

Comparison of the Solar Energy Utilisation Potential of three Different Urban Environments

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Project aims

Project aims

Locations

Urban sites

Typical views

Methodology

Site models

Indicators

Fractions

Maps

Conclusion

To promote the direct utilisation of solar energy in the urban environment

- **Passive/Active**
- **Photovoltaic**
- **Daylighting**



“Sunny Woods”
Beat Kämpfen (CH)

“Family House”
Manfred Brausem (D)

“Caisse Congé du bâtiment”
Philippe Samyn (BE)

“School Vella”
Bearth&Deplazes (CH)

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Evaluation of the actual solar energy utilisation potential for three urban sites in Switzerland

- **Basel – Geneva - Lausanne**

Financial support

- **Swiss Federal Office of Energy**

Programme insertion

- **"2000 Watt Society "**

Geographical locations

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Three representative Swiss cities

• Basel

Industrial

190 800 Inhab.

51.50 Inhab./ha

3 700 ha

• Geneva

International

180 000 Inhab.

106 Inhab./ha

1 700 ha

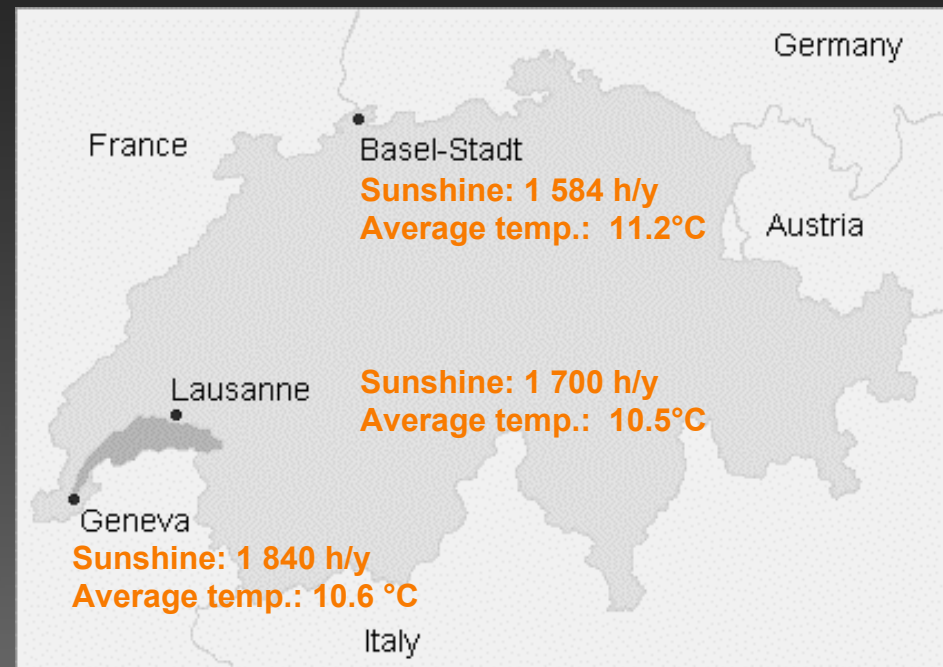
• Lausanne

Sport/Tourist

125 000 Inhab.

30.50 Inhab./ha

4 100 ha





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Selected urban sites

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0 500 1000 m



0 500 1500 m



0 100 500 m



- **Basel**

 - **Matthaesus**

 - City center

 - Medieval district

 - Checkboard plan

 - 59 hectares

 - 15 300 inhab.

- **Geneva**

 - **Meyrin**

 - Suburb

 - The sixties

 - Functionalist

 - 998 hectares

 - 20 500 inhab.

- **Lausanne**

 - **Bellevaux**

 - Edged city

 - The fifties

 - Mixte

 - 36 hectares

 - 4 600 inhab.



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- **Matthaeus/Basel**

259 inhab./hect.

4-5 stories block of flats

Residential beginning 20th C.

- **Meyrin/Geneva**

20 inhab./hect.

8-10 stories block of flats

Residential 1960-1970

- **Bellevaux/Lausanne**

130 inhab./hect.

Various stories block of flats

Mixed allocation 1970-1980

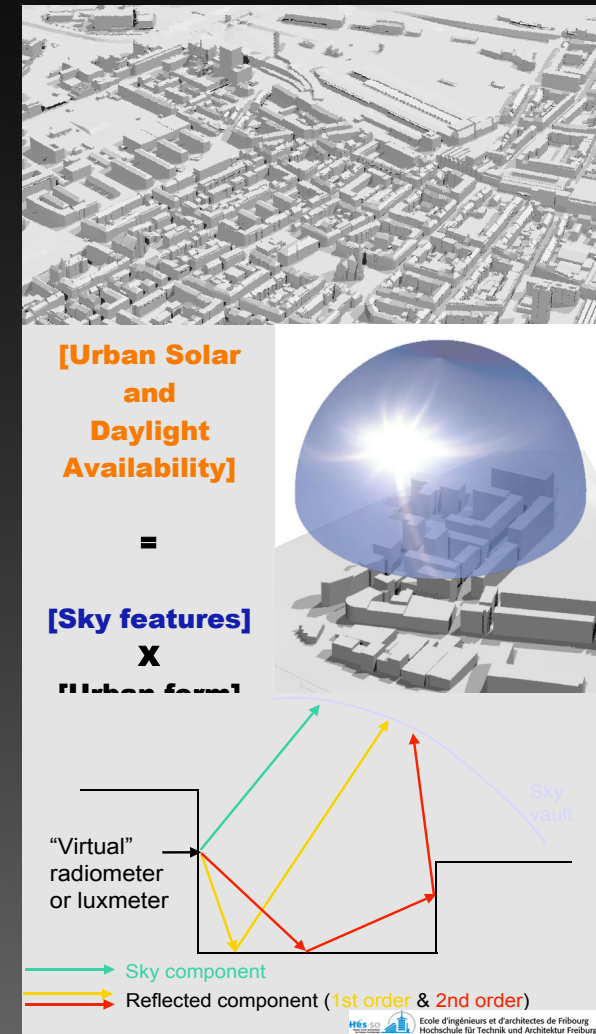


Simulation methodology

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Compagnon's methodology
PRECis european project

- **Statistical climate data**
 - Meteonorm
- **Site digital models**
 - Ground relief (Laser)
 - Buildings (3DFACE)
- **Computer simulation**
 - Ray tracing technique
- **Performance indicators**





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Site digital models

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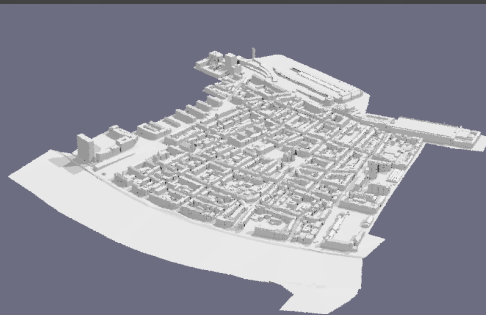
Showmodels

Sources

- AutoCAD (3DFACE)
- Laser (DTM)
- Laser (DTM/DSM)



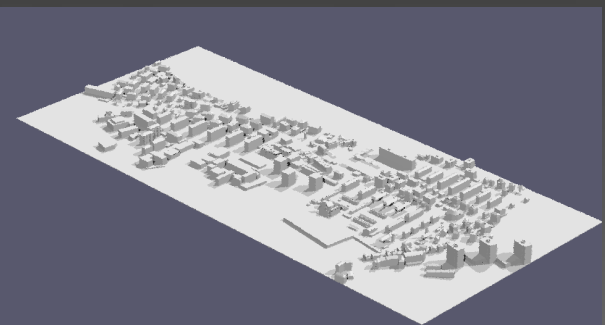
Matthaeus



Meyrin



Bellevaux





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Site digital models

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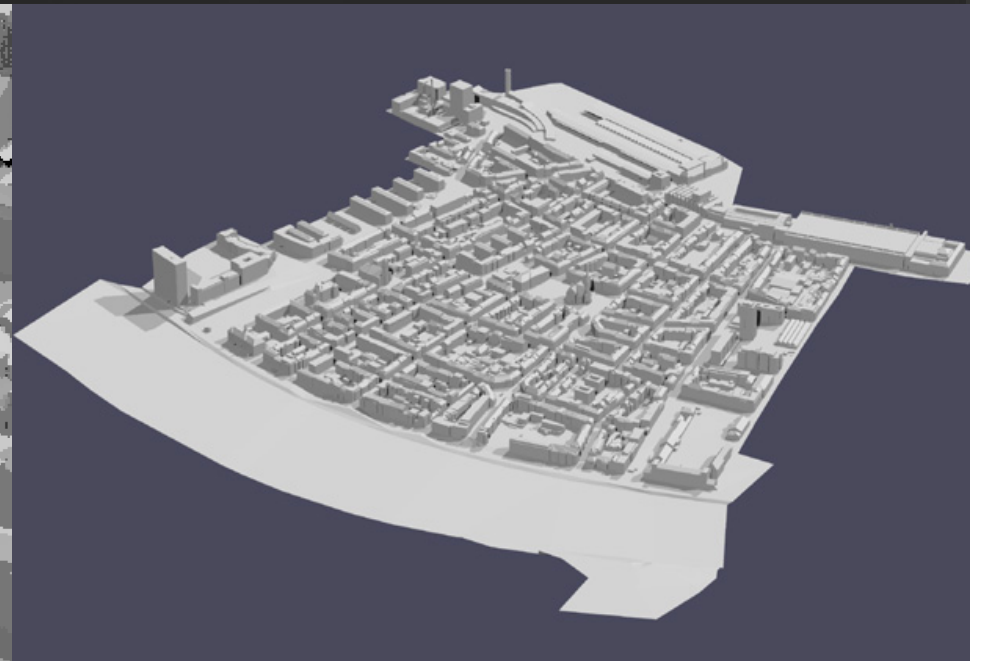
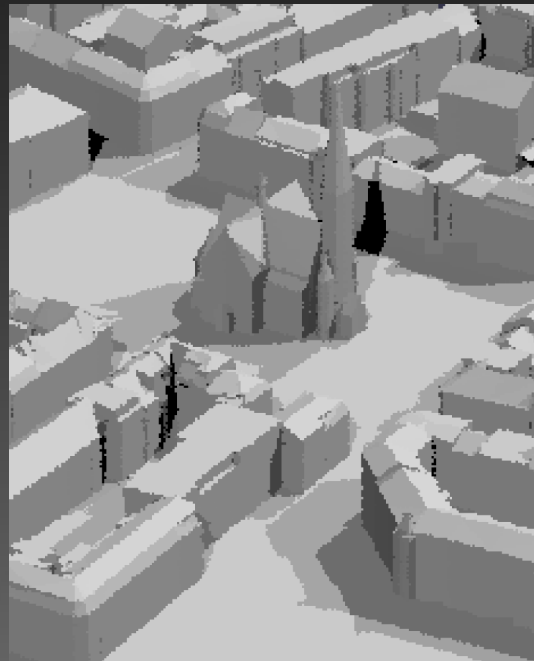
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Matthaeus' showmodel





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Solar performance indicators

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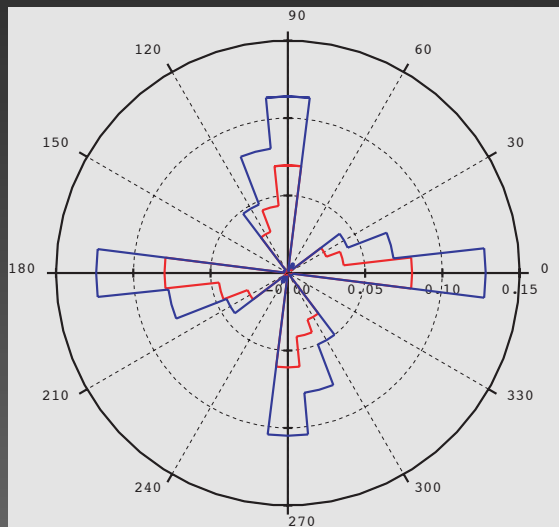
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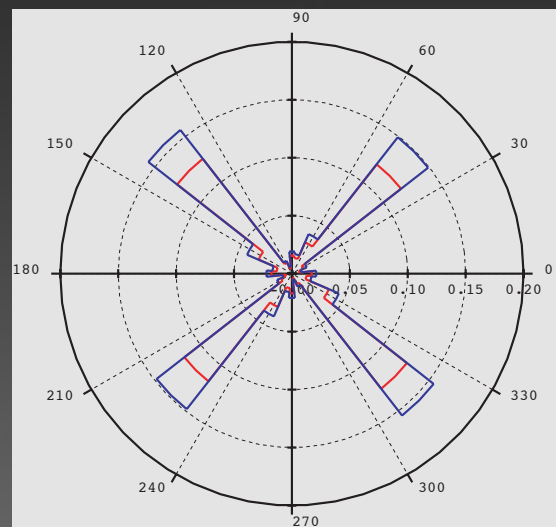
Orientation's roses

- Main building directions
- Surface facades
- Sky View Factor

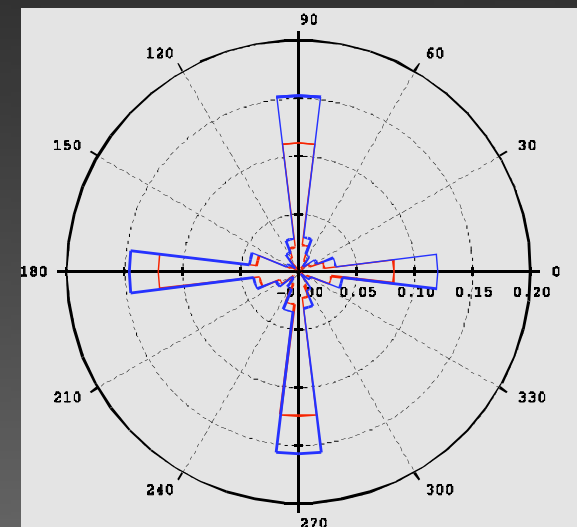
Matthaeus



Meyrin



Bellevaux



Solar performance indicators

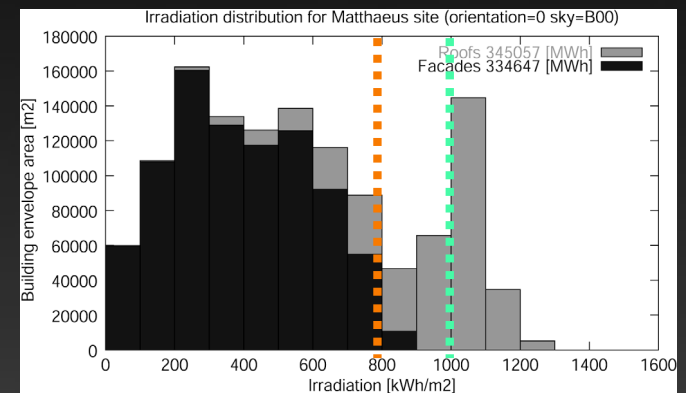
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Statistical distributions of the solar irradiation

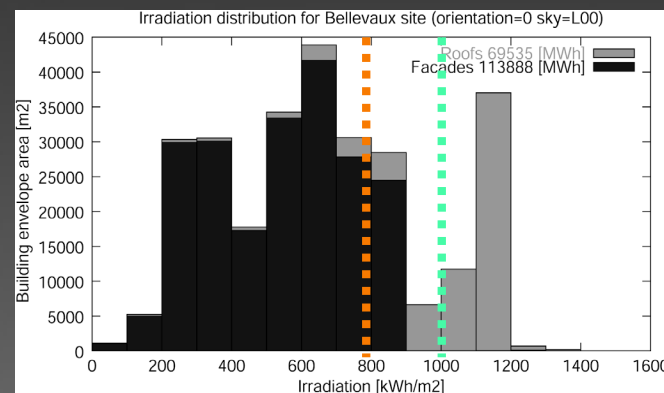
• Thresholds

- PV facades 800 kWh/m²
- PV roofs 1000 kWh/m²

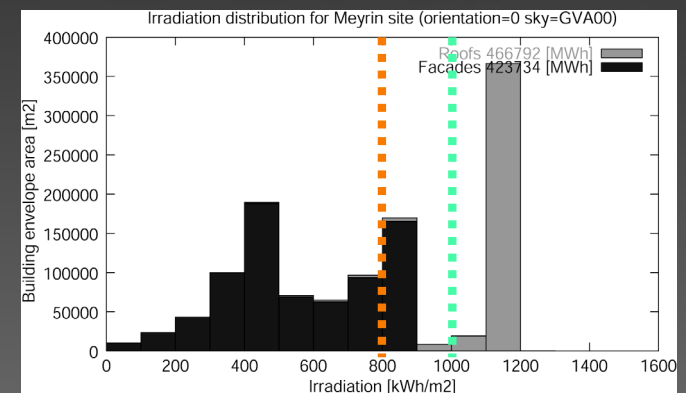
Matthaeus



Bellevaux



Meyrin





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Relative fractions

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Relative fractions of building facade/roof areas appropriate for:

- **PV facades**
- **Passive solar techniques**

Matthaeus

- PV roofs = 49 %
- **PV facades = 1.3 %**
- Passive solar = 32 %
- Daylighting = 51 %

Meyrin

- **PV roofs = 95 %**
- PV facades = 21 %
- Passive solar = 46 %
- **Daylighting = 78 %**

Bellevaux

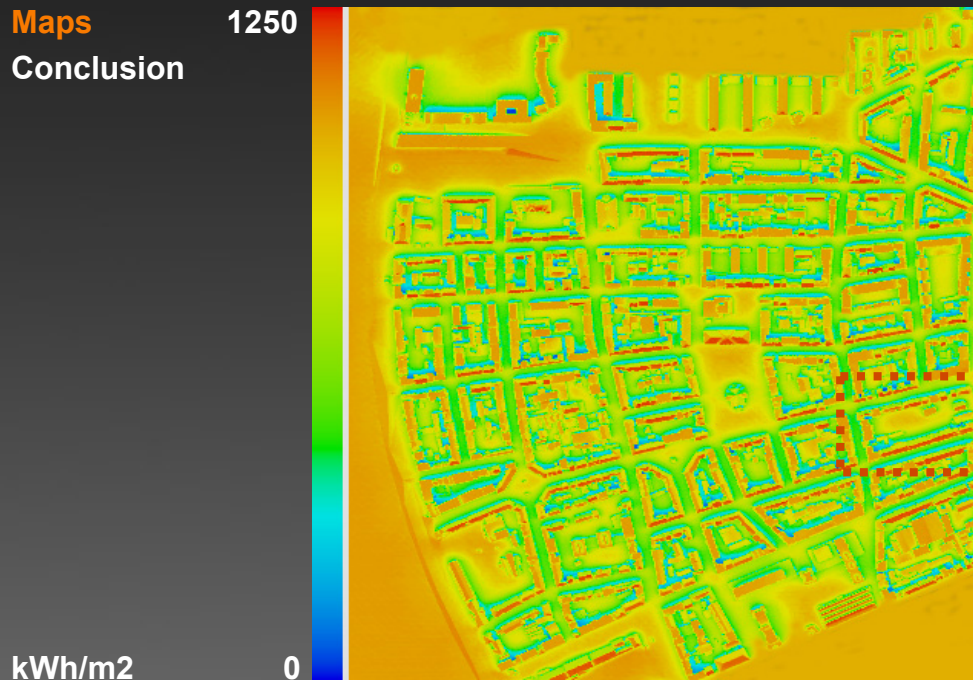
- PV roofs = 73 %
- PV facades = 12 %
- **Passive solar = 58 %**
- Daylighting = 70 %

False-colour maps

Statistical distributions of the solar irradiation

- Matthaeus district like example

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False-colour maps

Solar irradiance mapping

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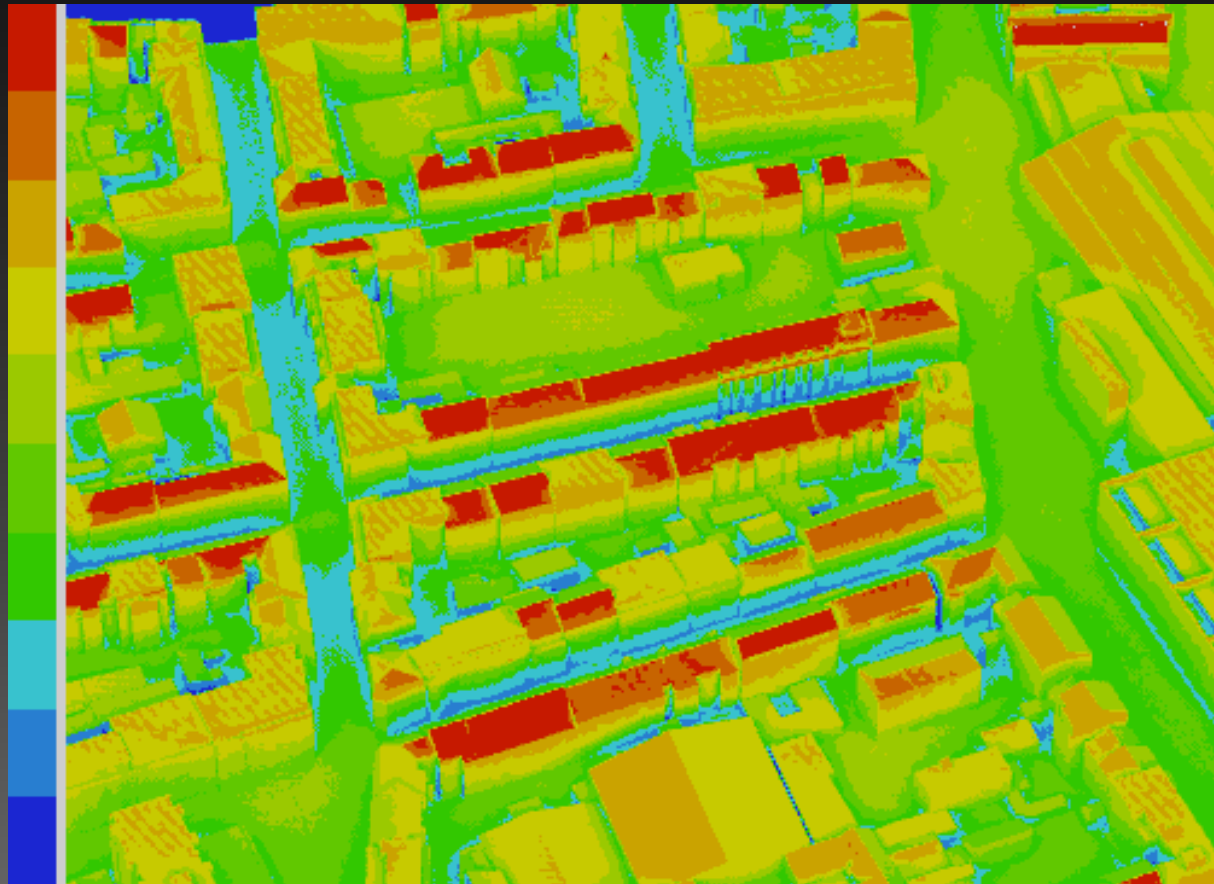
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1250



kWh/m²

0



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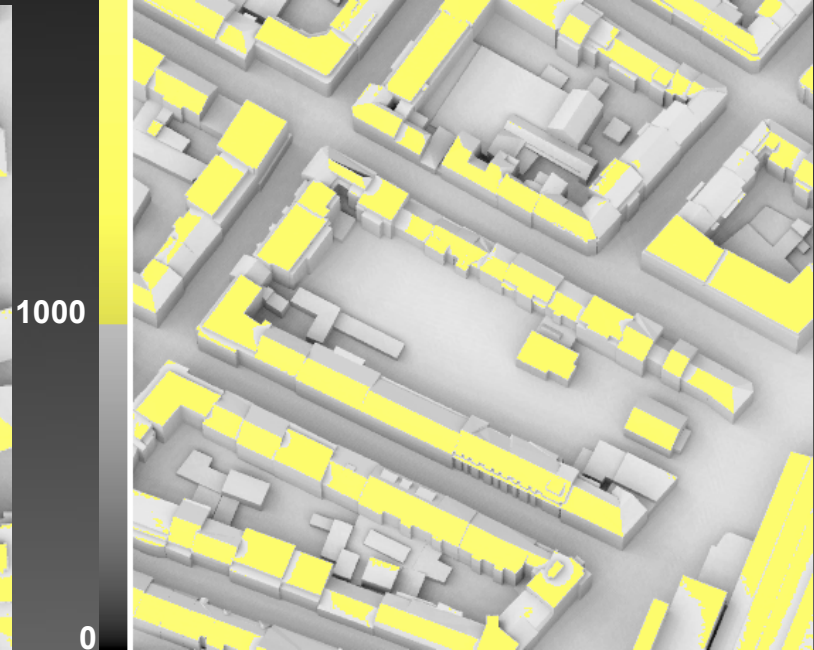
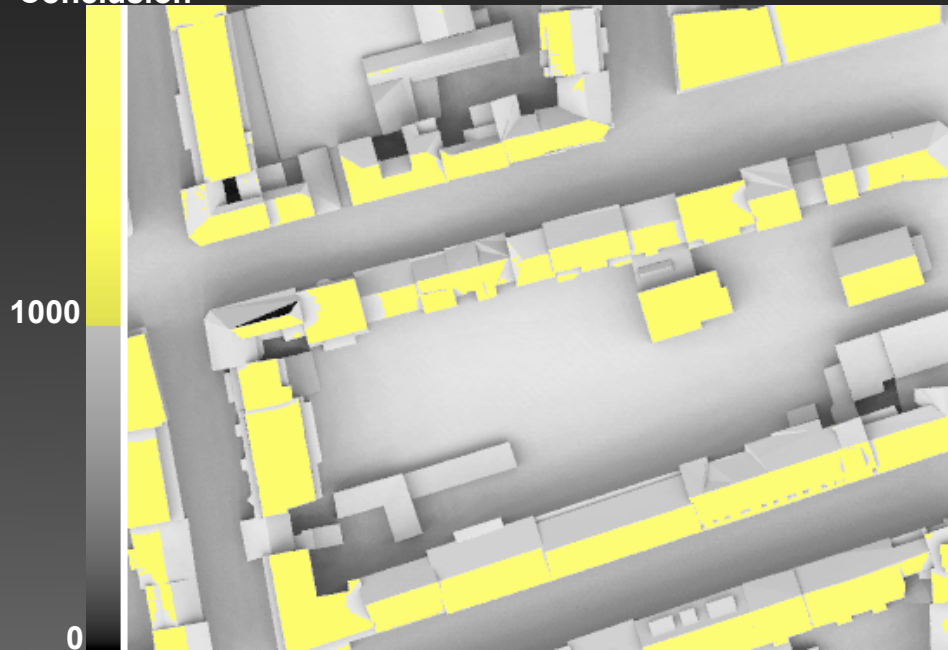
False-colour maps

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Statistical distributions of the solar irradiation

- PV roofs

kWh/m²





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The study purposes were:

- Evaluation of solar performances of three Swiss urban sites
- Definition of solar performance indicators and fractions of areas for urban areas
- Definition of solar performances for building areas

Results obtained:

- Solar performances of Matthaeus / Meyrin / Bellevaux
- Optimisation proposals for building sites and solar implantation models *in progress*



Thank you for your attention

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Thresholds

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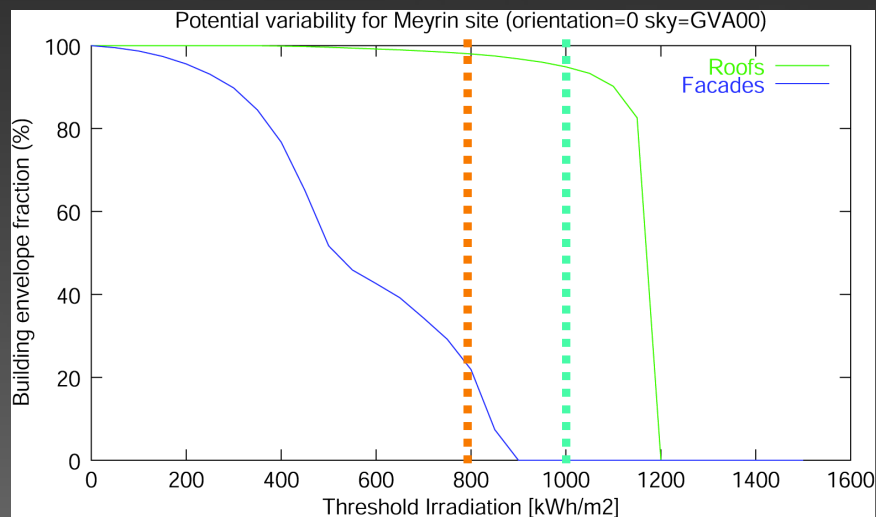
Maps

Conclusion

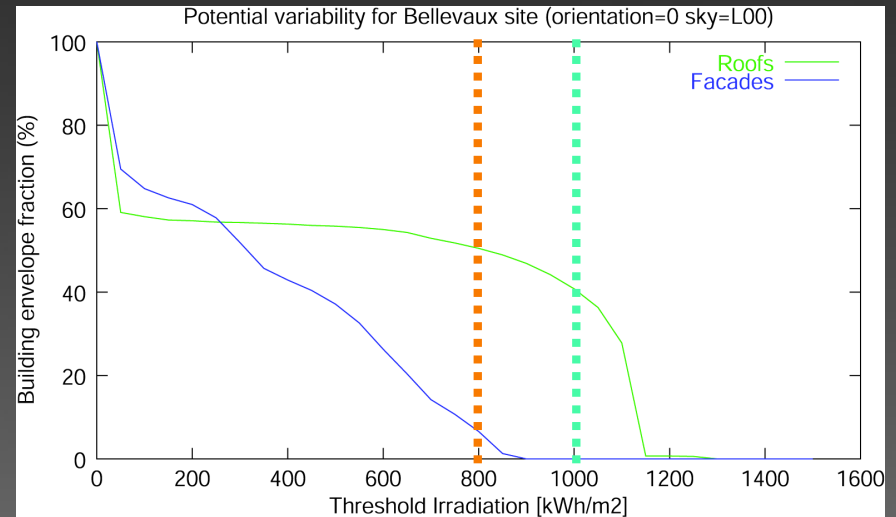
Potential variability

- PV facades 800 kWh/m²
- PV roofs 1000 kWh/m²

Meyrin



Bellevaux



Sky model

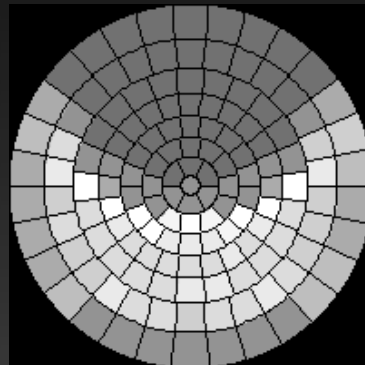
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- Sky model**
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Average anisotropic sky's Perez

Year

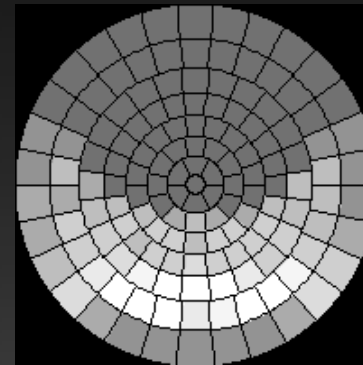
Heating season

8h–18h



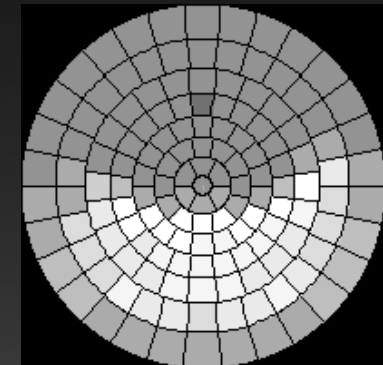
radiance values
[W/m²/sr]

**Active solar
applications**



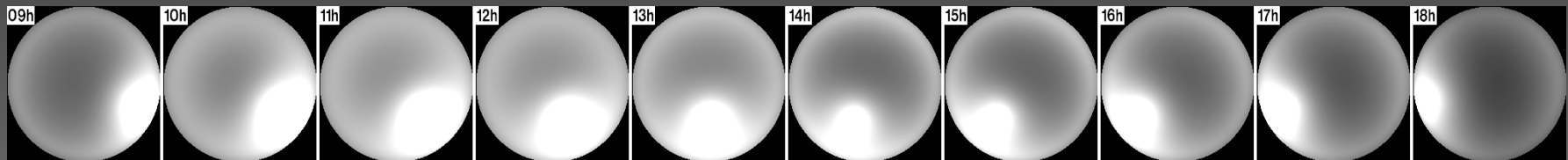
radiance values
[W/m²/sr]

Passive solar



luminance values
[lm/m²/sr]

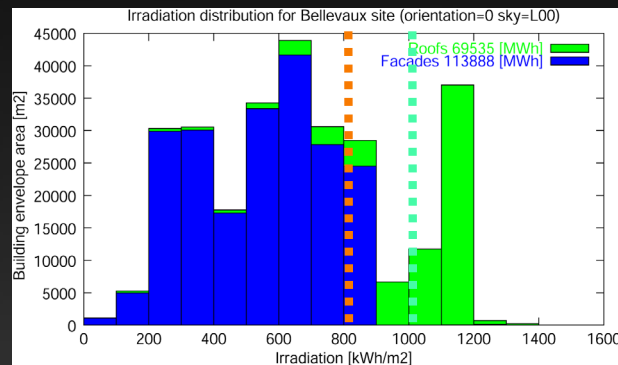
Daylighting



Practical/theoretical case

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Aloys-Fauquez N°29-31 in Bellevaux



- PV roofs = 73 %
- PV facades = 12 %
- Passive solar = 58 %
- Daylighting = 70 %

Vertical facades Orientations: Bellevaux

Total vertical area 580.3 Horizontal roof area 22.2

