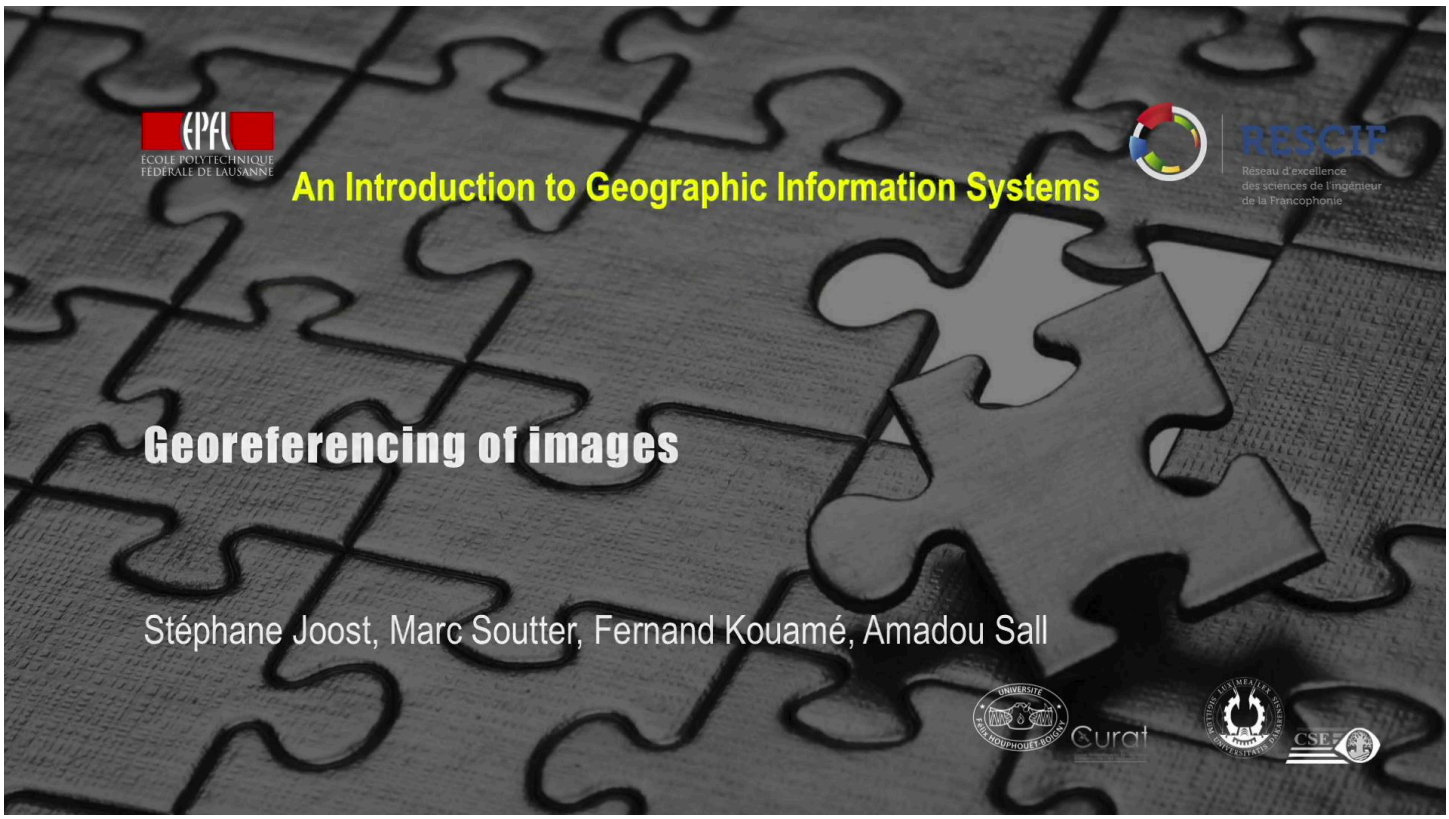

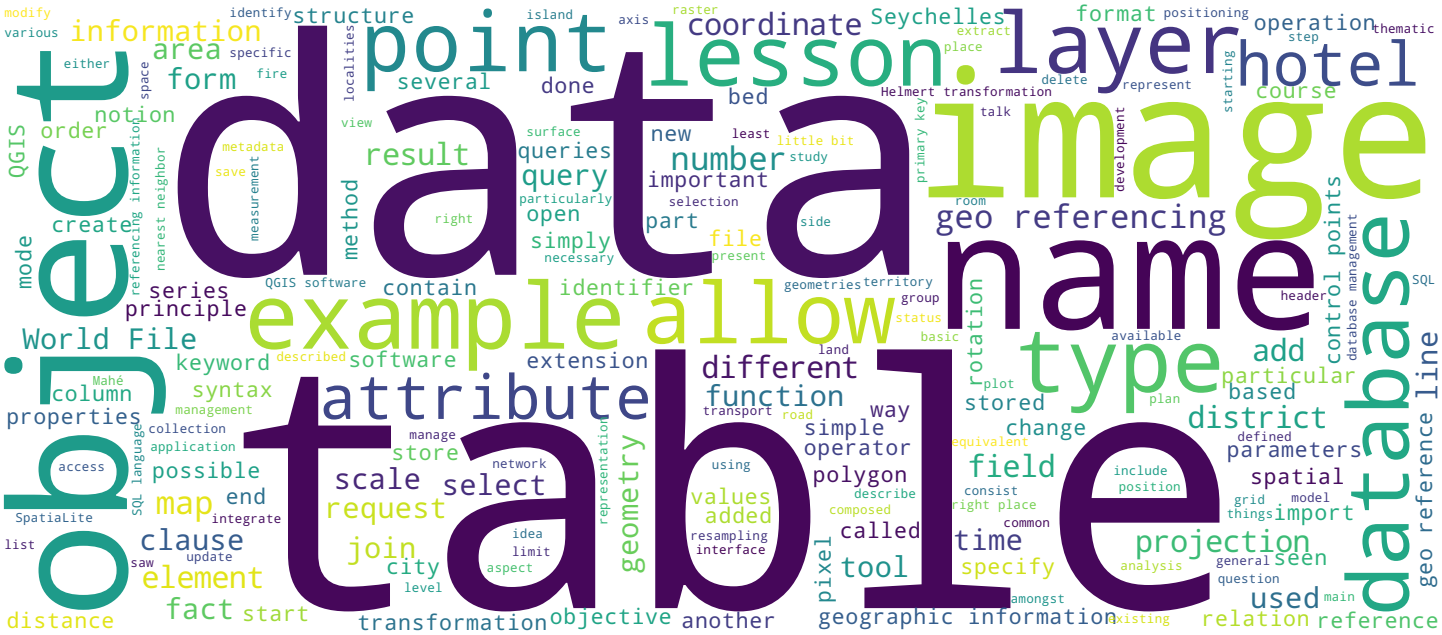

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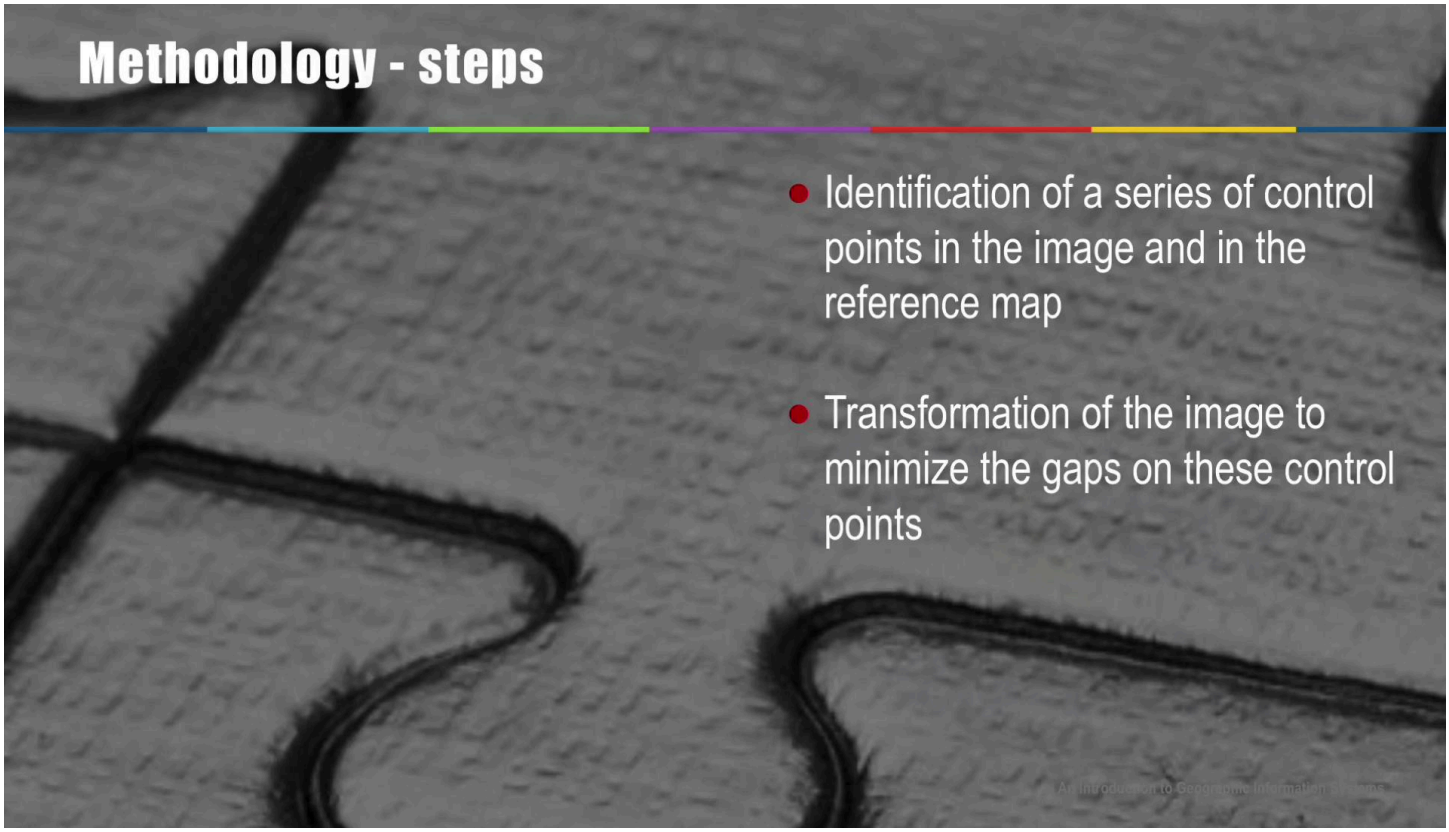
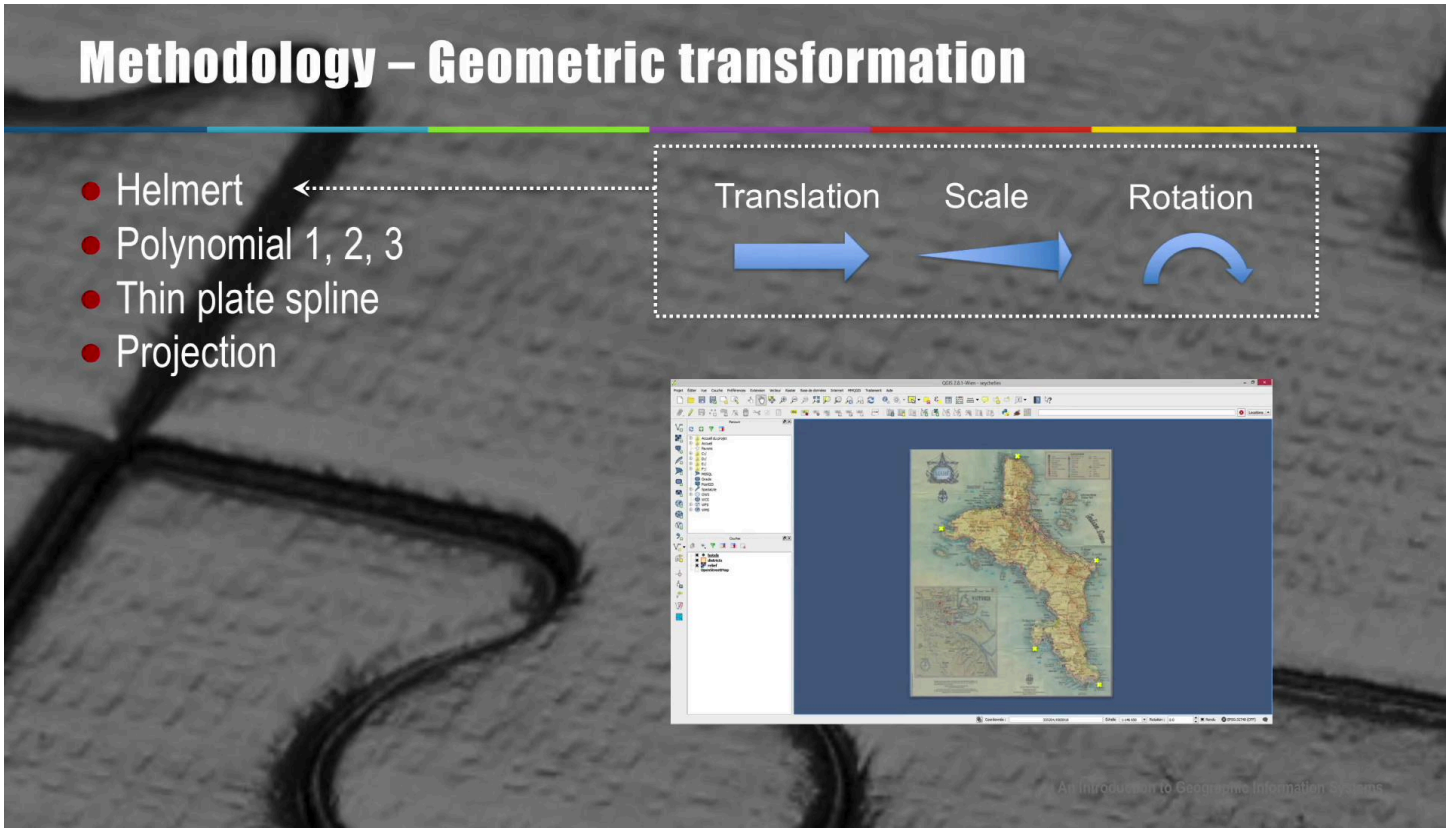


Welcome to this lesson on the geo-referencing of images. The images and rasters must be positioned in the right place in a geographic information system to be used correctly. The objective of this lesson is to familiarize yourself with the principles and the practice of the geo-referencing of images so that at the end you are able to geo-reference an image or manipulate the geo-referencing parameters of these images. During the lesson, we will discuss successively about the geo-referencing problem, a brief description of this problem, the methodology used to geo-reference an image, an example of application, how geo-referencing is done with the QGIS software and finally, how to store, how to save the characteristic parameters of a geo-reference. Let's start with the problematic which is that of an image inherited from an external source for example an old scanned card or an aerial photograph whose reference coordinates have been lost, so an ordinary image devoid of any spatial reference that we wish to integrate into a geographic information system. To do this, it is necessary to be able to place it in the right place so to reconstitute the corresponding spatial reference system. The operation is perfomed in two steps.

Notes

Summary

0m 22s

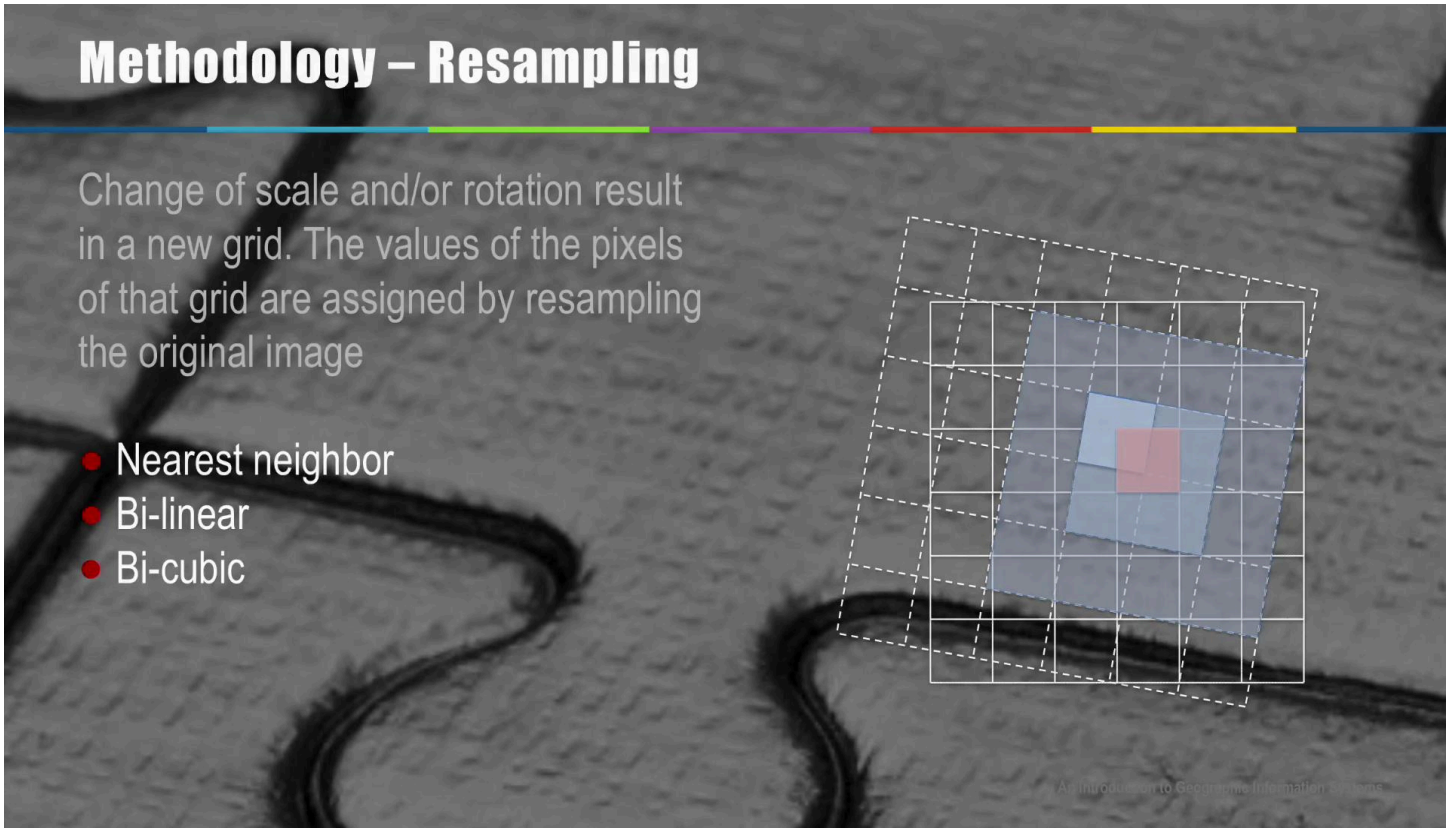


</ First, we will identify a series of points common to the image and to a reference map on which this image has to integrate. And subsequently, we will modify, transform the image move it, rotate it, change its scale to adjust it to the reference map. We need at least three control points, if possible more, they should be easy to identify both on the map and in the starting image. And these points should be spread if possible throughout the area that has to be geo-referenced so that the deformation of the image is approximately ... so that it is well distributed let's say and that there is no singularity. This geometrical transformation is composed of a translation of a scaling and a rotation, all of these operations characterizing a Helmert transformation or an affine transformation. There are other types of possible transformations, in particular polynomial transformations of the first, second or third order, the use of spleens or projections. All these approaches are less frequent. They are especially useful when the starting map is not very regular and that the deformation can take into account some local particularities to allow very specific adjustments Most of the time, however, we will use a Helmert transformation. Who says change of scale and rotation also says new grid for which the value of each pixel must be evaluated, so resampling the starting grid.

Notes

Summary

2m 30s

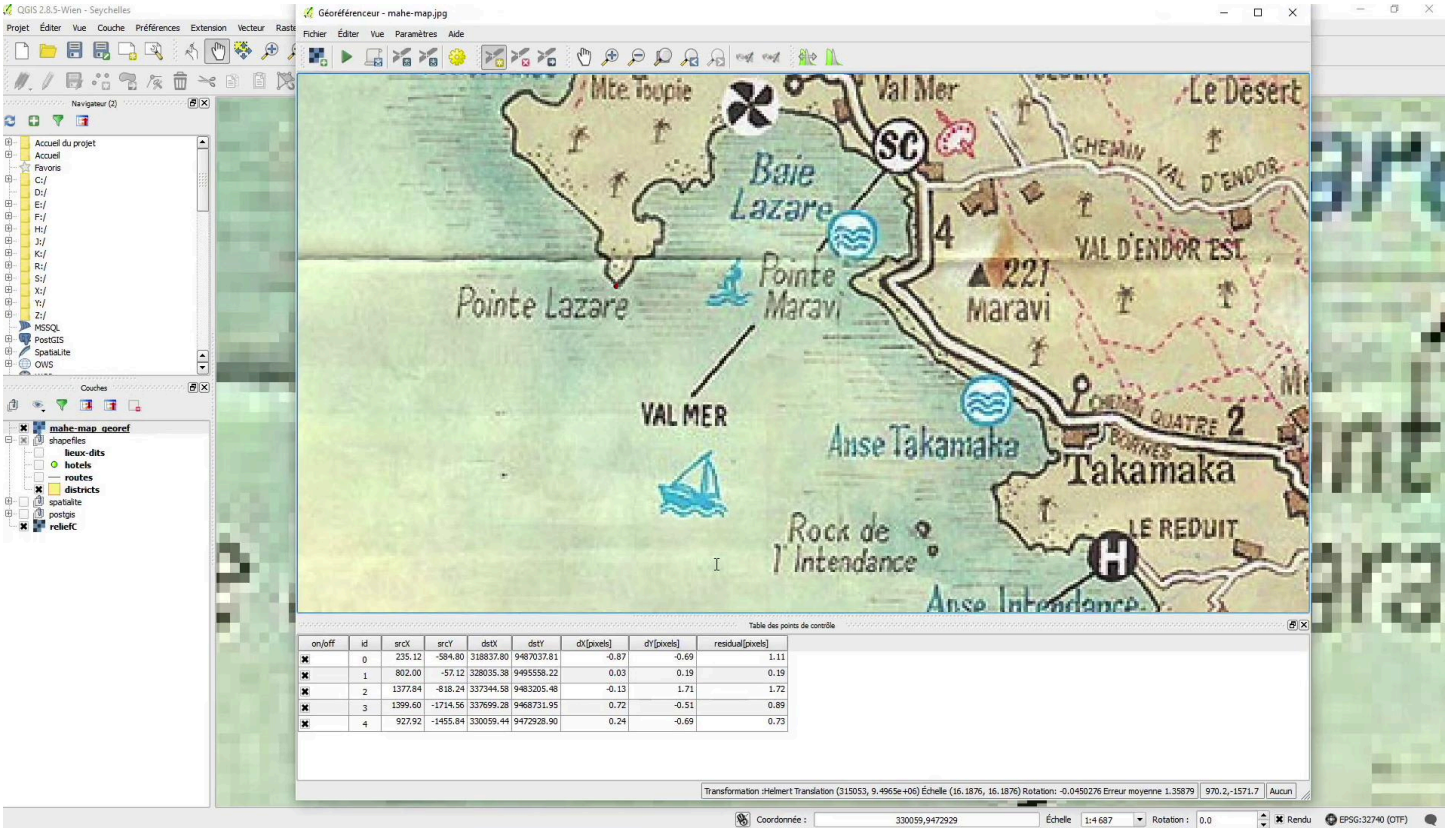


This resampling can use the nearest neighbor approach where we simply take the value of the nearest original map cell. Resampling by the nearest neighbor method is the one that best respects the original image so the one that will reduce the contrasts of the original image the least. The bi-linear bi-cubic approach is sometimes useful if the move, the scale change or the rotation are important and that the image in fact...

Notes

Summary

3m 58s

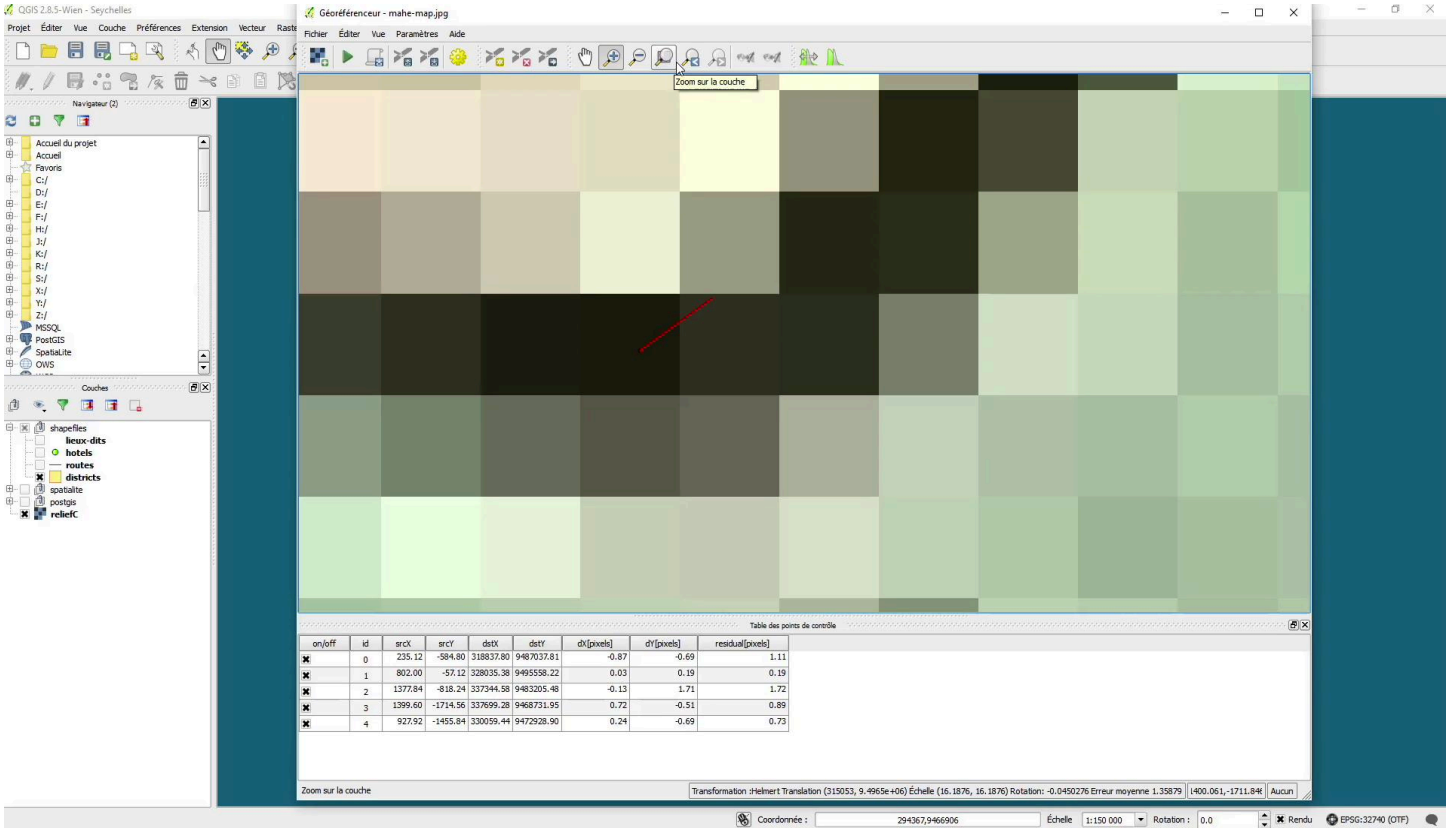


would become little readable because of the transformation. Let's now take a concrete example of how geo-referencing is practiced with the QGIS software. So in QGIS, we will open the geo-referencing tool and in this tool, we will import the image to geo-reference in this case, an old map of Mahé. We are asked to specify the system of references the system of projections of references which must be the same as the projection system of the map. Then, we will add the control points, a first point on Pointe Matoopa to the West of Mahé and then a second point to the North-East on Pointe Machabée, a third point near the airport, a fourth point to the South of the island and a last point to the South-West at Pointe Lazare. When we start the geo-referencing operation, the system asks us to specify the parameters of this transformation. We choose in this case amongst the types of transformation the Helmert transformation, a resampling by the nearest neighbors and then we specify the output file so a tif image file that will simply have the starting file name plus the word which is Georef. We must also specify the projection system released so in this case, we worked with Mercator web both for the starting map, the imported map and the resulting map.

Notes

Summary

4m 35s

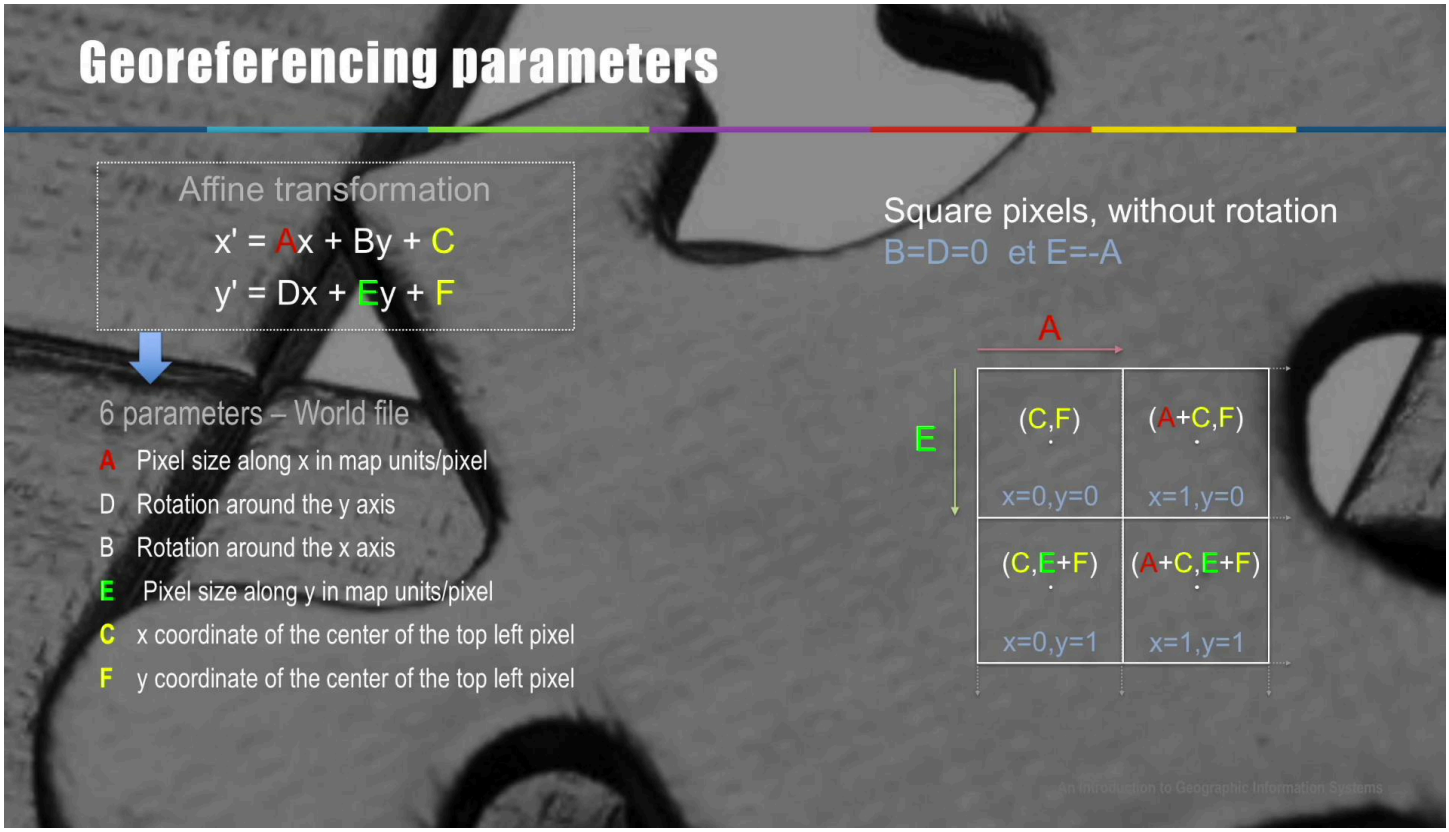


</ I We start the operation and before closing, we are still asked to save the adjustment points, the control points that have been defined. And we see that this map was actually added to the geographic information system. We can modify its transparency in the properties to note that indeed this map-image is now placed in the right place. And by reviewing the various control points, we can see that the adjustment is not of such poor quality. A little bit of approximation here on the side of Baie Lazare... But overall, the adjustment is fairly accurate.

Notes

Summary

6m 58s

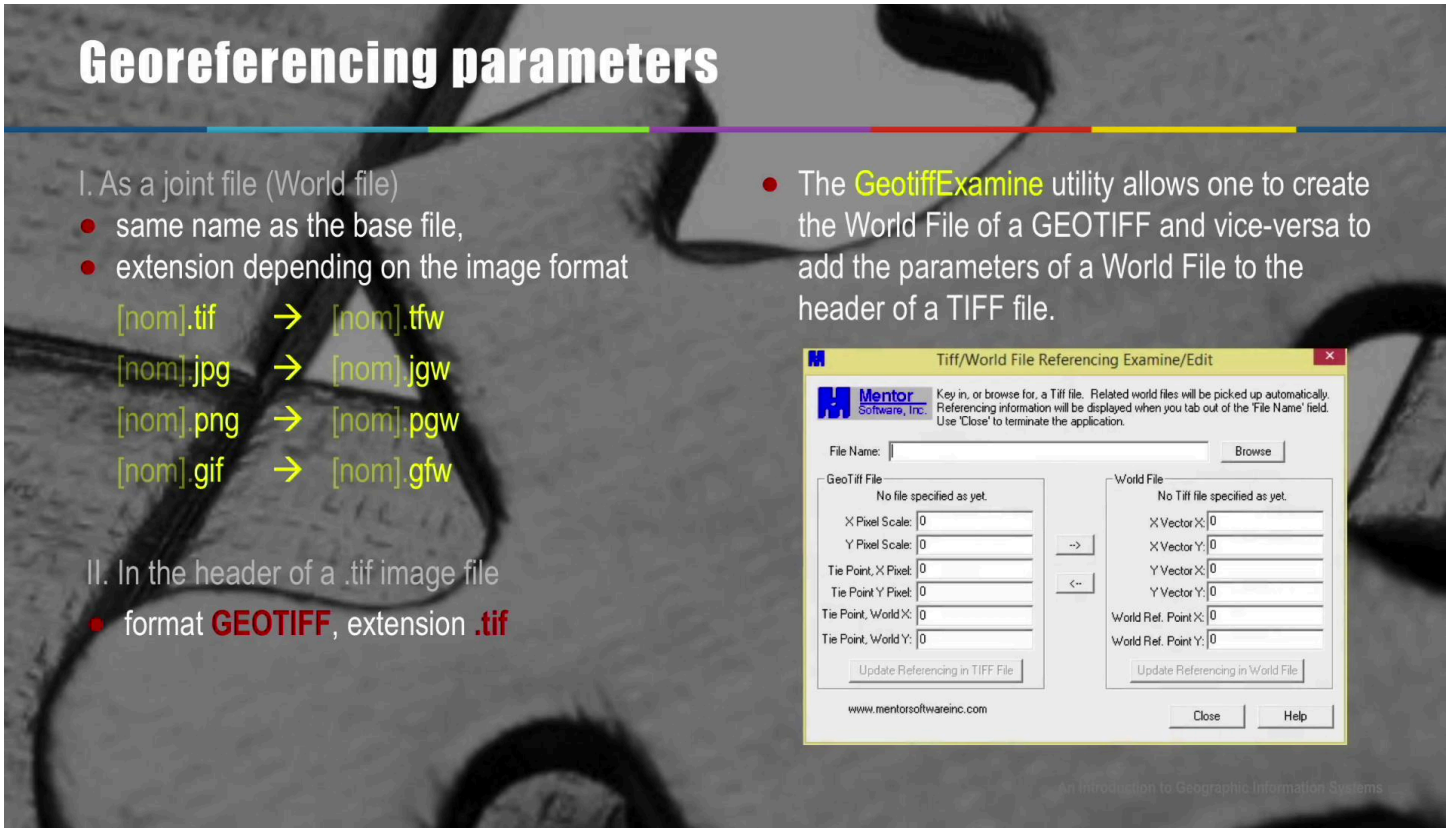


Now let's see the parameters that define the transformation and how to store them. As I said earlier, a Helmert transformation is an affine transformation, that is to say a transformation which can be described by a linear combination of the x y coordinates, of the starting system. So each coordinate of the arrival system, x' y' here, is expressed as a linear combination of the x y starting coordinates and then from a constant term. This system actually includes 6 parameters which are grouped together in what is called a World File describing in fact the geo-referencing of an image. And in this World File, these parameters are presented in the order described below with first the pixel size according to the x-axis, then the 2 rotation parameters around the y-axis and the x-axis, the size of the pixel according to y, and then finally the coordinates, the constant terms, the x y coordinates of the pixel center located on the top left of the image. So we see that if we define the position from the top left of the image, the cell size of the grid and then the rotation elements, we can actually position an image precisely in a geographic information system. In the example here to the right, when we have square pixels and no rotation, the angular terms are nil.

Notes

Summary

7m 57s

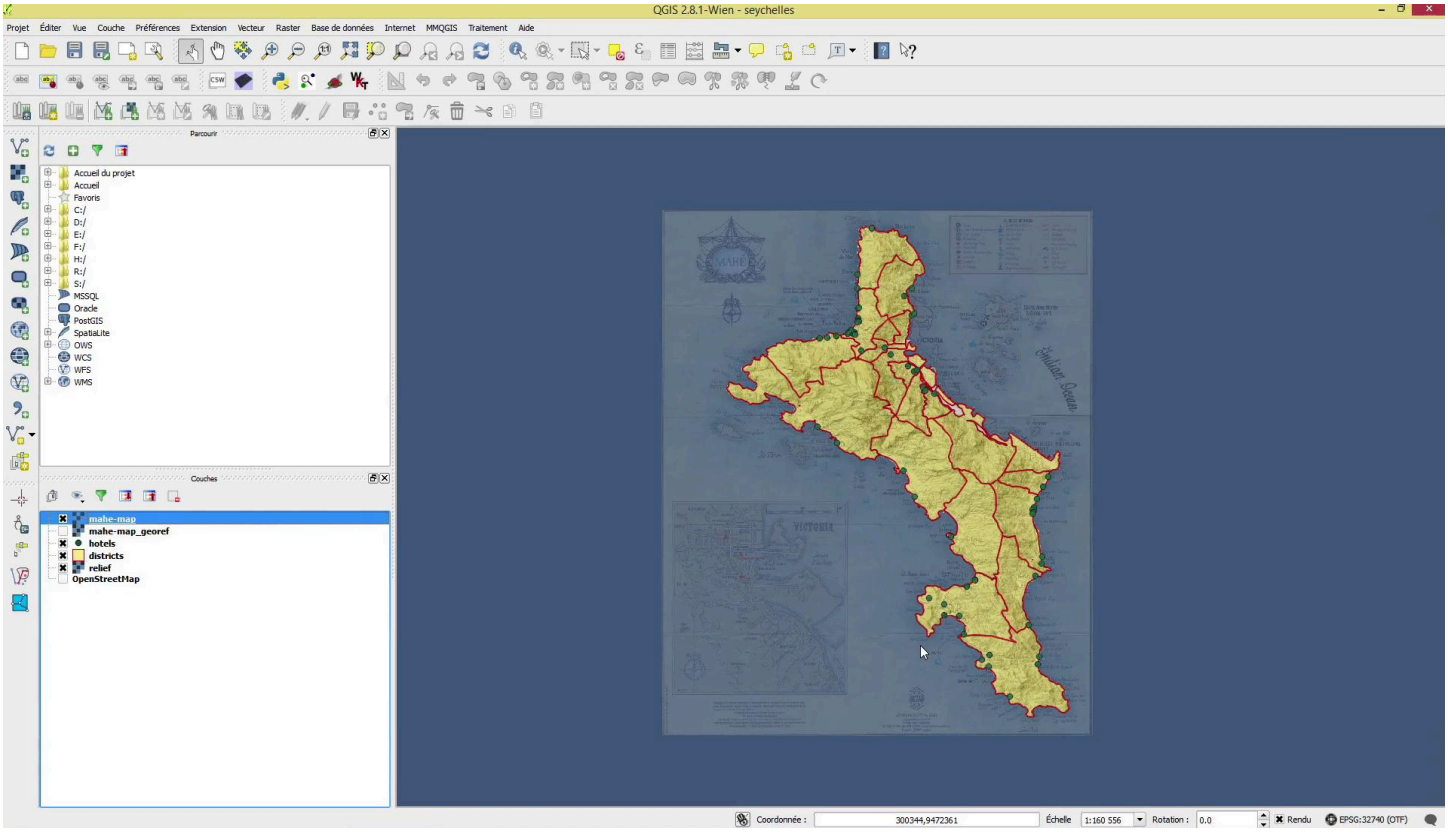


And finally, the calculation of the coordinates of each point at the center of each pixel is quite simple. In the case where the transformation includes a rotation component, we see that in fact the D and B parameters are not in fact angles of rotation but represent the components according to x and y of the width and height of the pixel. And it is therefore more accurate to talk about components according to x and y, of projections rather than angular terms. Afterwards, the calculations become more complicated if the pixel is not square but that it has different dimensions according to y and according to x. These various parameters can be stored in an accompanying file, the World File precisely, with the rule that the accompanying file has the same name as the base file and an extension that depends on the image format, tfw for the tif and jgw for the jpeg, pgw for the png gfw for the gif. Or, the second possibility, store these information in the header of an image file in.tif format And we talk here about GEOTIFF format since it is a single file that contains the geo-referencing information, so an image that intrinsically contains the geo-referencing information.

Notes

Summary

9m 34s



The GeotiffExamine utility that is free to access makes it easy to check if a TIFF file has the geo-referencing information and, if so, generates a World File or conversely, when we have the World File, to fill in the header of the TIFF file to transform a TIFF into Geotiff. We see for example that if we look for the geo-referenced file that we have just made and that we open this file with this utility, we see that the geo-referencing parameters are stored with the file itself and we can make the corresponding World File. As mentioned earlier, this World File has the tfw extension and if you open it with a simple text software, we find the 6 parameters that characterize the geometric transformation and the positioning of the image. The extension of this file, of this World File can be changed to jgw and the transformed name by removing the Georef suffix so that we can see that we can now import the original jpeg file using the geo-referencing information that was generated later. That is it. It is simple.

Notes

Summary

10m 59s