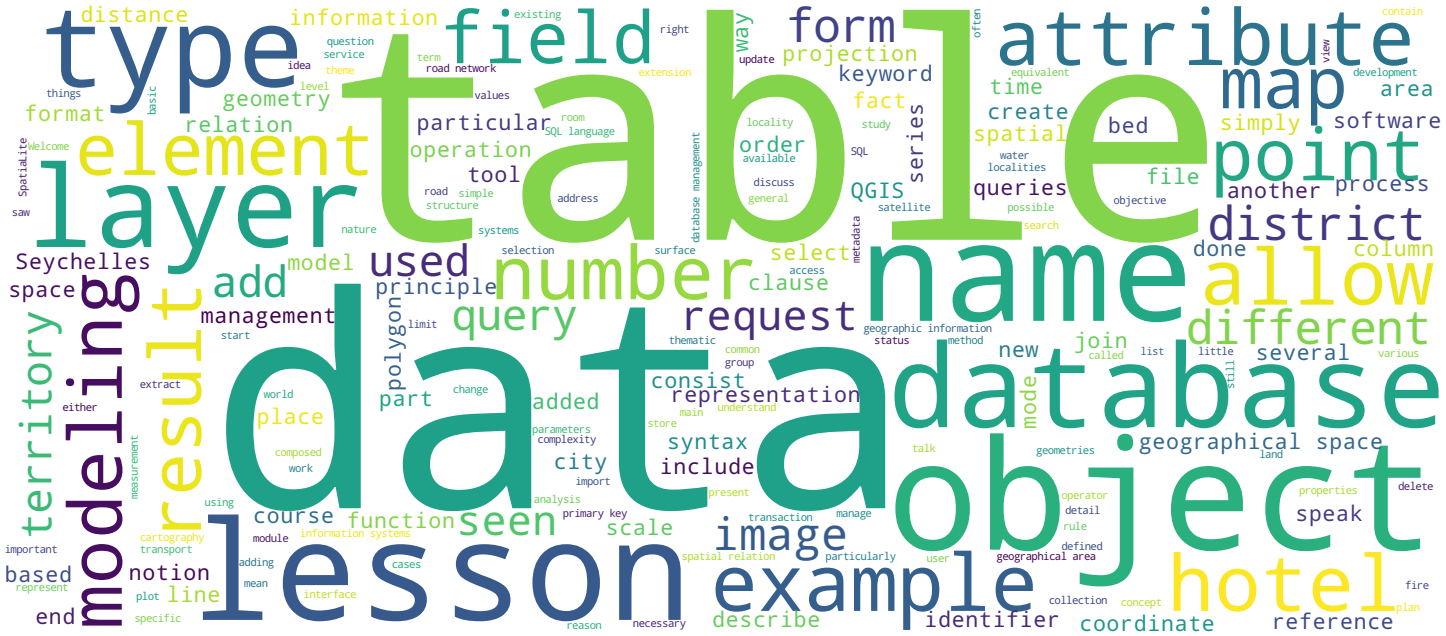
ÉCOLE POLYTECHNIQUE FÉDÉRALE DE LAUSANNE

RESCIF
Réseau d'excellence des sciences de l'ingénieur de la Francophonie

Land modeling

An Introduction to Geographic Information Systems

Stéphane Joost, Marc Soutter, Fernand Kouamé, Amadou Sall



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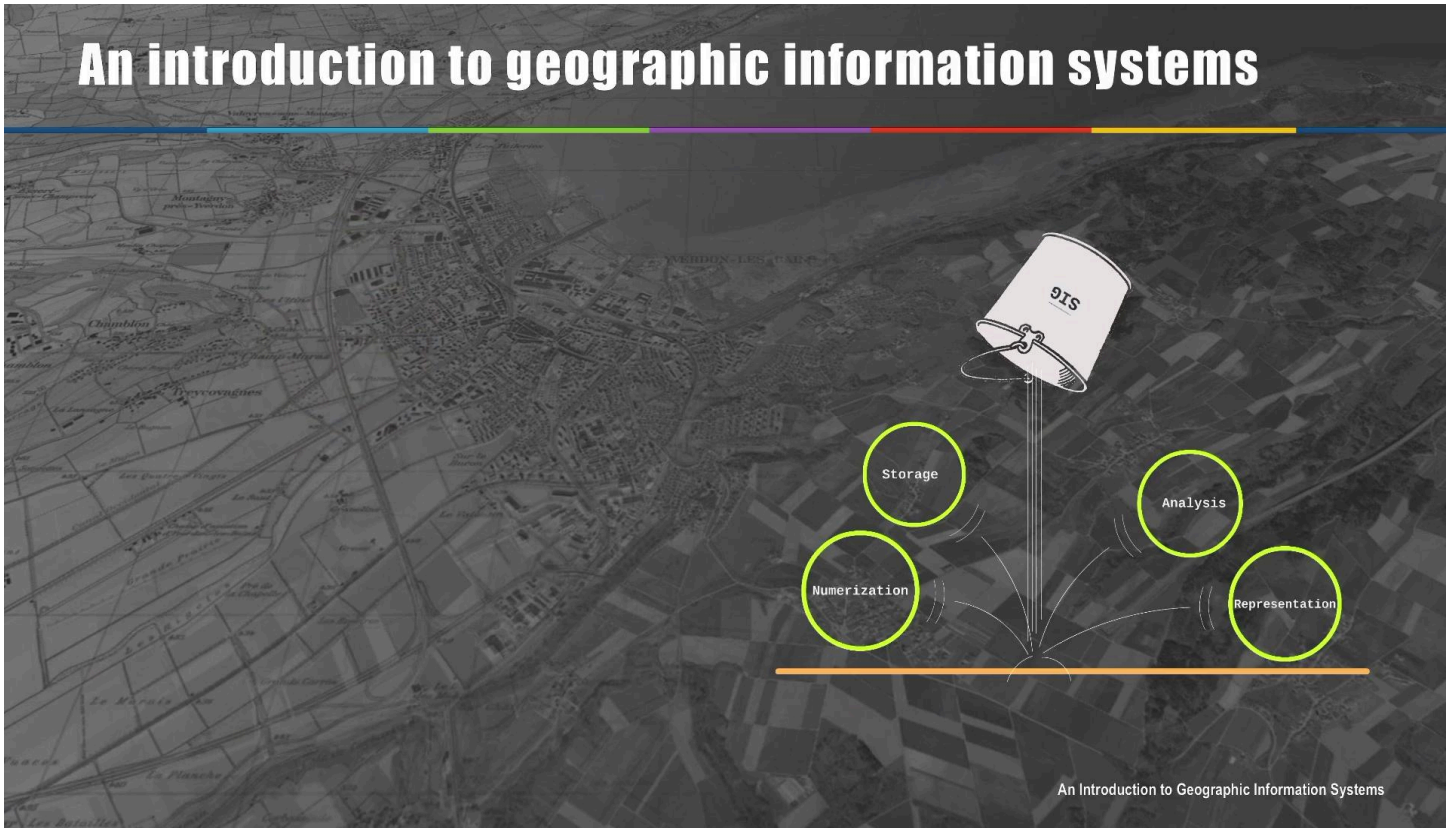
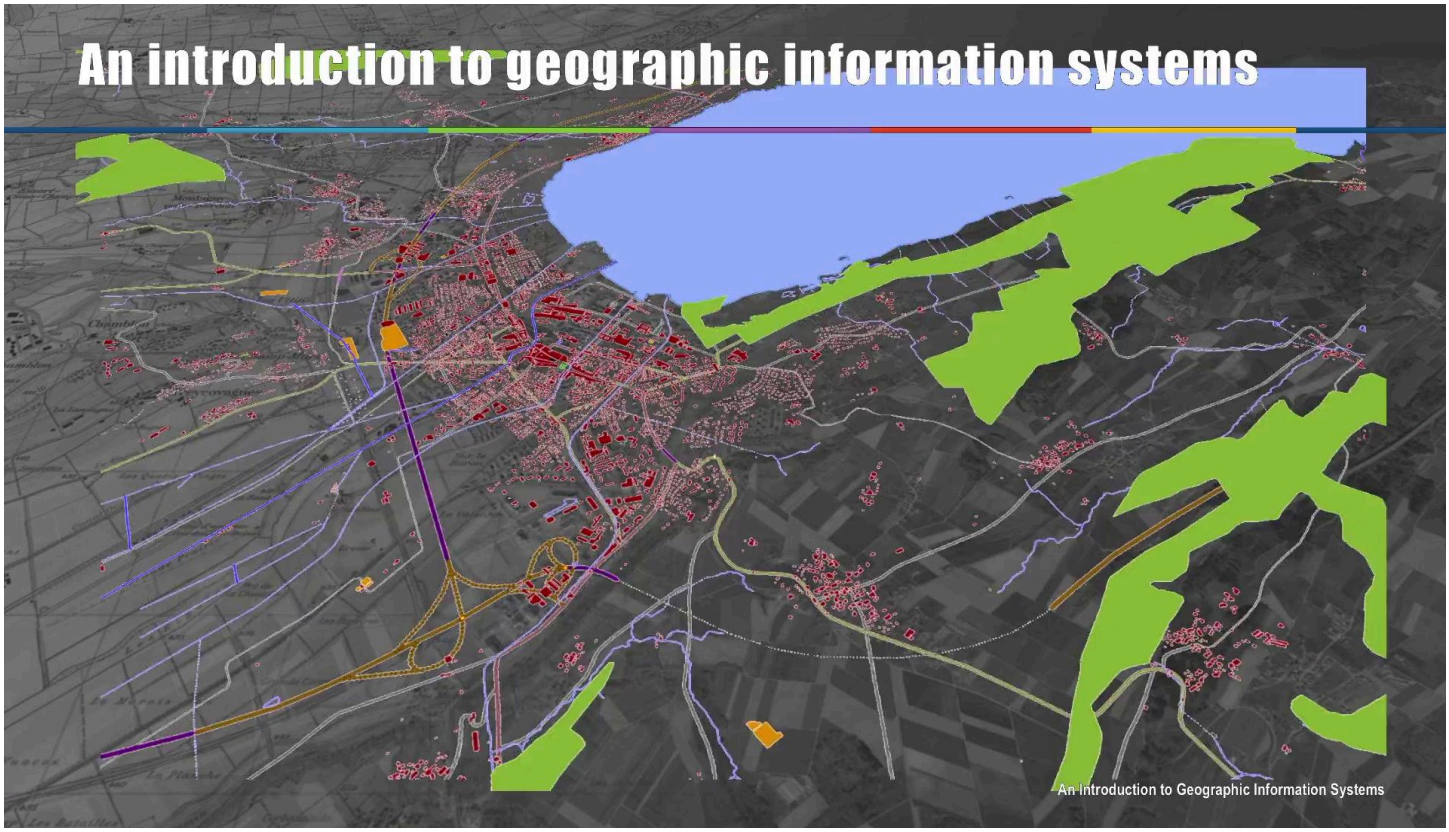


Hello and welcome to this MOOC dedicated to geographic information systems. As you can see, this MOOC consist of 2 parts and is structured around 4 modules. These modules are dedicated respectively to digitization, storage, analysis and representation of the geographical space.

Notes

Summary

0m 23s

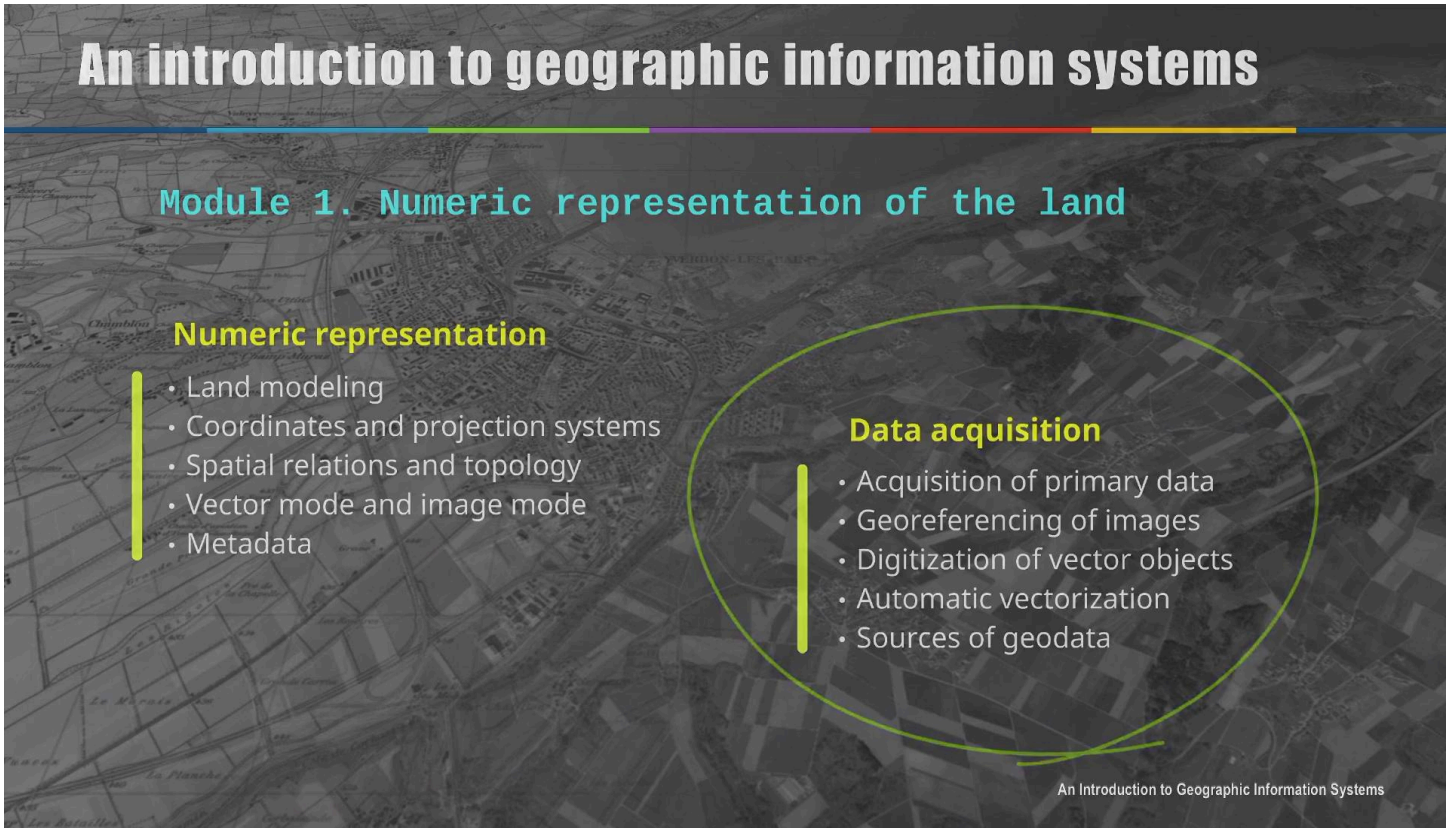


This first module dedicated to digitization is subdivided into a first series of 5 lessons which will allow us to tackle successively the various fundamental aspects of the transformation of a spatial reality to a set of property objects capable of being digitized then saved in a database.

Notes

Summary

0m 44s

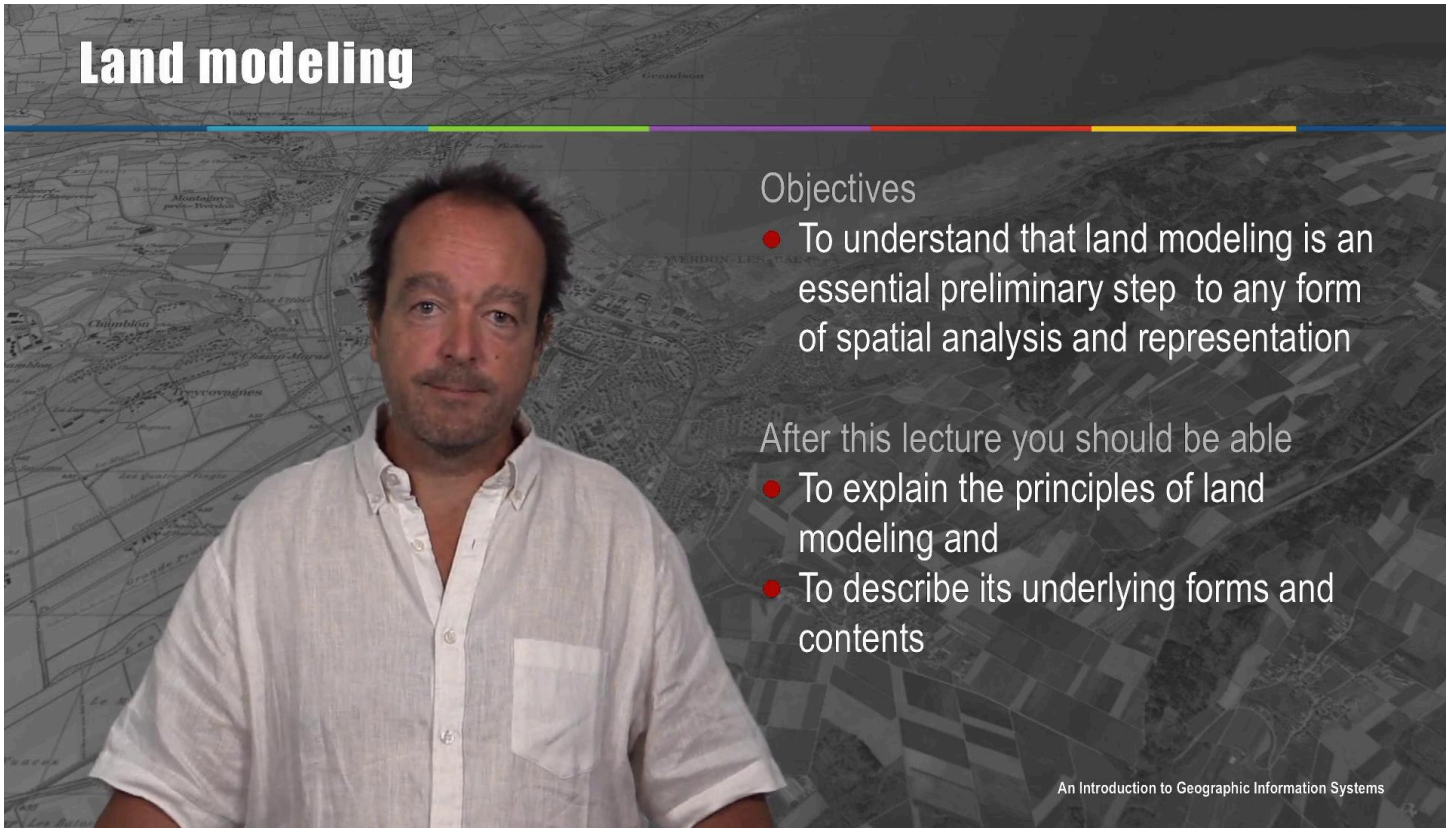


We will then speak successively of modeling of the territory, of coordinates and projection systems, of spatial relations and topologies, of vector modes and images, and metadata. In the second part of this module, we will talk more specifically of data acquisition techniques.

Notes

Summary

1m 03s

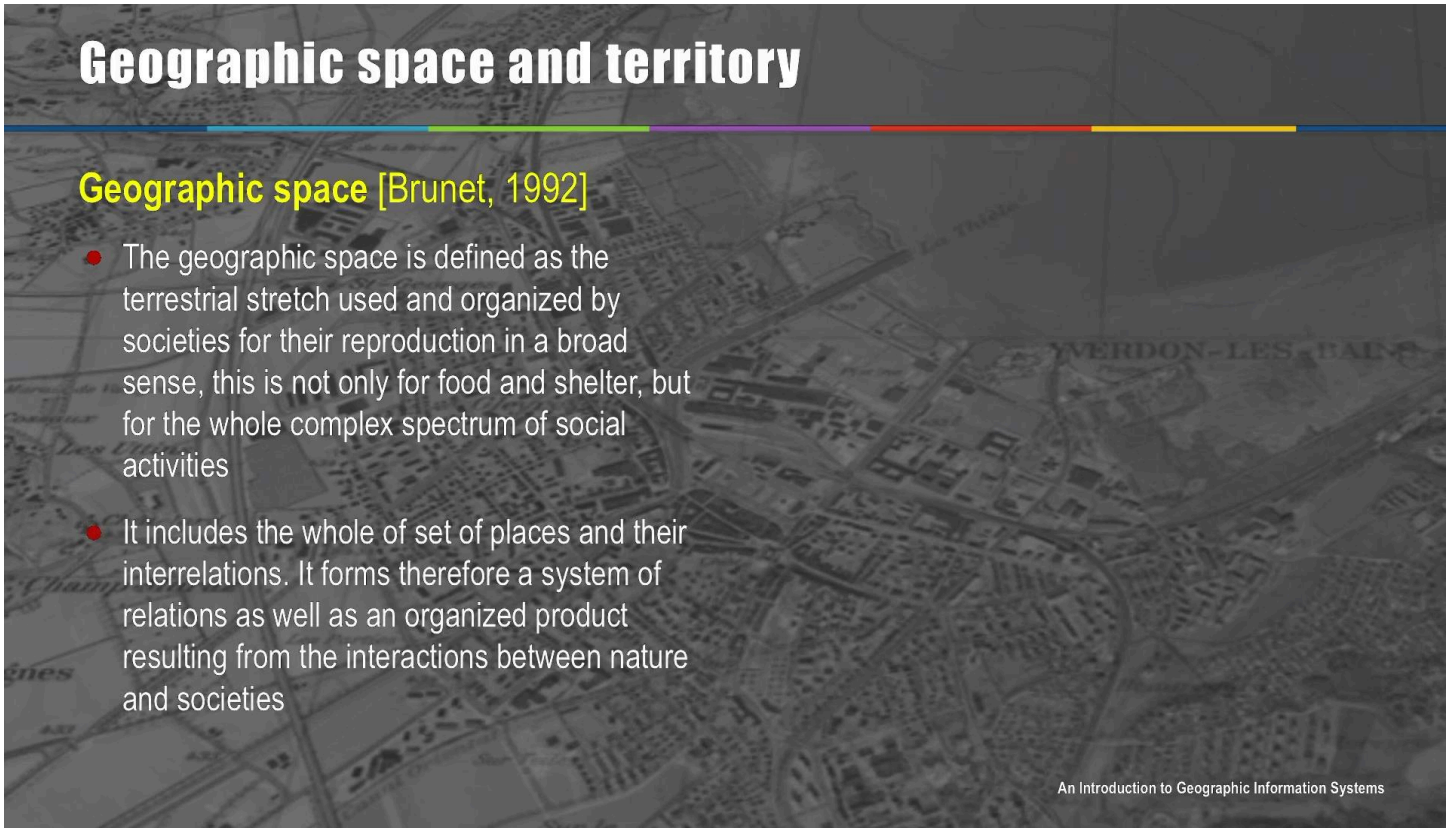


Describing the geographical reality simply by drawing a map or by conceptualizing it in terms of objects and properties necessarily implies a process of modeling in both cases. These are the fundamental elements of this process which we will discuss in this first lesson. The aim of this lesson is to understand the most basic aspects of the modeling of the territory, to understand that this modeling is an indispensable preliminary step for any form of analysis or representation of geographical space. At the end of this lesson, you will be able to explain the principles of the modeling of the territory and to describe the forms and contents on which it can rely on.

Notes

Summary

1m 23s

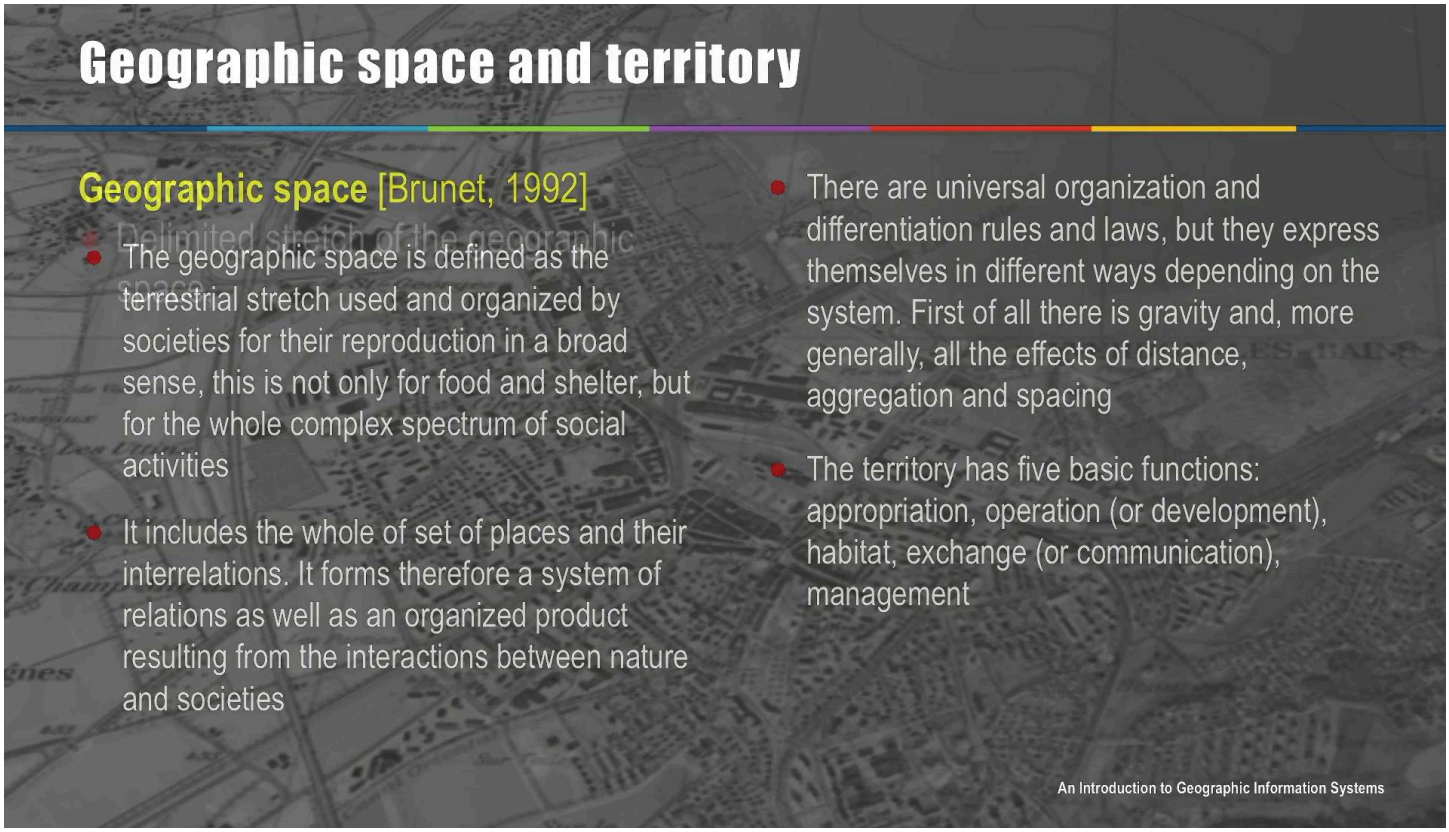


In this lesson we will discuss successively the notions of geographical area and territory, we will discuss the principles of modeling before addressing the cartography aspects which are the first form of modeling of the territory to finally end with the discrete and continuous phenomena which characterize geographical area. The geographical area can be considered at first glance as being composed of its natural physical components: the mountains, the lake or the forests to which anthropised areas such as, for example, built-up areas or transport infrastructures, here a highway, must be added. As soon as we speak of anthropized areas, this implies that the concept of geographical space also includes all the dimensions related to the human geography as well as all the elements related to how the companies function. It is clear that the geographical space extends well beyond its simple sensitive physical reality. Many formal definitions of the notion of geographical spaces have been proposed, such as those of Brunet who says that geographical space is defined as the terrestrial extent used and managed by societies with the intention to reproduce in the broad sense, not only for food and shelter but in all the complexity of social actions.

Notes

Summary

2m 09s



It includes all the places and their relations. It is thus both a system of relations and an organized product Resulting from the interactions between nature and societies. it has laws and rules of organization and universal differentiation but expressed differently depending on the systems. In the first rank is gravitation and more generally all the effects of distance, aggregation and spacing. There are five basic uses: Appropriation, exploitation or promotion, housing, exchange or communication and management.

Notes

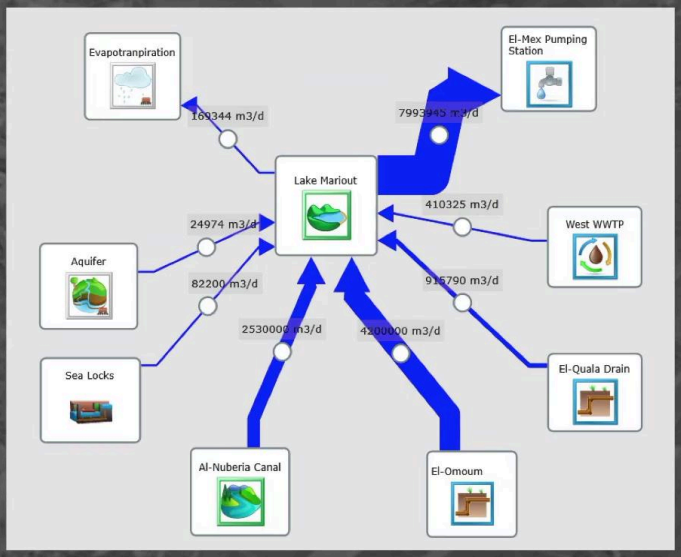
Summary

3m 48s

Land modeling

Due to the territory's complexity

- The model is a **simplified generalized schematic** representation and therefore **controlled reduction** of reality
- The model is rooted in a **systemic approach** to capture reality through its components/objects and their interrelations



An Introduction to Geographic Information Systems

The notion of territory which was also the subject of many discussions and definitions can be considered simply as a delimited part of the geographical space. This delimitation can be based on a boundary in the case of political-administrative subdivisions, as the canton of Vaud here and the councils which compose it. It can also be based on natural limits such as forest edges, watercourses or isolated objects such as trees. The modeling of the territory is the process by which the transition from a visible geographical reality to a diagrammatic representation is done like a north-south facing map on which only what we want appears. Due to the complexity of the territory, its modeling gives a simplified generalized, schematized representation so that we can speak of controlled reduction of reality. As we have just seen, this schematization leads to go from a three-dimensional vision to a 2-dimensional orthogonal view from which we extract the elements worthy of being represented. This extraction is based on a systemic analysis which seeks to describe the reality by its components and their interrelations, as is the case here for the problematic of the management of the waters of Lake Mariout near Alexandria.

Notes

Summary

4m 25s

Land modeling

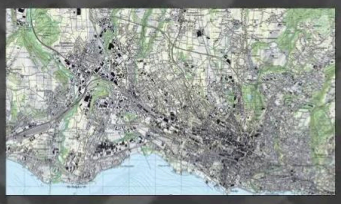
Due to the territory's complexity

- The model is a **simplified generalized schematic** representation and therefore **controlled reduction** of reality
- The model is rooted in a **systemic approach** to capture reality through its components/objects and their interrelations
- The model depends on the thematic vision – geologist, hydrologist, planner – and **scale** of description

1:200'000

1:100'000

1:25'000



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It can be seen that the model of the adopted territory depends on the subject treated. We will not have the same kind of modeling or maps at all to deal with the geology, the water management or to address the issue of public transport. The model chosen also depends on the description scale because the same objects are not selected with the same richness of details at all scales.

Notes

Summary

6m 02s

Cartography

- Initial form of land modeling

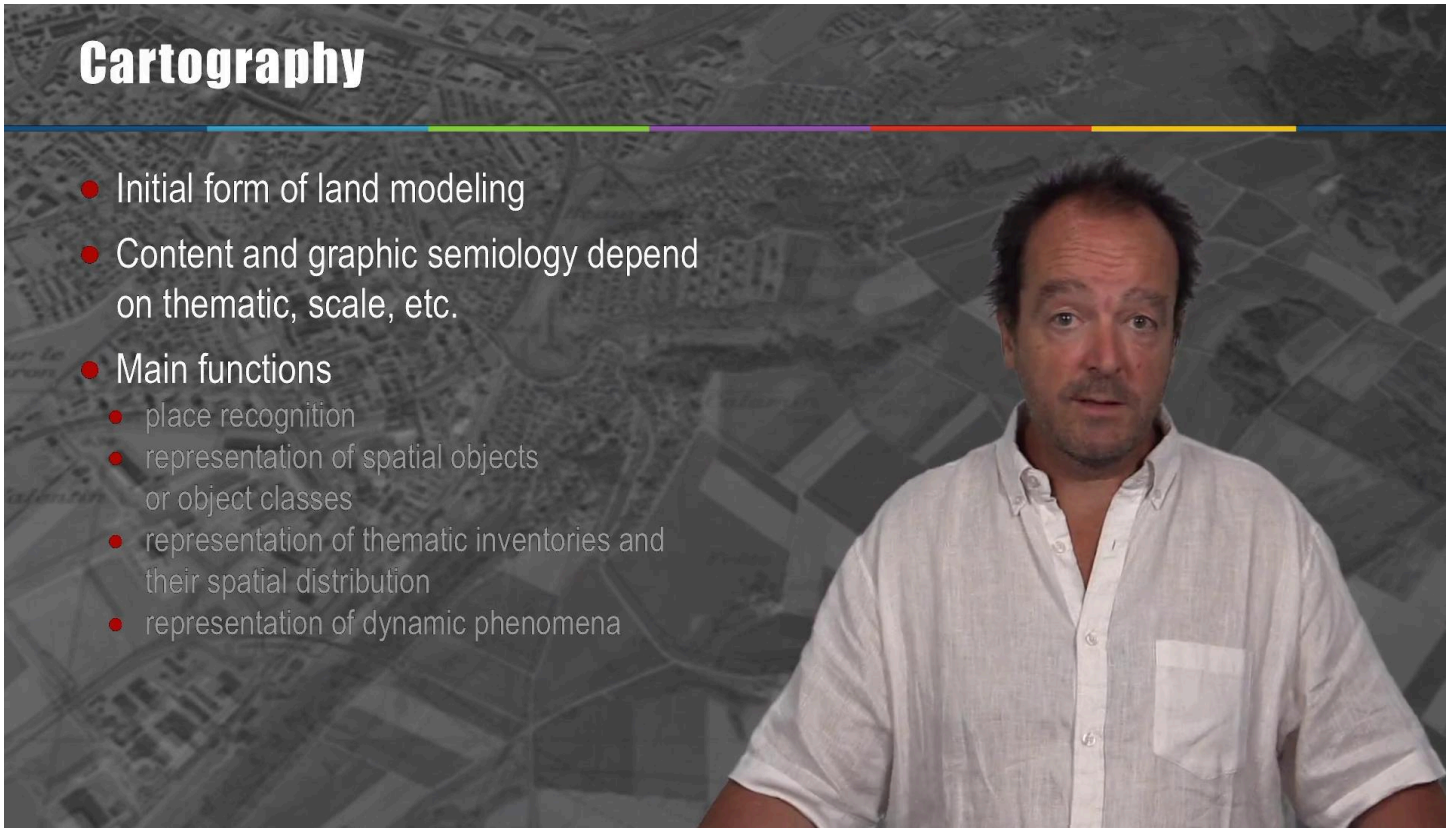
Colomb, 1490

The cartography was the first form of modeling of the geographic space with Eratosthenes' map right from the third century BC, Al Idrissi's map in 1145 Columbus' map in 1490, Cantino's map in 1507, and Mercator's map in 1569.

Notes

Summary

6m 38s

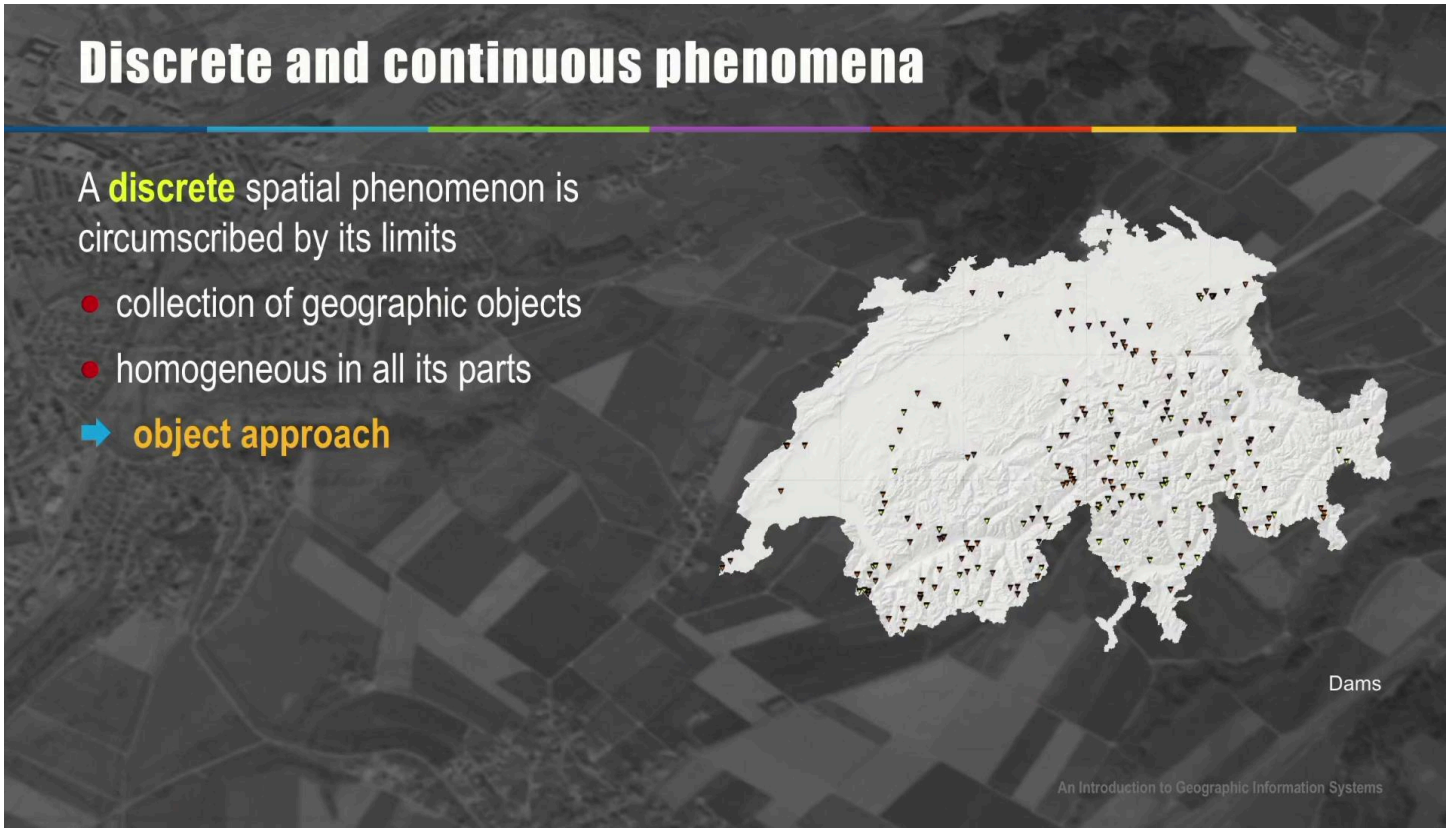


Content and graphical semiology depend, as we have seen, on the discipline and scale, so much so that the cartography has developed by becoming more precise with a regular updating on several scales and for a wide variety of themes. The main functions of cartography are the recognition of a place, the spatial representation of objects or classes of objects, the representation of thematic inventories and their spatial distribution and the representation of dynamic phenomena.

Notes

Summary

6m 58s



We have talked about the notion of modeling of the territory, but we must now look at the possible contents of these models. We can therefore rely on the fact that geographical space is perceived through spatial objects, of the distribution of spatial phenomena and processes and their dynamics in space as well as in time. A discrete spatial phenomenon is circumscribed by its limitations. It consists of a collection of homogeneous objects in all their parts and it is for this reason that we will speak of object approach. It is the case of building areas, wooded areas, hedges, isolated trees, road network lakes and rivers and river basins or the location of dams.

Notes

Summary

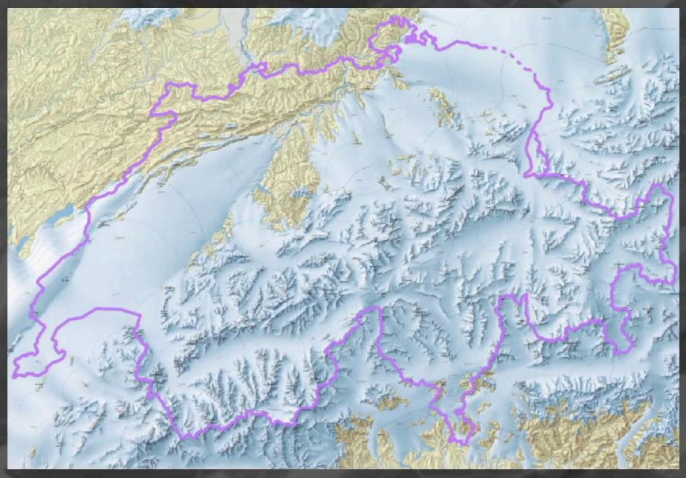
7m 45s

Discrete and continuous phenomena

A **continuous** spatial phenomenon is uncircumscribed

- Properties vary in space
- Represented by isovalue lines
- Represented in regular grids, similar to a numerical image

➡ **image or raster approach**



Glacial maximum

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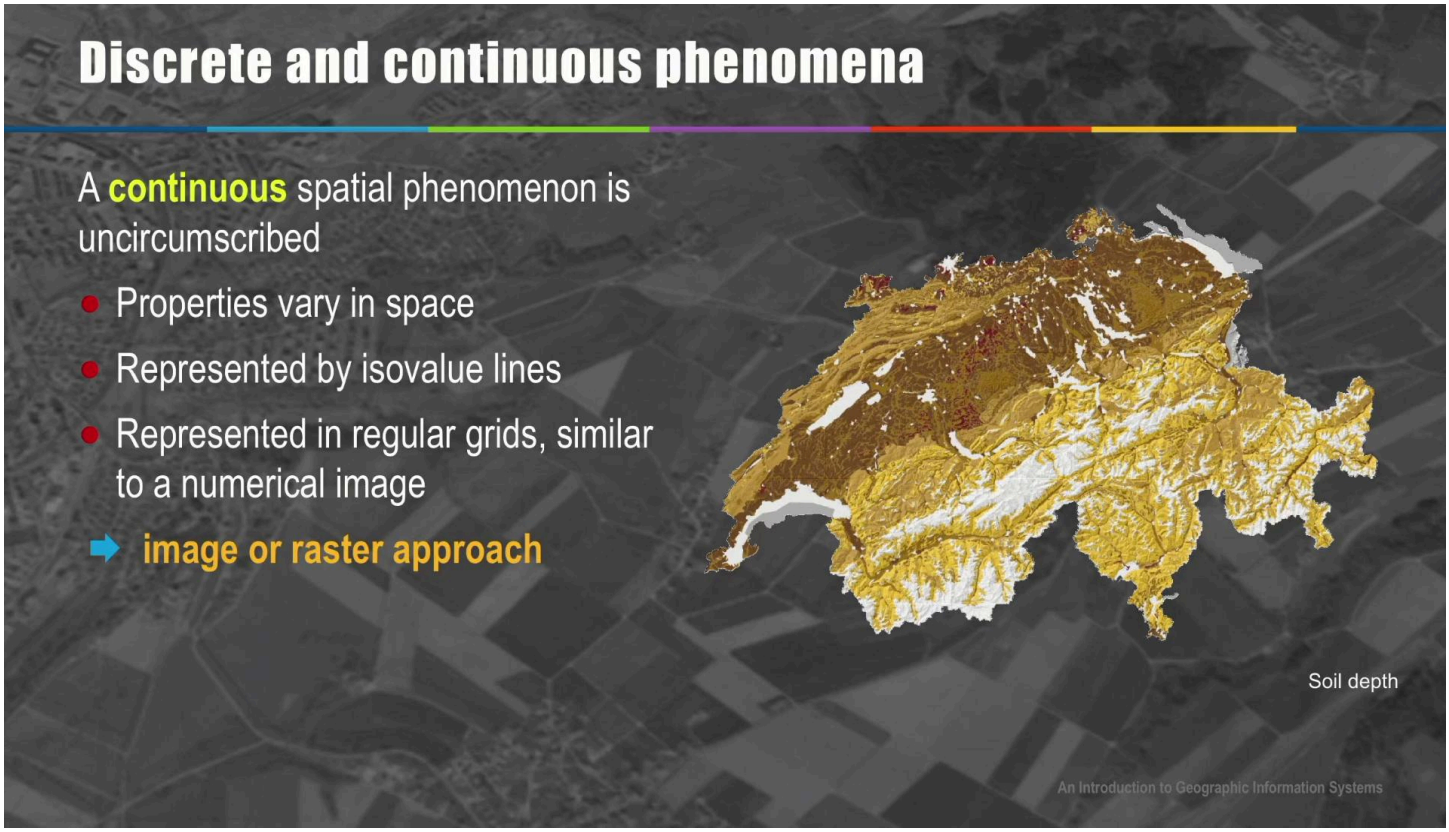
A continuous spatial phenomenon is not circumscribed, its properties vary in space and it can be represented by iso-value curves or in the form of a regular image-like grid, reason why we talk about image approach.

Notes

Summary

8m 37s



It is the case of the glacial maximum, of the slope distribution, of isostatic anomalies or the depth of the soil.

Notes

Summary

8m 55s