iCeBOUND

Cloud Based Decision Support System for Urban Numeric Data

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Brief description

The goal of iCeBOUND is to design and develop a Decision Support System (DSS) that leverages 3D digital urban data to facilitate environmental analyses in cities. iCeBOUND aims at providing:

1. innovative tools for analysing fine-grained satellite images, and
2. decision-makers with relevant indicators for city planning and energy management.

Two use cases are considered in the scope of this project: solar energy potential and Global Navigation Satellite System visibility.

Key points

iCeBOUND is a research project funded by the Swiss Commission for Technology and Innovation (CTI).

It involves several partners:

1. University of Applied Sciences and Arts, Western Switzerland (HES-SO), hepia
2. European Centre for Nuclear Research (CERN)
3. Water and electric power provider of Geneva (SIG)
4. Geneva Canton
5. Arxt-IT

The "diversity" of partners shows the importance of the project and its multi-disciplinary aspect.

Annual solar radiation of Geneva city

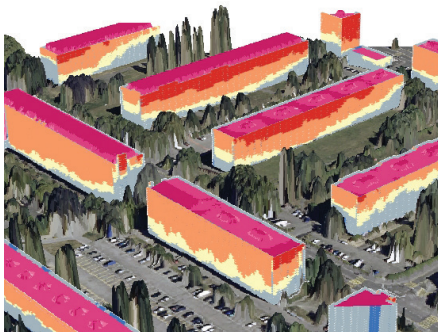
Cities of developed countries are nowadays increasingly digitized as 3D urban numerical models. However, the use of these models as a technological support for different applications related to the fields of environment, energy and urban planning, remains underused. The assessment of solar potential (solar mapping) and the estimation of satellite visibility, underlined here as solar energy potential and Global Navigation Satellite System (GNSS) visibility respectively, are two types of applications based on the computation of 3D urban numerical models. The main goal is to use each of these applications for different stakeholders, such as:

1. Local authorities, considering their distinct needs and purposes;
2. Industrial and energy companies doing business at a local level;
3. Surveying companies that use GNSS for topographical measurements in densely populated urban areas.

The extraction of three-dimensional spatial indicators adjusted to both applications represents a great research challenge. This research has been conducted using different methods of data aggregation. Indeed, the use of these particular spatial indicators allows a more refined analysis of the urban fabric and guarantees that output results are adjusted to end-user needs.

The goal of the "Cloud Based Design Support System for Urban Numeric Data" (iCeBOUND) project is to design and develop a Decision Support System (DSS) that leverages 3D digital urban data to facilitate environmental analyses in cities. iCeBOUND aims at providing decision-makers with relevant indicators for city planning and energy management.

Although both applications (solar energy potential and GNSS) are very different in terms of functionality and targeted market, the algorithm they use is the same: the Shading Algorithm (see Figure). This algorithm is memory and CPU time consuming.



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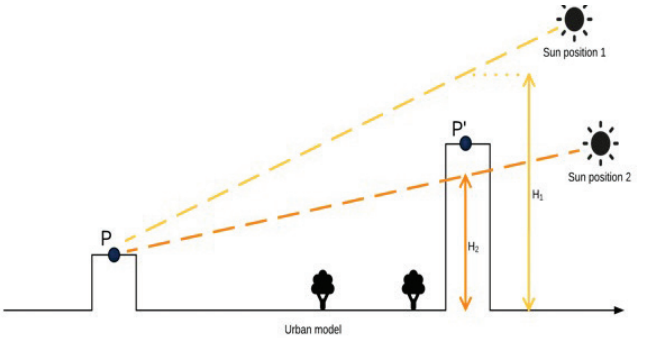

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Output

Cities play an increasingly important role regarding energy transition. The main goal is to reach international and national (Swiss) targets related to energy efficiency and CO2 emission reduction. As a contribution to these global challenges, during the last 6 years, the State of Geneva has produced a detailed solar cadaster. The iCeBOUND project has been launched in order to facilitate periodical updates of this solar cadaster.

Special equipment

The computing resources used to experiment iCeBOUND are based on cloud infrastructures: Amazon Web Services (AWS), SWITCHEngines and Amazon Elastic MapReduce (EMR). These infrastructures are chosen according to:

1. The ease of availability in the case of AWS;
2. The possibility to obtain a customised “configuration” in the case of SWITCHengines.

Legend

1 -Solar energy potential of roofs and facades
2 -The Shading Algorithm

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