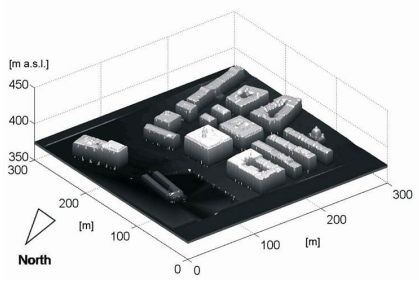
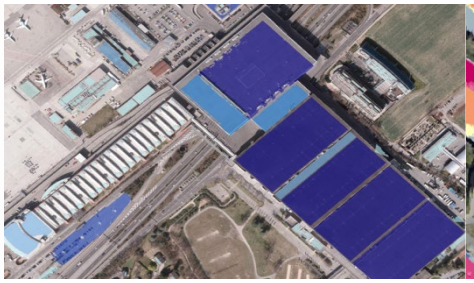
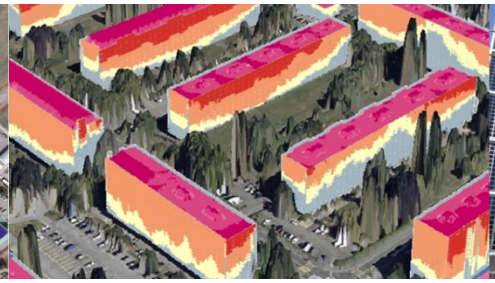



Swiss Contribution to Task 63: Improving planning for solar energy access in urban areas (G2Solaire, VALES, HELIOS)

SOLAR HEATING & COOLING PROGRAMME
INTERNATIONAL ENERGY AGENCY

Prof. Gilles Desthieux, gilles.desthieux@hesge.ch

IEA SHC National Research Day, Rapperswil, 01.06.2022

Swiss contribution with the support of:

Schweizerische Eidgenossenschaft
Confédération suisse
Confederazione Svizzera
Confederaziun svizra

Federal Department of the Environment, Transport, Energy and Communications

Swiss Federal Office of Energy SFOE

h e p i a
Haute école du paysage, d'ingénierie et d'architecture de Genève

Hes·SO GENÈVE
Haute Ecole Spécialisée de Suisse occidentale

Overview

G2Solaire

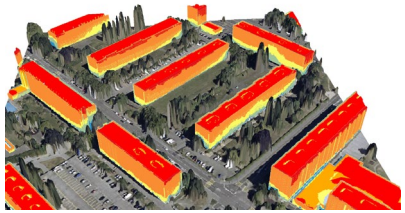
Interreg France - Suisse

2019 - 2022

Boosting solar market in the Greater Geneva (**Solar cadaster**)

VALES

Hes·so
University of Applied Sciences and Arts Western Switzerland



2021 - 2022

3D and solar modelling of building **facades** at large urban scales

HELIOS

The Research Council of Norway

Helios
enHancing optimal ExploitatIOn of Solar energy in Nordic cities through digitalization of built environment

2022 - 205

Enhancing optimal exploitation of solar energy in **Nordic cities** through the digitalization of the built environment

Task 63 | Solar Neighborhood Planning

SHC
SOLAR HEATING & COOLING PROGRAMME
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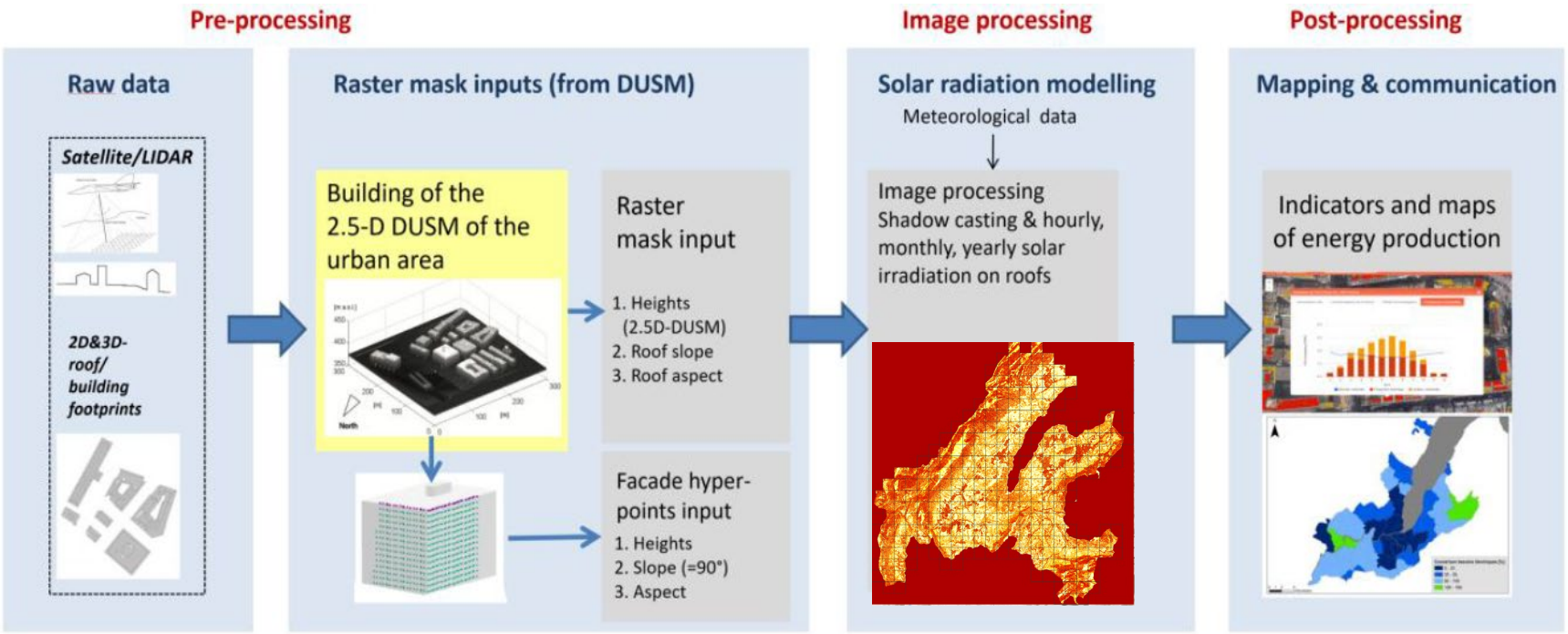
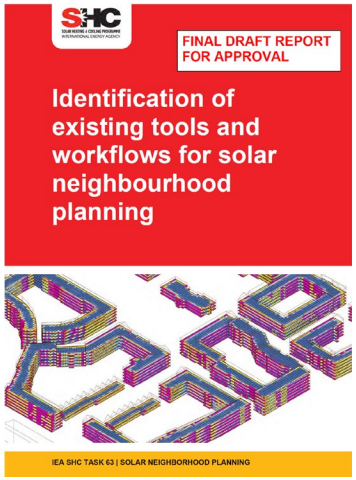
Workflow to compute solar cadaster



Contribution to STC: solar planning tools

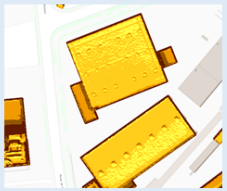


Selfconsumpion of solar PV workflow

- Simulation selfconsumption of each building of the Greater Geneva

Raw data

Solar cadaster

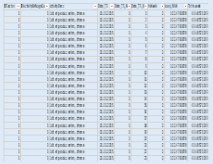


Hourly weather statistics

Yearly consumptions by building

Data from ESCO (SIG, ENEDIS)
Estimated data (usage, built areas)

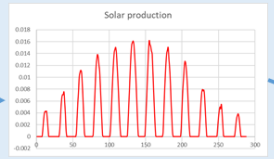
Database of load profile by use



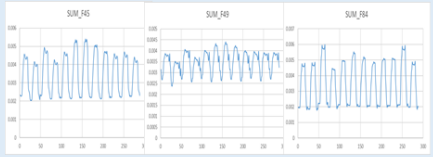
SIG – Geneva (96 classes)

Hourly profiles

Solar production profile

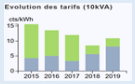


Load profiles (by type of use)



Economic assumptions

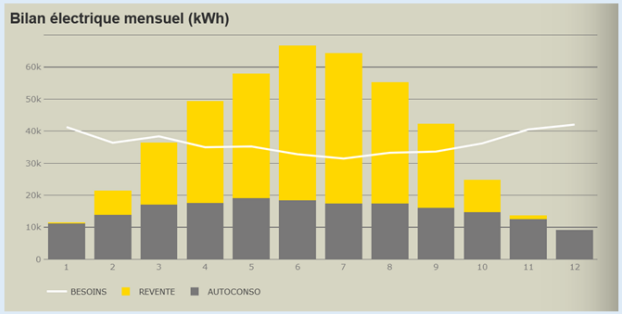
Investment and cost statistics CHF ou €/kW (SFOE, ADEME)



Feed-in tariffs for solar electricity (according to GE, France, VD)

Electricity resale rates (according to GE, France, VD)

Selfconsumption balance and KPIs



Monthly balance (loads, selfconsumption, resale)

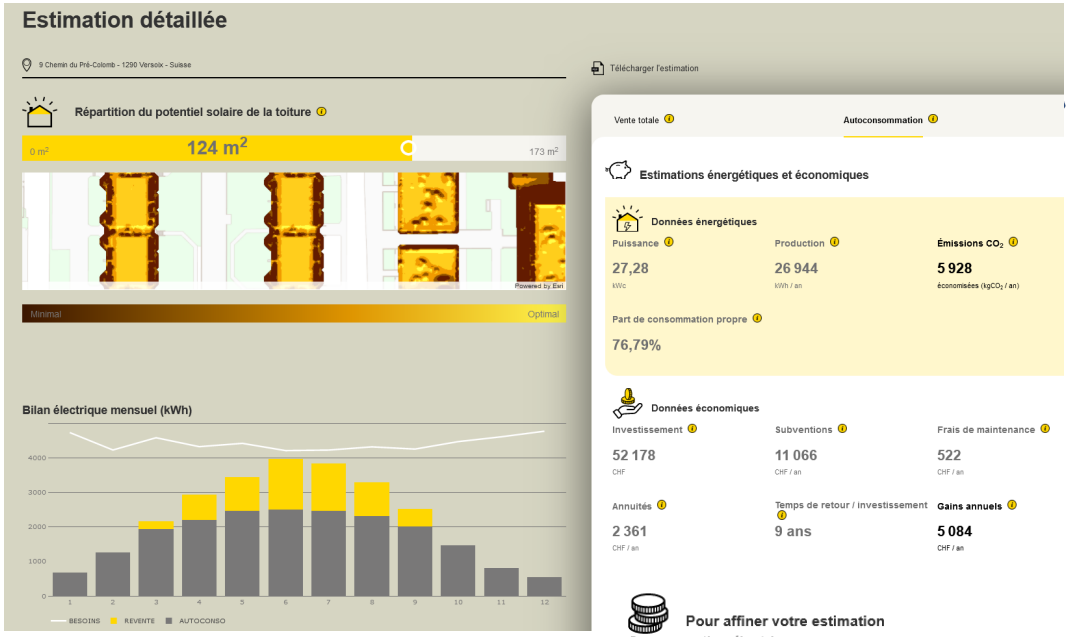
Key peformance indicators (economic and energy)

Web interface of solar cadaster

Key performance indicators

To be published from 15.6.22 on: https://apps.sitg-lab.ch/solaire/

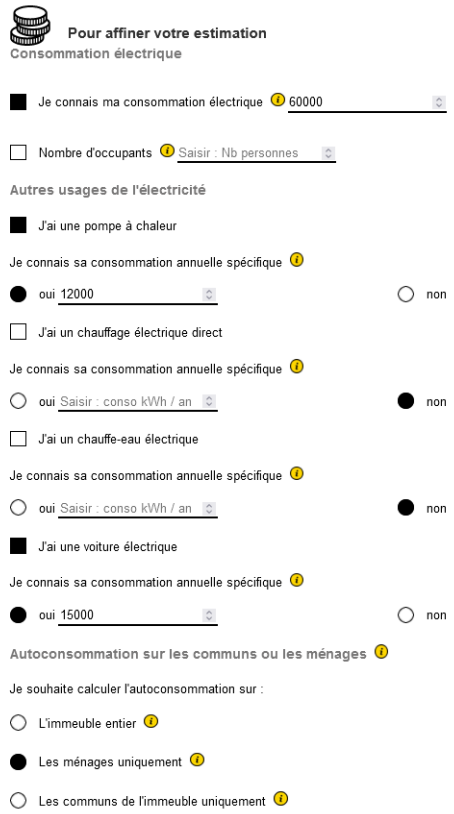
Technical and financial estimation



Principle:

- Pre-calculated input data
- Online update by changing the cursor position
- And/or by providing information and data via the form

Online formular to fill consumption data and refine simulation



Pilot neighborhoods

ZAC Ferney-Genève (01)
Demonstration new ND development

©CCPG/SPL

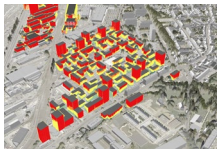
Industrial area of Bois-de-Bay (GE)
PV solar and microgrid

©FTI/SIG | Photographe Lindsay Rebetez

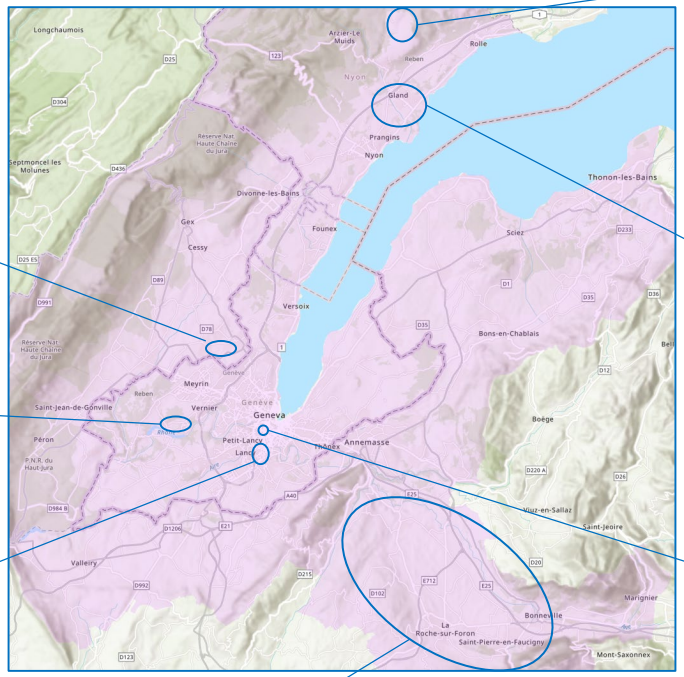
©FTI/SIG

PAV Grosselin (GE)
Demonstration new ND development

© CLR architectes @archigraphie



© HEPIA



CC Rochois et Faucigny-Glière (74)
Solar communities

©Le Dauphiné libéré, 23.10.21

Burtigny (VD)
Solar energy and heritage

©Wikiwand

© www.prime-energy-technics.ch

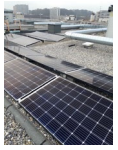
Gland (VD)
Grouped call for tenders

© Rapport de gestion Gland 2019

©SEIC GLAND

Cité Carl Vogt (GE)
Energy retrofit

©Hospice général



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SHC
SOLAR HEATING & COOLING PROGRAMME
INTERNATIONAL ENERGY AGENCY

Contribution to:
STA: solar planning strategies
STD: case studies

Hes·so
University of Applied Sciences and Arts
Western Switzerland

Colorful BIPV in Basel (Kholesilo) *(source : Architectes.ch, 2022)*

Aerial image of the Meyrin district (Geneva)
(GoogleMaps)

- Geometry
- Windows detection (machine learning)
- Cloud points
- Albedo

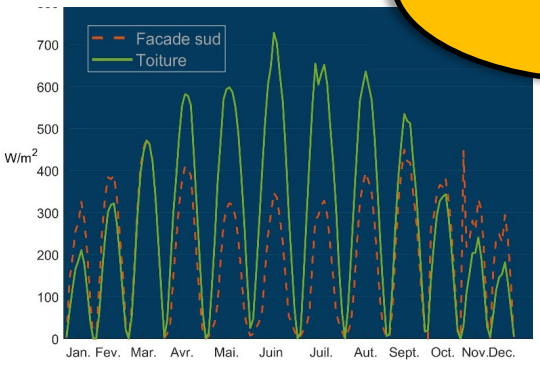
Bringing solar to the urban environment

Digital modeling of the urban environment

VALES

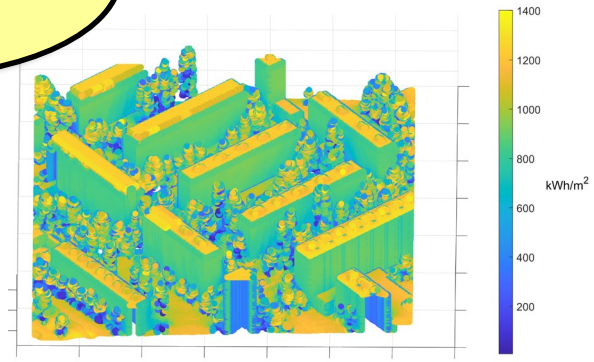
Advise on strategies to adopt

Simulate solar gain on all surfaces

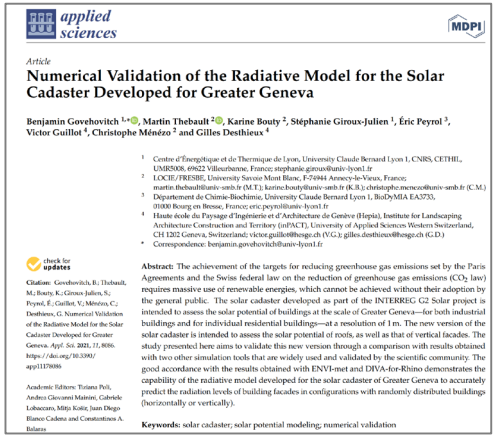


Difference in potential between south facade and roof on an isolated building in Geneva

Simulation of the sunshine on the Meyrin district (radiosity approach)



Collaborative work in Solar task 63 on modelling tools benchmarking



applied sciences

MDPI

Article

Numerical Validation of the Radiative Model for the Solar Cadaster Developed for Greater Geneva

Benjamin Govehovitch [1,*], Martin Thebault [2], Karine Bouty [2], Stéphanie Giroux-Julien [1], Éric Peyrol [3], Victor Guillot [4], Christophe Ménézo [2] and Gilles Desthieux [4]

[1] Centre d'Énergétique et de Thermique de Lyon, University Claude Bernard Lyon 1, CNRS, CETHIL, UMR5008, 69622 Villeurbanne, France; stephanie.giroux@univ-lyon1.fr
[2] LOCIE/FRESBE, University Savoie Mont Blanc, F-74944 Annecy-le-Vieux, France; martin.thebault@univ-smb.fr (M.T.); karine.bouty@univ-smb.fr (K.B.); christophe.menezo@univ-smb.fr (C.M.)
[3] Département de Chimie-Biochimie, University Claude Bernard Lyon 1, BioDyMIA EA3733, 01000 Bourg en Bresse, France; eric.peyrol@univ-lyon1.fr
[4] Haute école du Paysage d'Ingénierie et d'Architecture de Genève (Hepia), Institute for Landscaping Architecture Construction and Territory (inPACT), University of Applied Sciences Western Switzerland, CH 1202 Geneva, Switzerland; victor.guillot@hesge.ch (V.G.); gilles.desthieux@hesge.ch (G.D.)
* Correspondence: benjamin.govehovitch@univ-lyon1.fr

check for updates

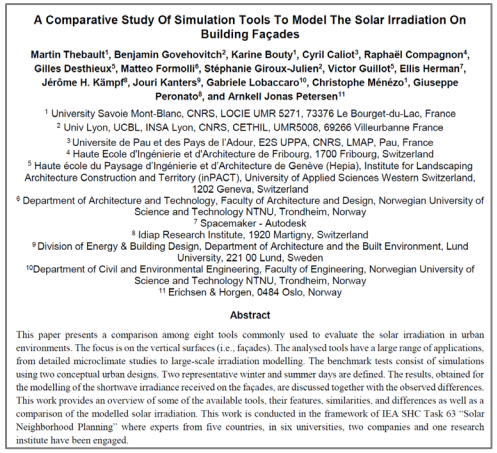
Citation: Govehovitch, B.; Thebault, M.; Bouty, K.; Giroux-Julien, S.; Peyrol, É.; Guillot, V.; Ménézo, C.; Desthieux, G. Numerical Validation of the Radiative Model for the Solar Cadaster Developed for Greater Geneva. *Appl. Sci.* **2021**, *11*, 8086. https://doi.org/10.3390/app11178086

Academic Editors: Tiziana Poli, Andrea Giovanni Mainini, Gabriele Lobaccaro, Mitja Kolar, Juan Diego Blanco Cadena and Constantinos A. Balaras

Abstract: The achievement of the targets for reducing greenhouse gas emissions set by the Paris Agreements and the Swiss federal law on the reduction of greenhouse gas emissions (CO_2 law) requires massive use of renewable energies, which cannot be achieved without their adoption by the general public. The solar cadaster developed as part of the INTERREG G2 Solar project is intended to assess the solar potential of buildings at the scale of Greater Geneva—for both industrial buildings and for individual residential buildings—at a resolution of 1 m. The new version of the solar cadaster is intended to assess the solar potential of roofs, as well as that of vertical facades. The study presented here aims to validate this new version through a comparison with results obtained with two other simulation tools that are widely used and validated by the scientific community. The good accordance with the results obtained with ENVI-met and DIVA-for-Rhino demonstrates the capability of the radiative model developed for the solar cadaster of Greater Geneva to accurately predict the radiation levels of building facades in configurations with randomly distributed buildings (horizontally or vertically).

Keywords: solar cadaster; solar potential modeling; numerical validation

Govehovitch et al., 2021



A Comparative Study Of Simulation Tools To Model The Solar Irradiation On Building Façades

Martin Thebault[1], Benjamin Govehovitch[2], Karine Bouty[1], Cyril Caliot[3], Raphaël Compagnon[4], Gilles Desthieux[5], Matteo Formolli[6], Stéphanie Giroux-Julien[2], Victor Guillot[5], Ellis Herman[7], Jérôme H. Kämpf[8], Jouri Kanters[9], Gabriele Lobaccaro[10], Christophe Ménézo[1], Giuseppe Peronato[9], and Arnkell Jonas Petersen[11]

[1] University Savoie Mont-Blanc, CNRS, LOCIE UMR 5271, 73376 Le Bourget-du-Lac, France
[2] Univ Lyon, UCBL, INSA Lyon, CNRS, CETHIL, UMR5008, 69266 Villeurbanne France
[3] Universite de Pau et des Pays de l'Adour, E2S UPPA, CNRS, LMAP, Pau, France
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[6] Department of Architecture and Technology, Faculty of Architecture and Design, Norwegian University of Science and Technology NTNU, Trondheim, Norway
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[8] Idiap Research Institute, 1920 Martigny, Switzerland
[9] Division of Energy & Building Design, Department of Architecture and the Built Environment, Lund University, 221 00 Lund, Sweden
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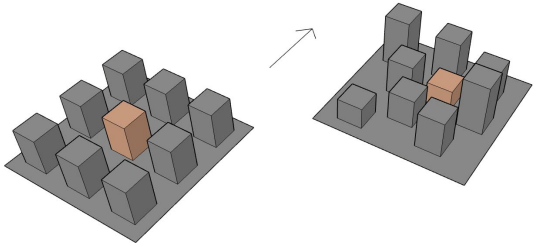
[11] Erichsen & Horgen, 0484 Oslo, Norway

Abstract

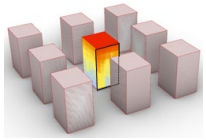
This paper presents a comparison among eight tools commonly used to evaluate the solar irradiation in urban environments. The focus is on the vertical surfaces (i.e., façades). The analysed tools have a large range of applications, from detailed microclimate studies to large-scale irradiation modelling. The benchmark tests consist of simulations using two conceptual urban designs. Two representative winter and summer days are defined. The results, obtained for the modelling of the shortwave irradiance received on the façades, are discussed together with the observed differences. This work provides an overview of some of the available tools, their features, similarities, and differences as well as a comparison of the modelled solar irradiation. This work is conducted in the framework of IEA SHC Task 63 "Solar Neighborhood Planning" where experts from five countries, in six universities, two companies and one research institute have been engaged.

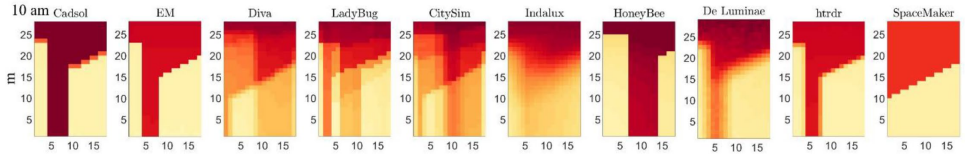
Thebault et al., 2022 (Solar World Congress 2021, in press)

- **Objectives**: to compare the CadSOL model with other known models on fictitious roofs and facades on two representative days (February and August).
- **Conclusions**: CadSOL tool globally consistent and reliable compared to other tools.

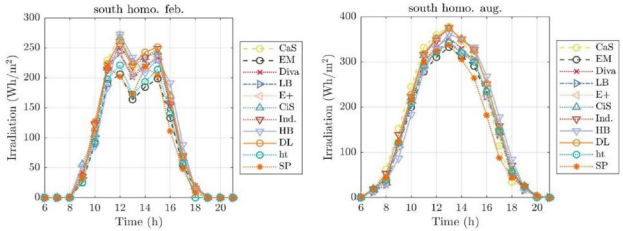


Homogeneous and heterogeneous fictitious neighborhoods





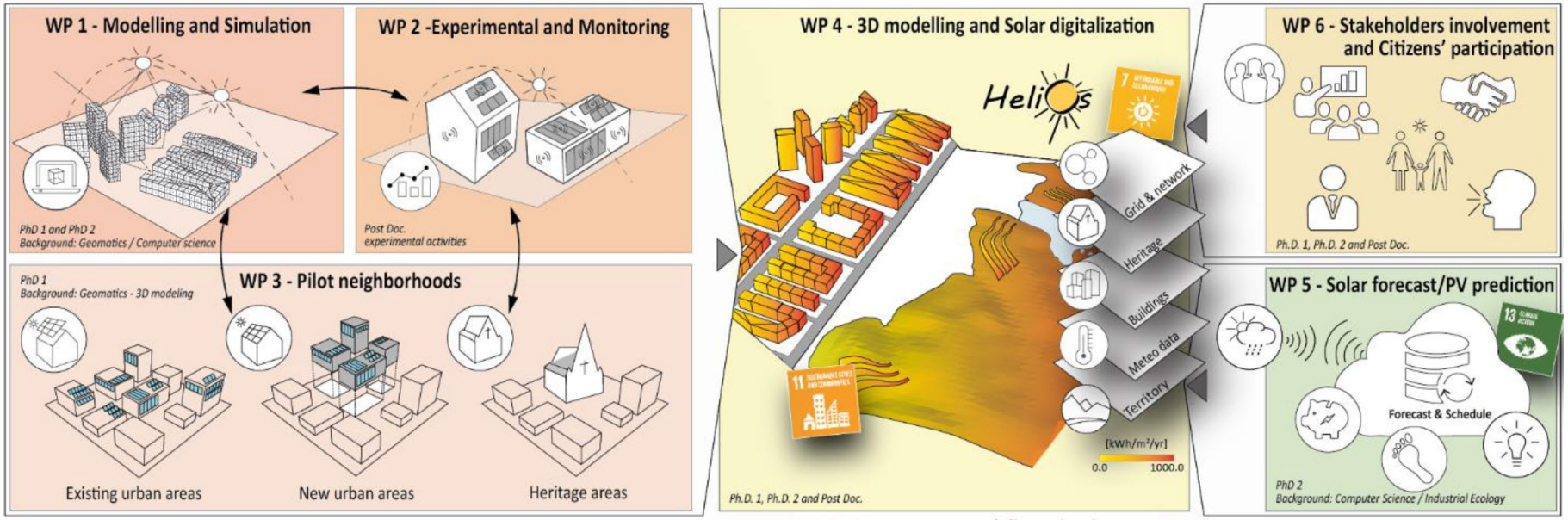
Irradiation profiles, homogeneous neighborhood, eastern facade, February at 10 am (source: Thebault et al., 2022)



Comparison of hourly global values, homogeneous neighborhood, South facade, February (left) and August (right) (source: Thebault et al., 2022)

HELIOS

- Enabling solar irradiation mapping for optimal exploitation of solar energy at multiple spatial scales, ranging from the facade, building, to neighborhoods and whole city.
- Predicting solar energy generation at multiple temporal domains, ranging from short (daily), mid (50 years) and long (100 years) term under climate change scenarios.



https://www.ntnu.edu/helios

Contribution from HEPIA

- Co-supervision with NTNU of a PhD work on 3D and solar modelling
- Workshops / meetings
- Publications