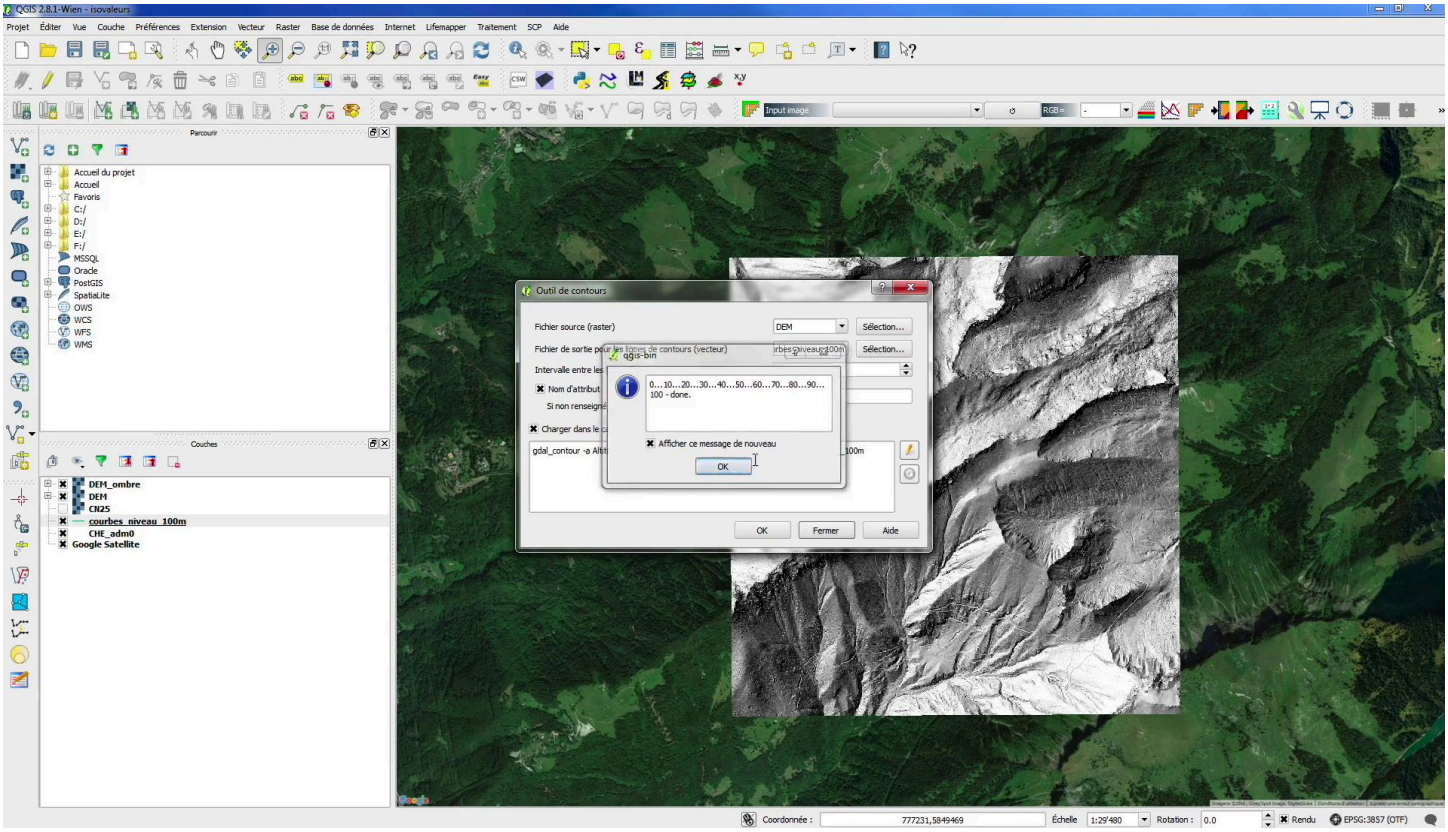


For example, if we want to determine f (2.5), while we know the values of f(2) = 0.75 and f(3) = 0.55, the method consists in calculating the average of the 2 values knowing that 2.5 is in the middle of the two points. We obtain f(2.5) = 0.75 + 0.55 / 2 so a result of 0.65. And to draw an isoline for the value 0.65 we will determine its location according to the same principle on the following segment. On this regular grid whose altitude values are located on the nodes, we want to create the 480 meters contour line. The linear interpolation method allows to adjust the value 480 on the segments between the nodes of the grid. It is a better spatial resolution of the grid which will result in a more precise and smoother isoline. But most GIS softwares are equipped with algorithms capable of smoothing isovale curves without changing the spatial resolution of the basic model.

Notes

Summary

5m 29s

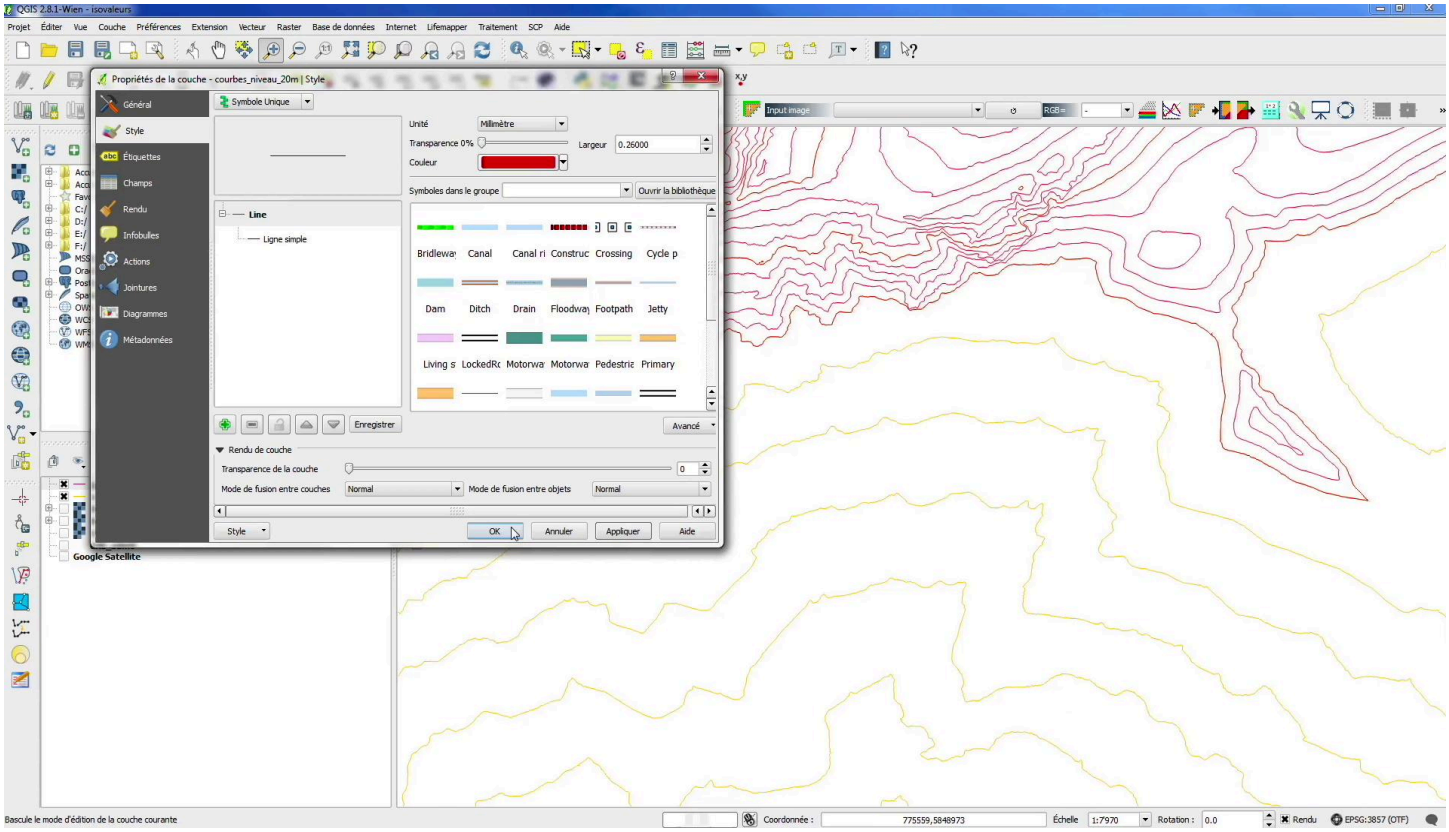


We propose you now to discover how to calculate isovalues with the help of the QGIS software. We will extract the contour lines for the Rochers de Naye region, located in Switzerland on the right bank of Lake Geneva. We have for this region a very precise digital terrain model, in the form of a raster file with a spatial resolution of 50 centimeters. To better distinguish the relief, this model can be displayed with a shading that can be calculated with QGIS. We will begin by extracting the contour line spaced by 100 meters. To extract these contour lines from the numerical model, we must use the "contour lines" tool in the "raster", "extraction", "contour lines" drop-down menu. In the "source file" menu, we must choose the file corresponding to our altitude model. Under "output file", for contour lines we specify the name of the result file and where we want to save it. Here we call this file "courbes_niveau_100m". Next, we have to define the interval between the contour lines, 100 meters in our case. Finally, we can give a name to the attribute that will store the isovalues. In our case it is the altitude. We can then click on OK. The curves created are displayed on the screen.

Notes

Summary

6m 34s

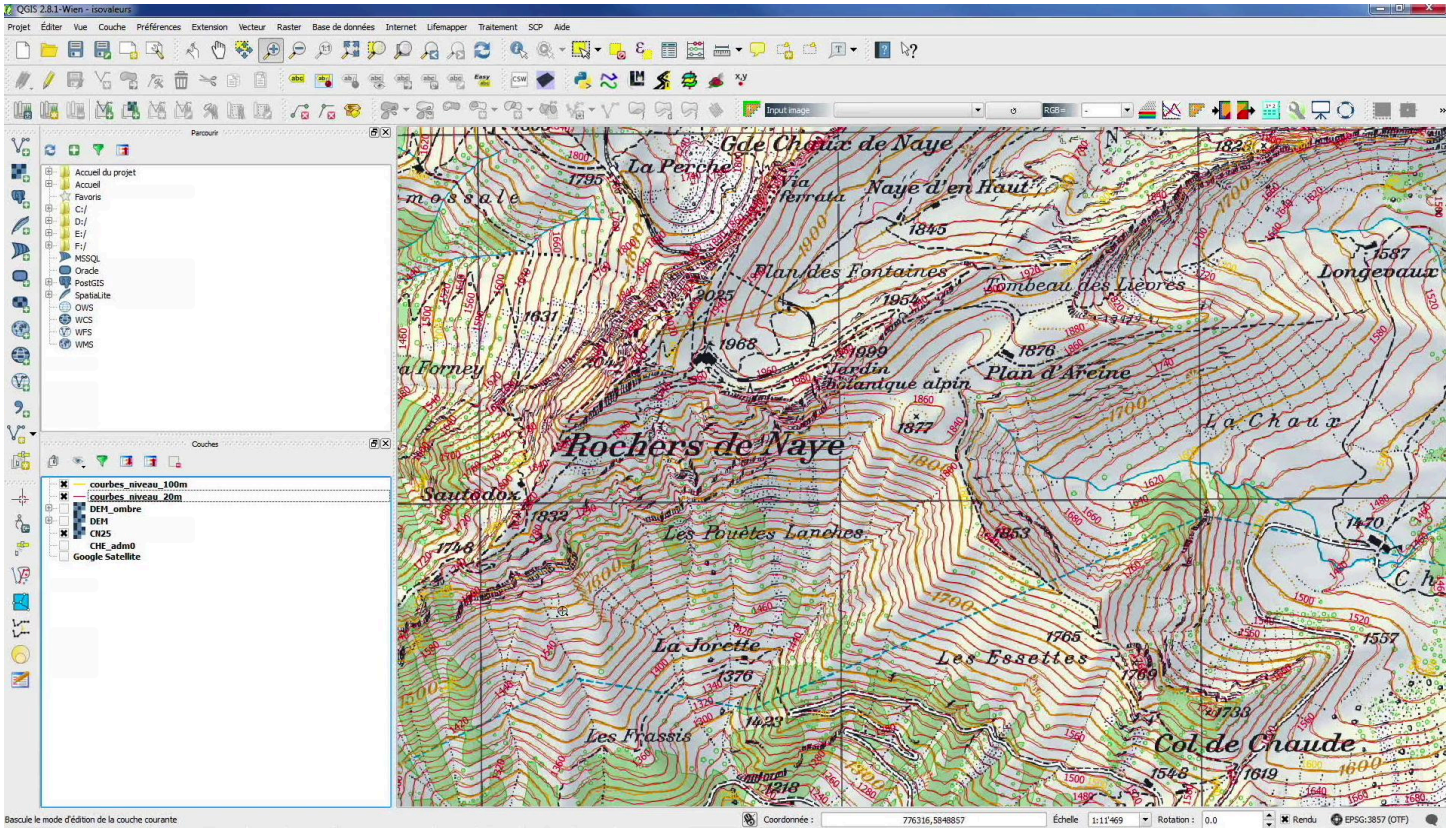


To see them, we have to move them over the layer of the digital land model. In the layer properties, on the "style" tab, we will choose to display the curves in orange. we will also display a text with the altitude corresponding to each curve. In the "labels" tab, we choose to label the layer with the altitude attribute, then we choose a font size and color. The contour lines spaced 100 meters apart are displayed in orange on the digital altitude model with a text that indicates the altitude of each curve. To get a greater precision, we now extract the contour lines spaced 25 meters apart. To do this, we use "raster", "extraction", "contour lines" again. Like before, we choose the file corresponding to our numerical model of altitude, we specify the name of the result file and the location where it will be saved, then we define the spacing of the curves, so 20 meters, and we name the attribute of the result "altitude". The new curves created are displayed on the screen. In the "properties" tab, we will show them in red, with the text again indicating the altitude of each curve. By placing the curves spaced 100 meters apart ahead of those of 20 meters, we thus have red contour lines every 20 meters, and orange curves every 100 meters.

Notes

Summary

8m 20s



The contour lines are used in particular to represent altitude on Swiss national maps. On the 1/25,000th card, the contour lines are spaced 20 meters apart. If we display the map at 1/25,000th for the region we are interested in, we can see that the contour lines on this map correspond to curves spaced 20 meters apart which we have extracted from the numerical model of altitude.

Notes

Summary

10m 00s