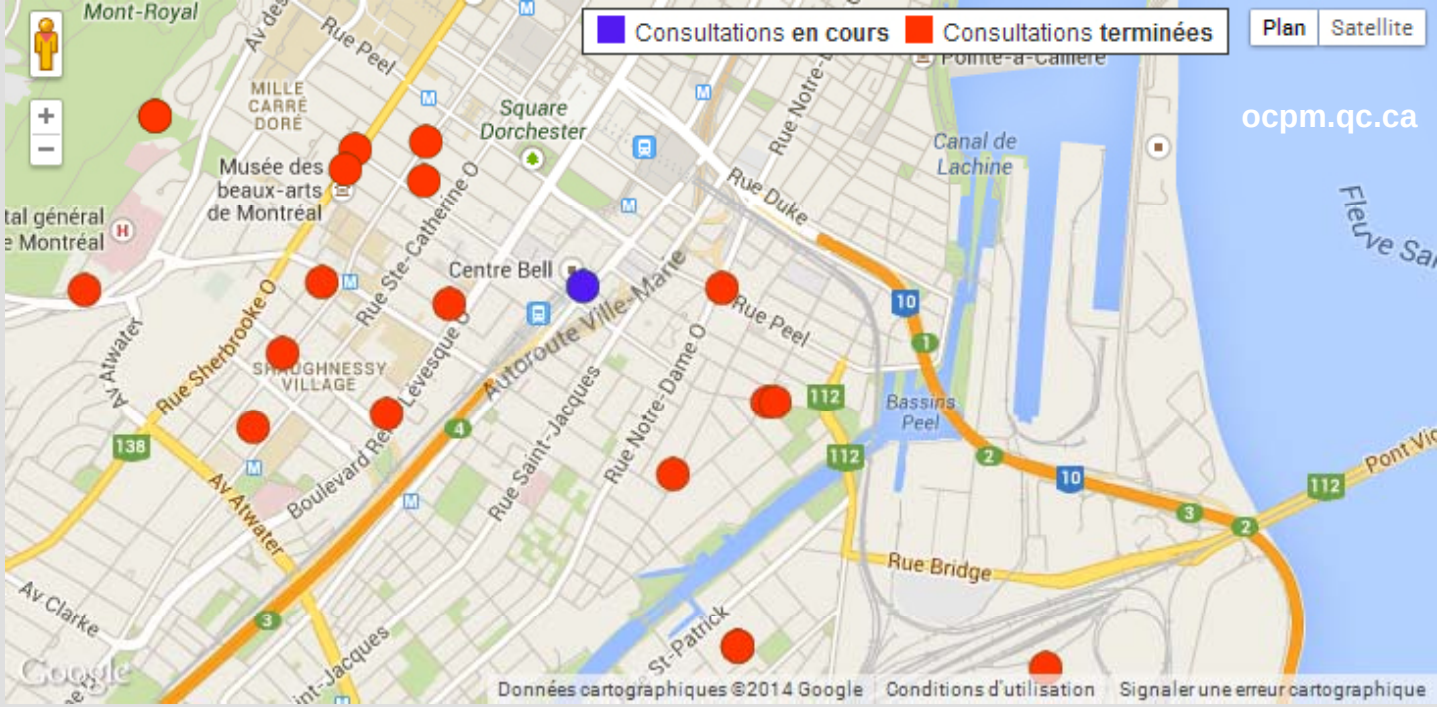


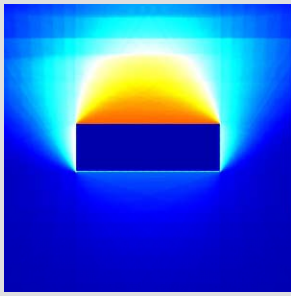
OFFICE DE CONSULTATION PUBLIQUE DE MONTRÉAL

Projet immobilier sur la rue St-Antoine Ouest

Solar-Climatic and Impacts Analysis of Proposed Towers Added to Montréal's Downtown

February 25, 2014

MOJTABA SAMIMI



Introduction

Facts and Factors:

► Current and future challenges: Energy resources, Energy efficiency, Pollution, Heat island effect, Climate change, Global warming, etc.

► Montréal's solar-climatic response has a direct effect on health, comfort and safety for people inside and outside buildings.

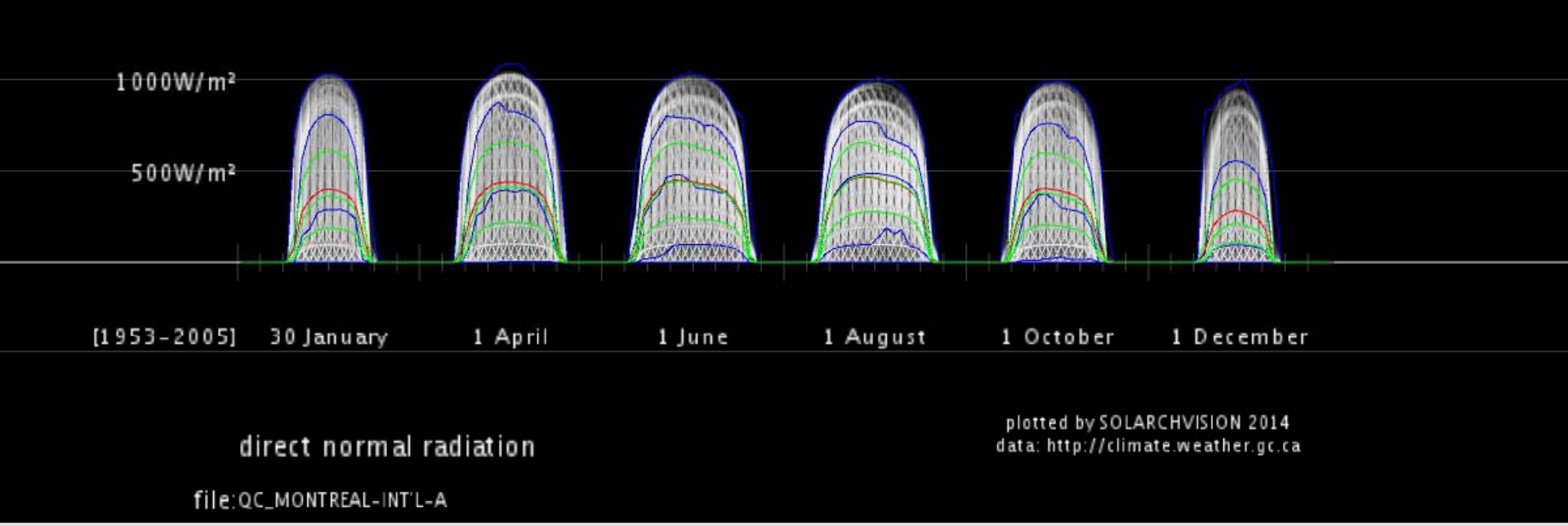
► **Bold** effect of the municipality, urban planners, architects and landscape architects in the process of decision making.

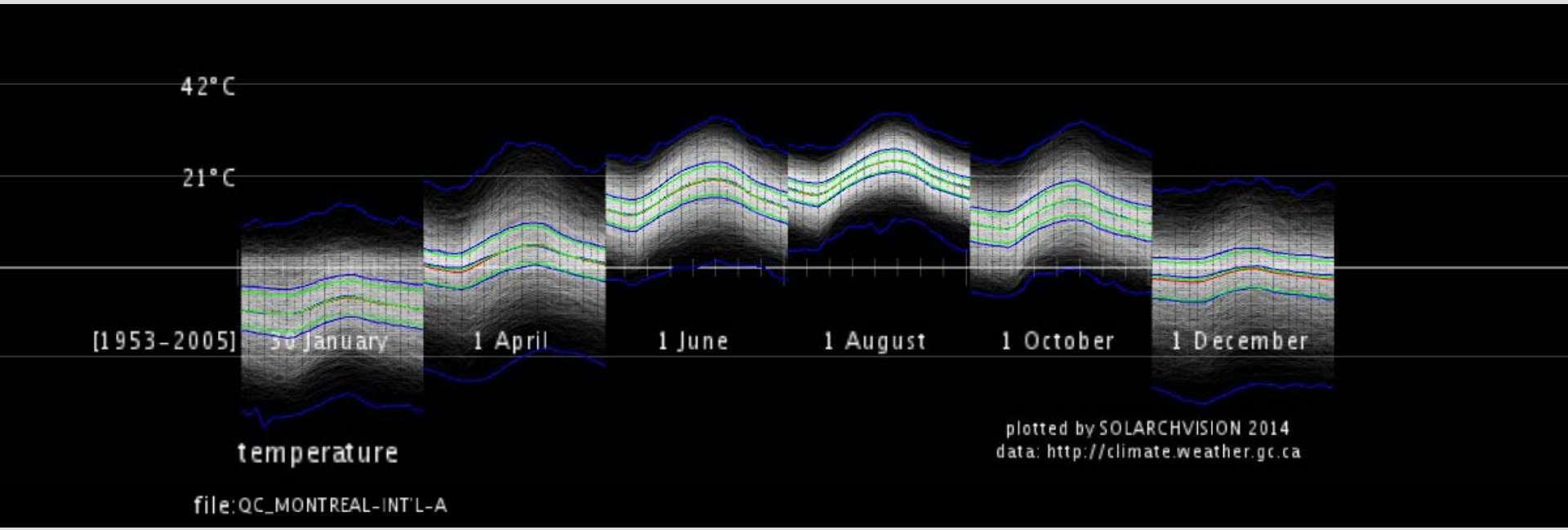
Problem Definition

Passive strategies: to receive more from the Sun in cold times and to be protected in hot times (Health, Comfort and safety measures as well as energy efficiency).

Active strategies: to receive more from the pure and unlimited energy of the Sun (Energy efficiency, energy production).

► SOLARCHVISION studies put the active and the passive strategies into a dialectical relationship to fashion a culture of Solar-Climatic Vision in design and planning, which traverses different scales (from a human scale to an urban and territorial as well as global scale) like the sun itself.


1000W/m²
500W/m²
[1953-2005]
30 January
1 April
1 June
1 August
1 October
1 December
direct normal radiation
plotted by SOLARCHVISION 2014
data: http://climate.weather.gc.ca
file:QC_MONTREAL-INT'L-A


42°C
21°C
[1953-2005]
30 January
1 April
1 June
1 August
1 October
1 December
temperature
plotted by SOLARCHVISION 2014
data: http://climate.weather.gc.ca
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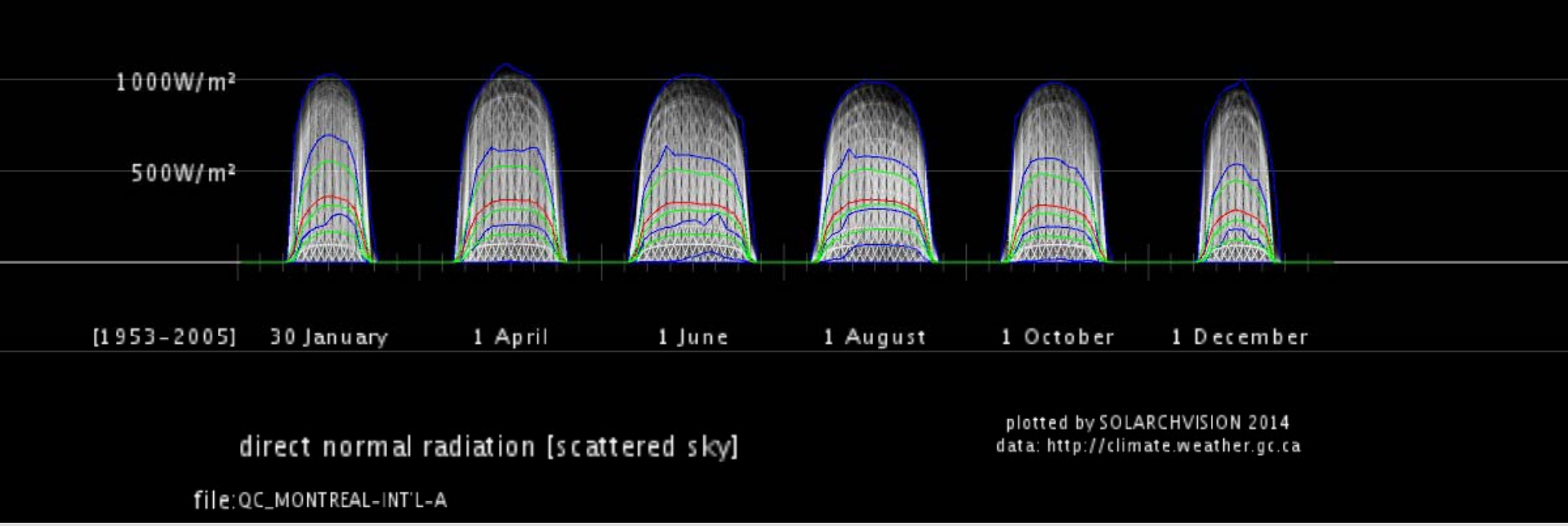
1000W/m²
500W/m²
[1953-2005]
30 January
1 April
1 June
1 August
1 October
1 December
direct normal radiation [scattered sky]
plotted by SOLARCHVISION 2014
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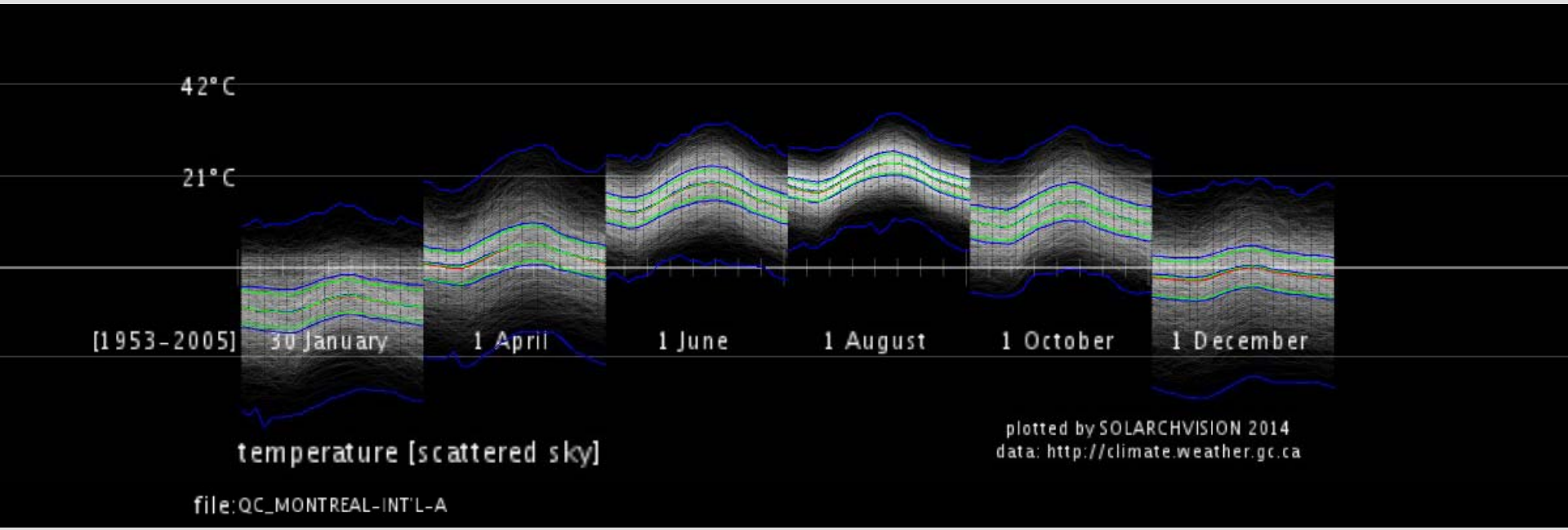
42°C
21°C
[1953-2005]
30 January
1 April
1 June
1 August
1 October
1 December
temperature [scattered sky]
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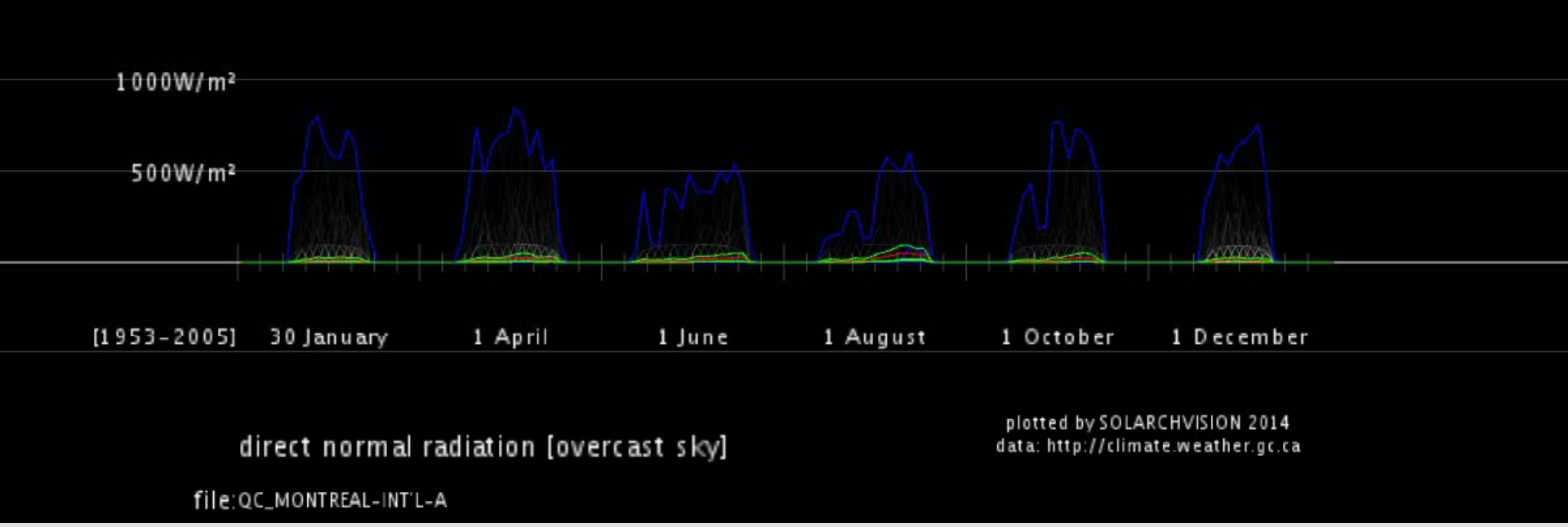
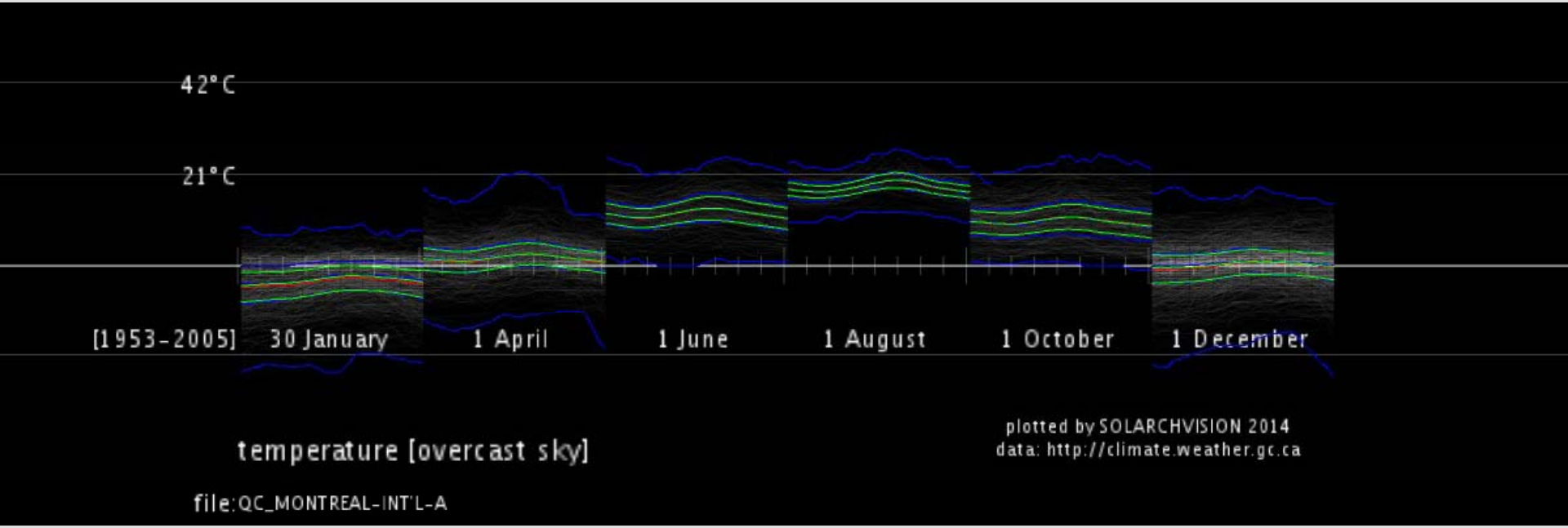
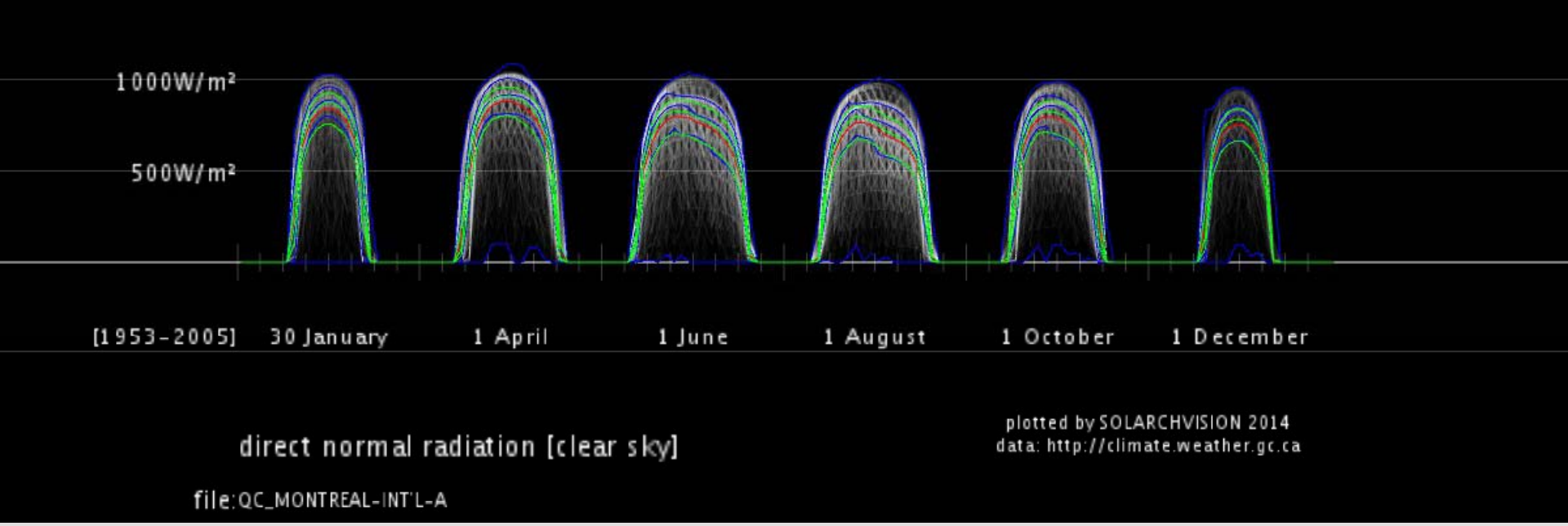
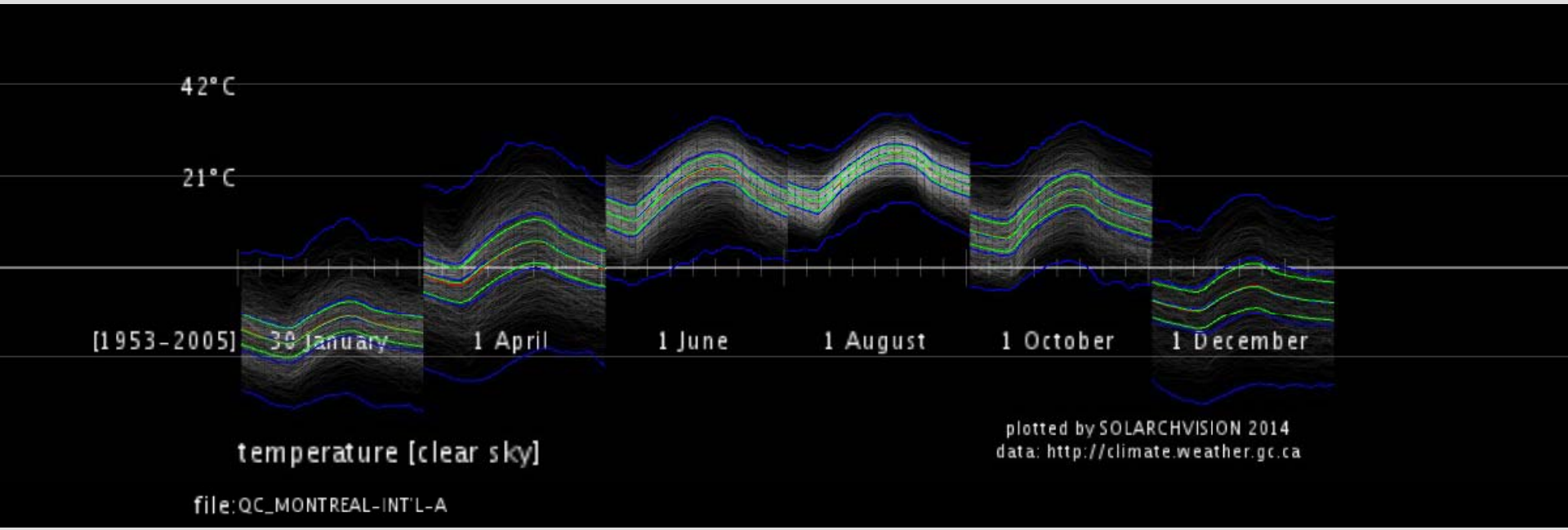
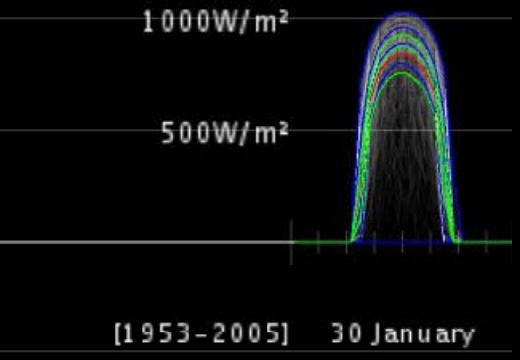

1000W/m²
500W/m²
[1953-2005]
30 January
1 April
1 June
1 August
1 October
1 December
direct normal radiation [overcast sky]
plotted by SOLARCHVISION 2014
data: http://climate.weather.gc.ca
file:QC_MONTREAL-INT'L-A


42°C
21°C
[1953-2005]
30 January
1 April
1 June
1 August
1 October
1 December
temperature [overcast sky]
plotted by SOLARCHVISION 2014
data: http://climate.weather.gc.ca
file:QC_MONTREAL-INT'L-A


1000W/m²
500W/m²
[1953-2005]
30 January
1 April
1 June
1 August
1 October
1 December
direct normal radiation [clear sky]
plotted by SOLARCHVISION 2014
data: http://climate.weather.gc.ca
file:QC_MONTREAL-INT'L-A

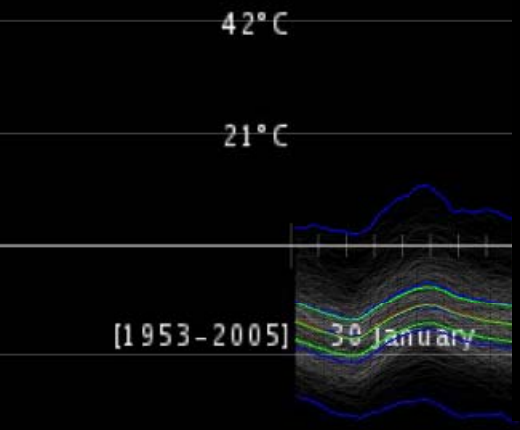

42°C
21°C
[1953-2005]
30 January
1 April
1 June
1 August
1 October
1 December
temperature [clear sky]
plotted by SOLARCHVISION 2014
data: http://climate.weather.gc.ca
file:QC_MONTREAL-INT'L-A



In Montréal with winter temperatures between -10°C and -30°C, the availability of direct normal radiation can exceed 750W/m² and sometimes even reach 1000W/m². In other words, in such locations the coldest and warmest temperatures most often likely occur on sunny days. This simple fact increases the importance and great benefit of considering the sun, both in planning of buildings as well as the interaction of those buildings with outdoor areas in Montréal.

direct normal radiation [clear sky]

file:QC_MONTREAL-INT'L-A

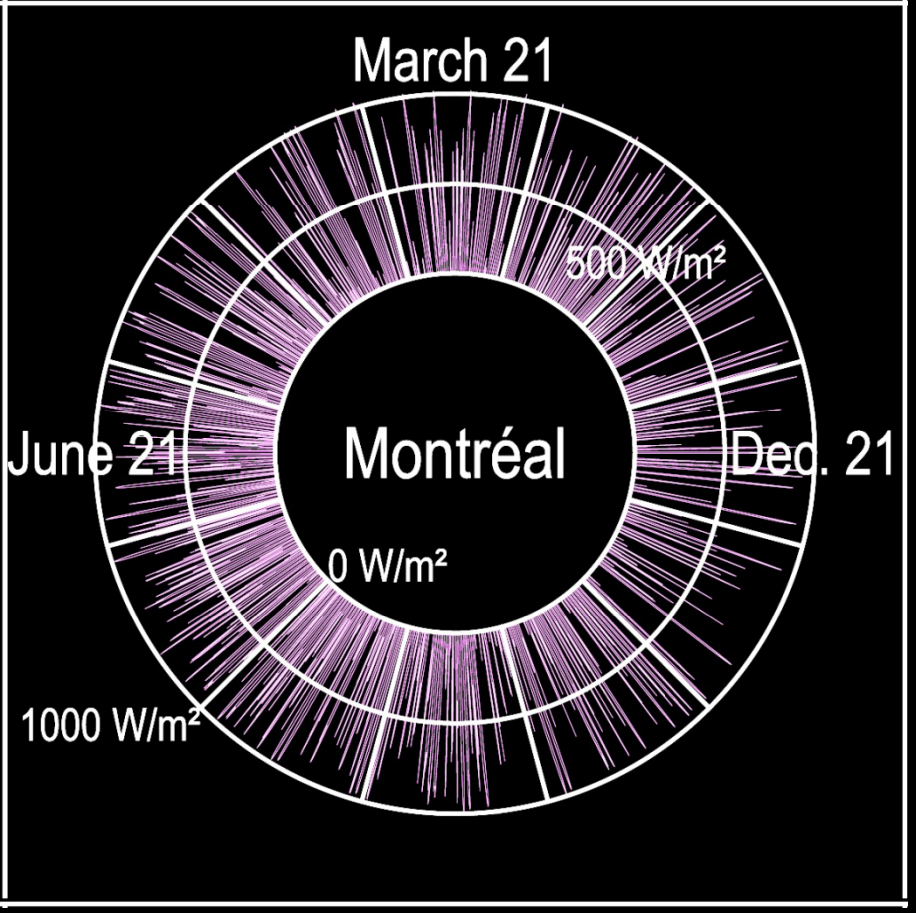


As a result, cold and at times cloudy conditions, like those of a Montréal winter, should not be considered a convincing reason to avoid applying and optimizing solar design in buildings and urban quarters. In contrast, solar studies as well as consideration of the sun in architectural and urban design are essential in cities with extreme temperature conditions simply because in many cases, extreme temperature conditions are also sunny.

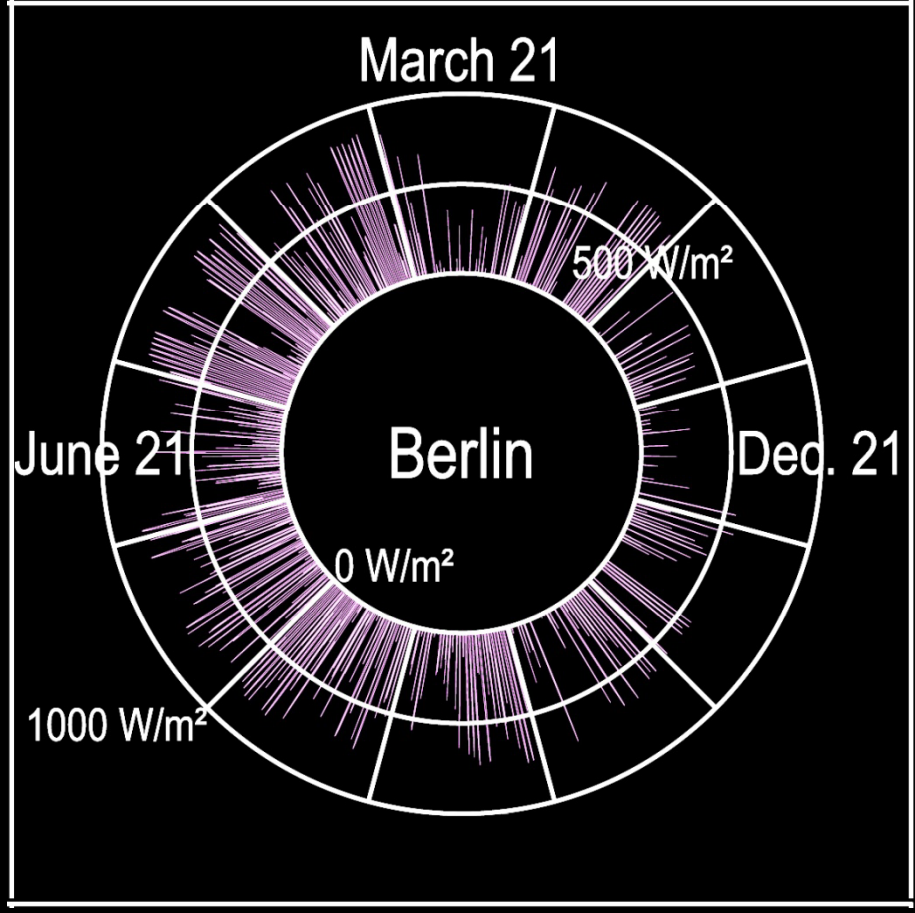
temperature [clear sky]

file:QC_MONTREAL-INT'L-A

"Intelligent design using solar-climatic vision: Energy and comfort improvement in architecture and urban planning using SOLARCHVISION", Young Cities Research Paper Series, Volume 09, Technische Universität Berlin, 2014

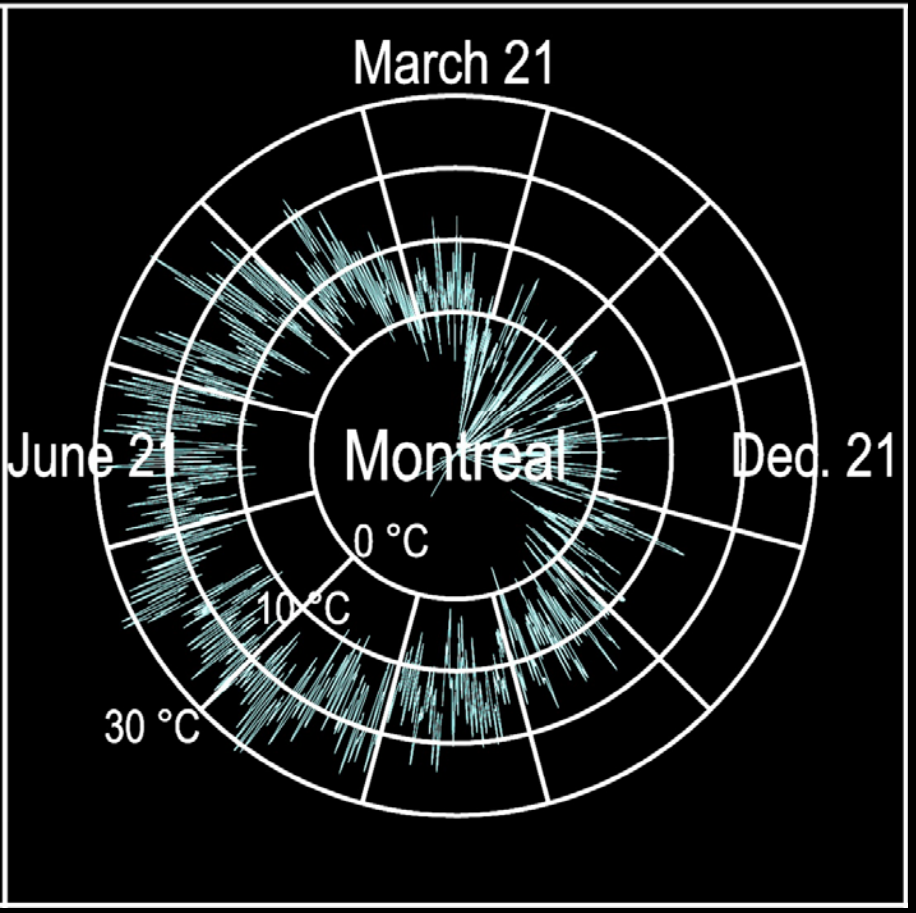


Montréal, Canada

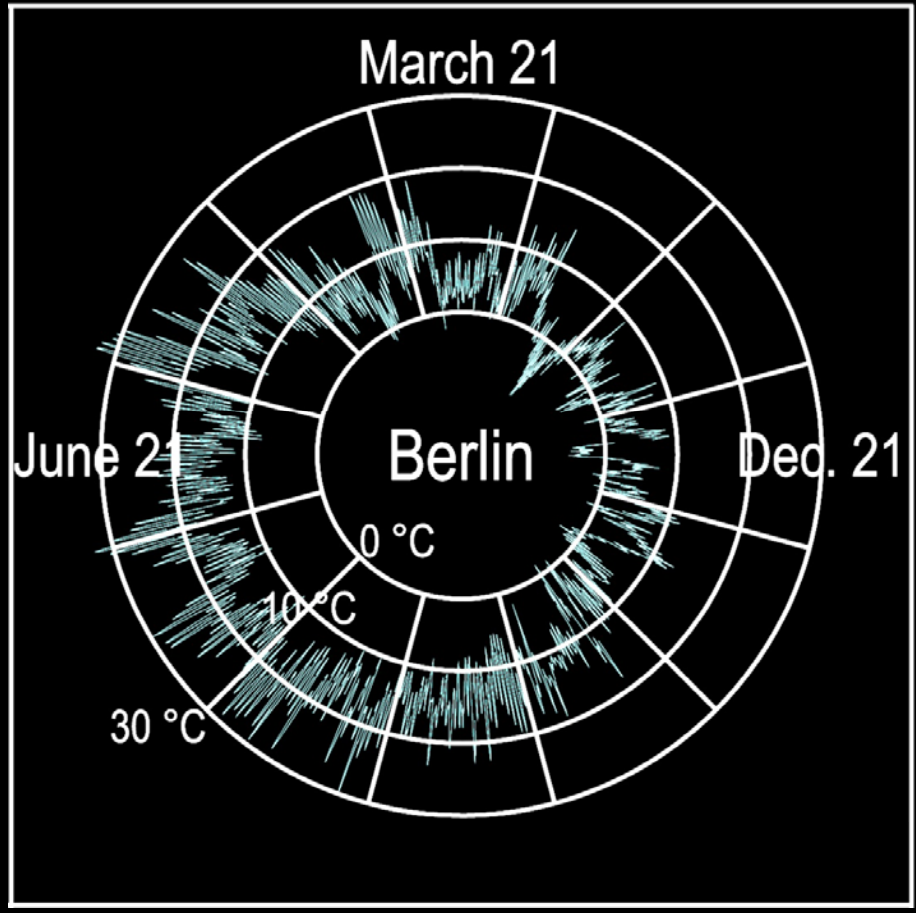


Berlin, Germany

SOLARCHVISION radial annual plot of hourly direct beam radiation,
in typical meteorological year (U.S. Department of Energy TMY files)

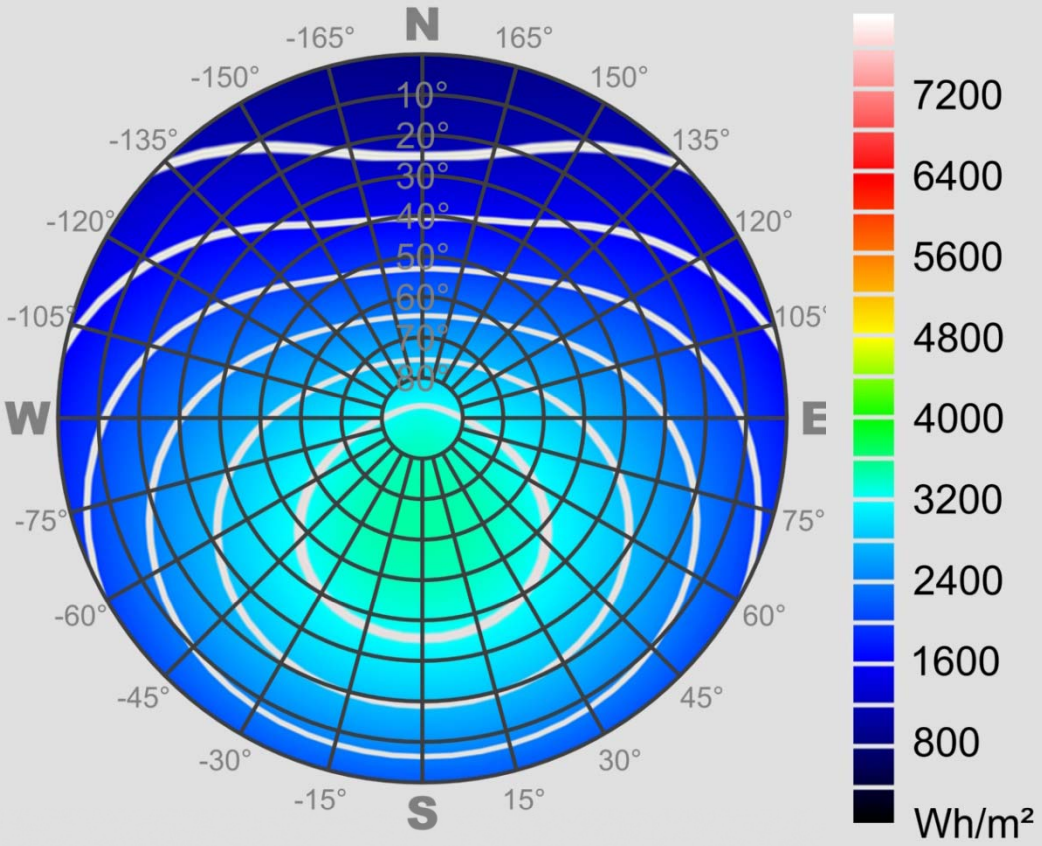


Montréal, Canada

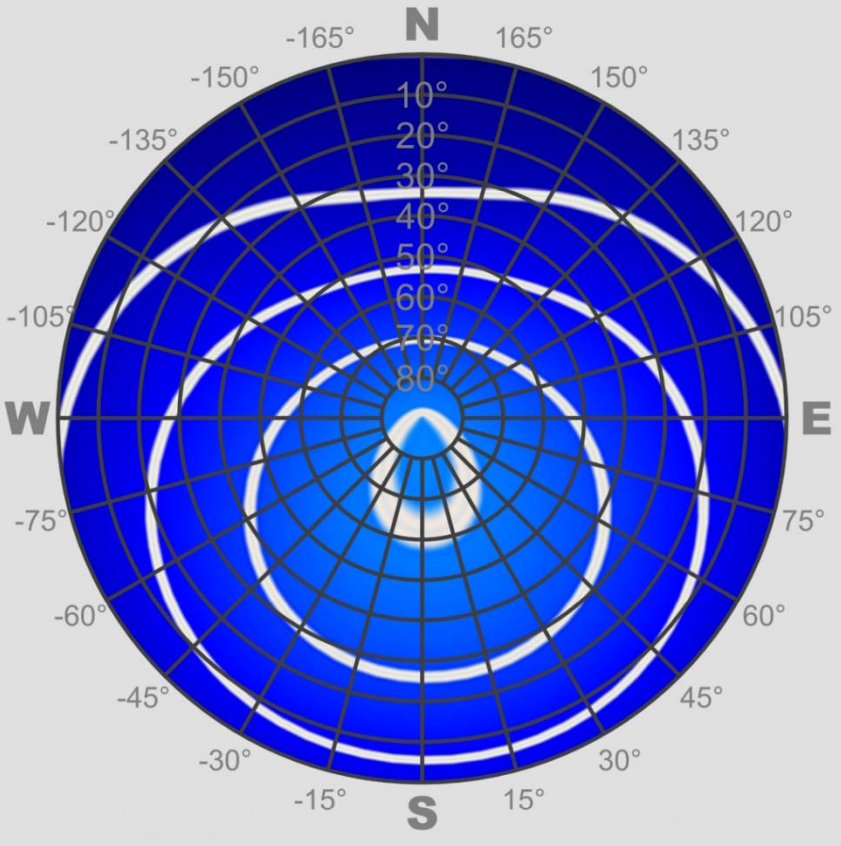


Berlin, Germany

SOLARCHVISION radial annual plot of hourly temperature,
in typical meteorological year (U.S. Department of Energy TMY files)



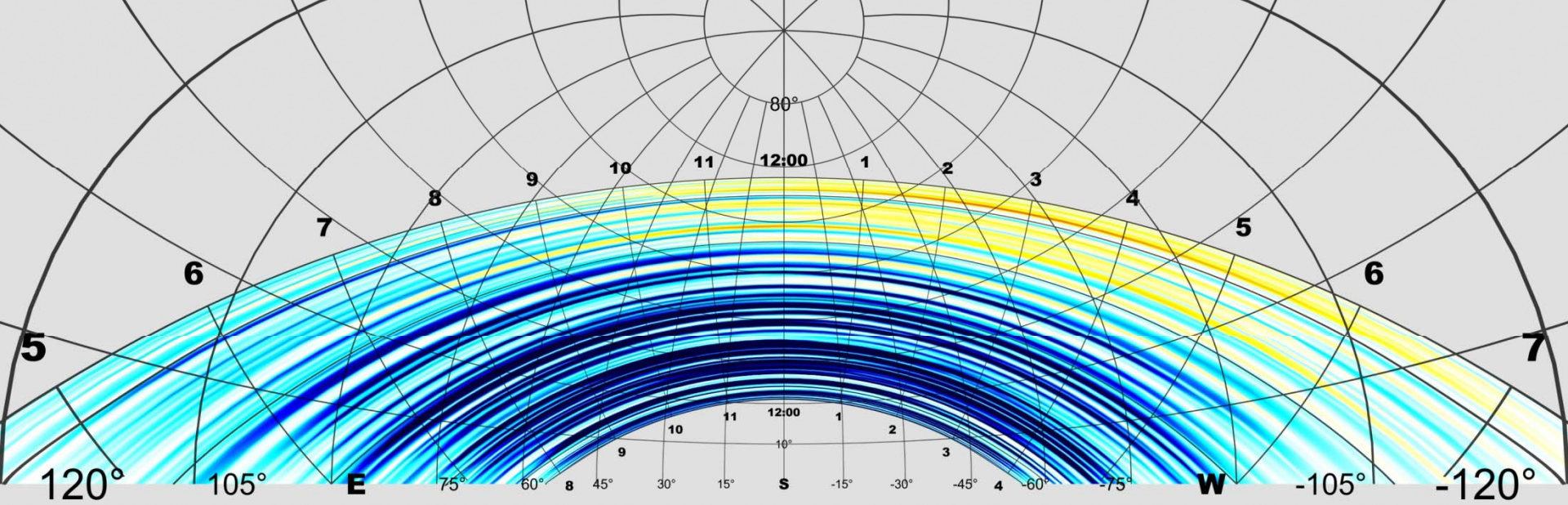
Montréal, Canada



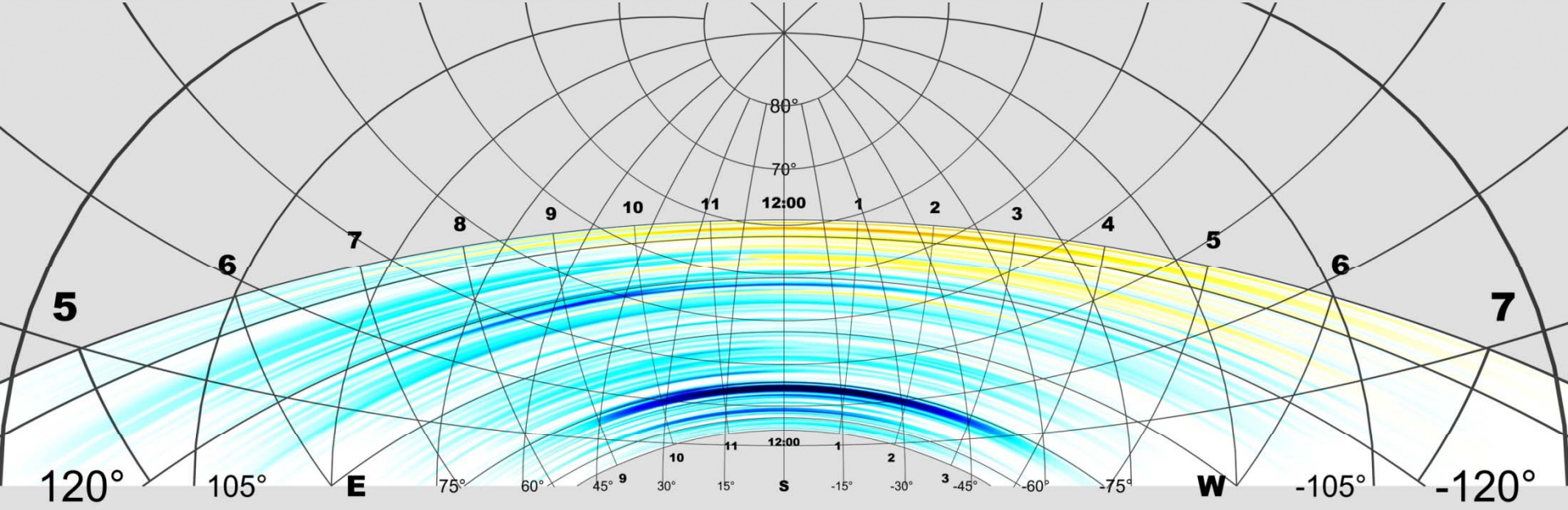
Berlin, Germany

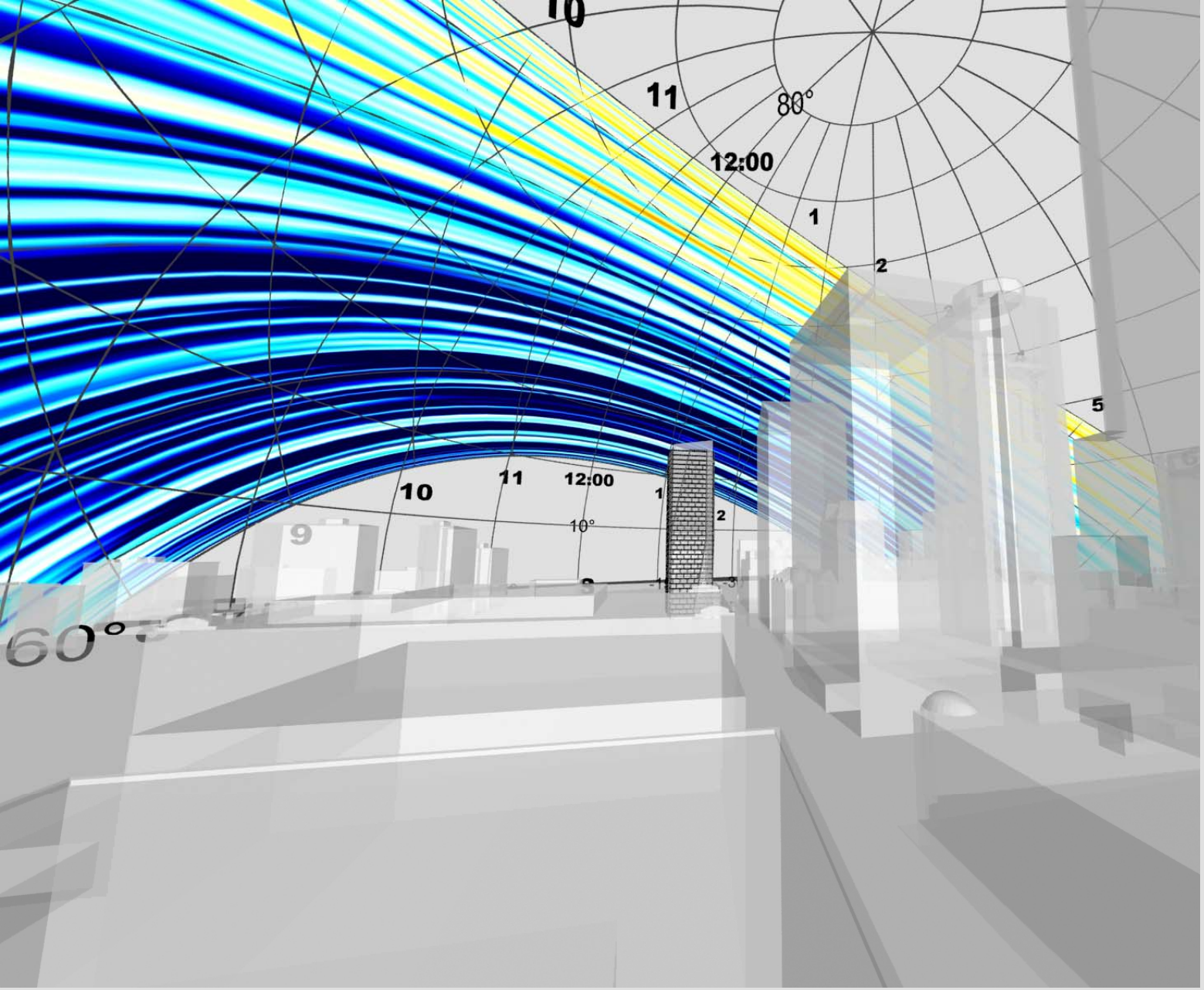
Differences between the total amount of annual radiation on different orientations and inclinations in typical meteorological year (U.S. Department of Energy TMY files)

Potentials for active of strategies in Montréal (CA) is much higher comparing to those of Berlin(DE).
In addition potentials for passive strategies in Montréal (CA) is also significantly high (see next slide).

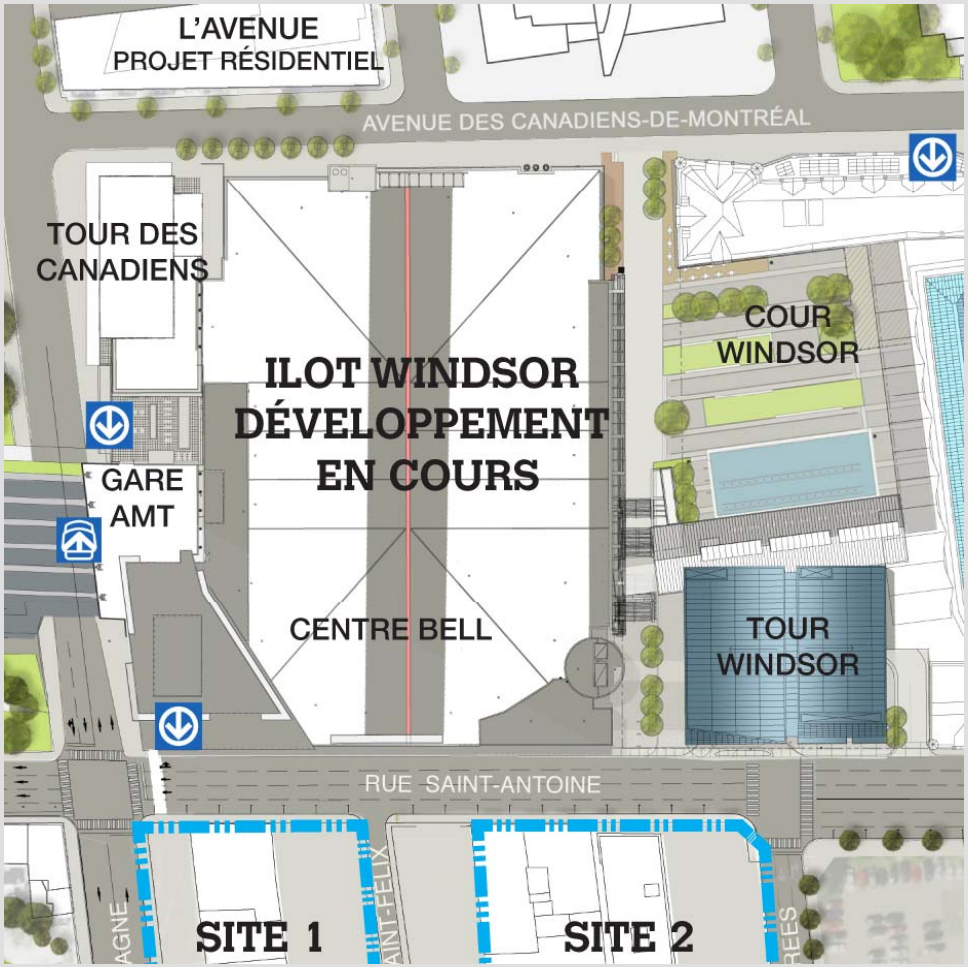


Differences between the +/- effects of direct radiation in **Montréal** (above) and **Berlin** (below)





+20000
+16000
+12000
+8000
+4000
0 W°C/m²
-4000
-8000
-12000
-16000
-20000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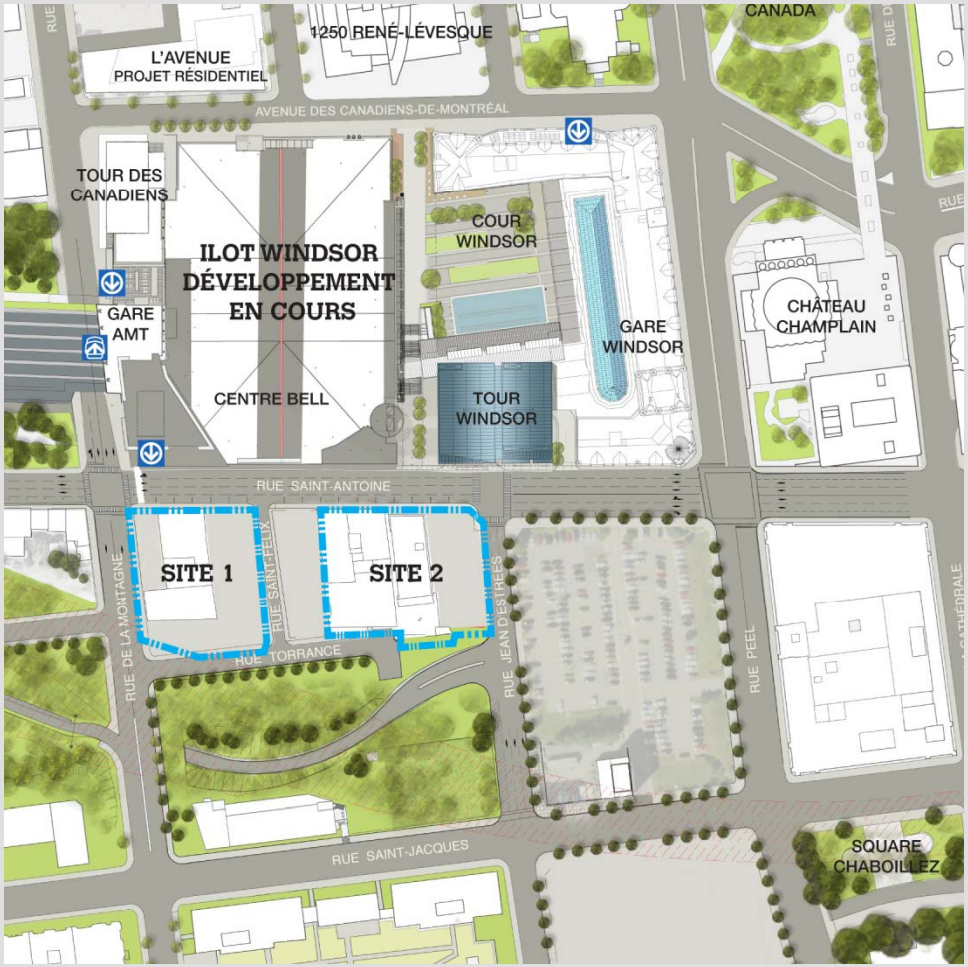
PROJET RÉSIDENTIEL
AVENUE DES CANADIENS-DE-MONTRÉAL
TOUR DES CANADIENS
ILOT WINDSOR
DÉVELOPPEMENT
EN COURS
COUR WINDSOR
GARE AMT
CENTRE BELL
TOUR WINDSOR
RUE SAINT-ANTOINE
SITE 1
SITE 2


1250 RENÉ-LÉVESQUE
CANADA
L'AVENUE
PROJET RÉSIDENTIEL
AVENUE DES CANADIENS-DE-MONTRÉAL
TOUR DES
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ILOT WINDSOR
DÉVELOPPEMENT
EN COURS
COUR
WINDSOR
GARE
AMT
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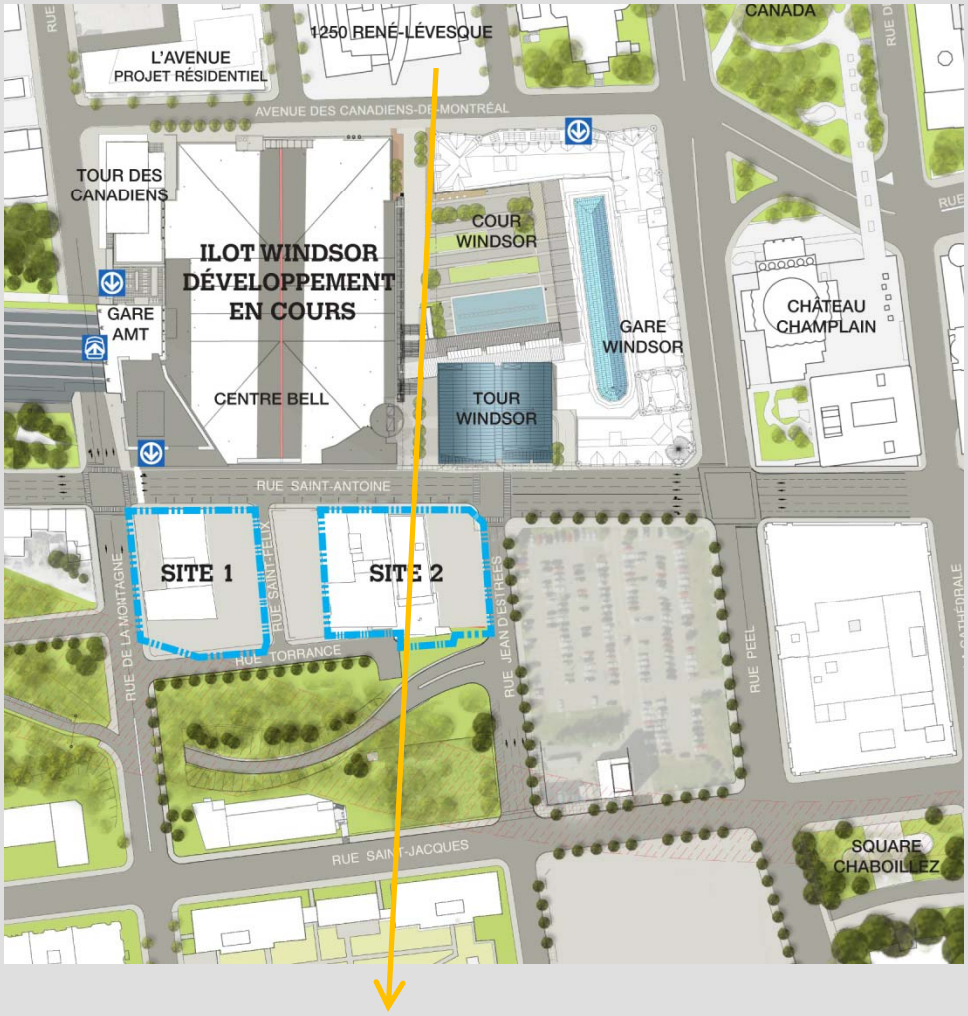
WINDSOR
CHÂTEAU
CHAMPLAIN
CENTRE BELL
TOUR
WINDSOR
RUE SAINT-ANTOINE
SITE 1
SITE 2
RUE DE LA MONTAGNE
RUE SAINT-FELIX
RUE TORRANCE
RUE JEAN-DESTREES
RUE PEEL
RUE SAINT-JACQUES
SQUARE
CHABOILLEZ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L'AVENUE
PROJET RÉSIDENTIEL
AVENUE DES CANADIENS-DE-MONTRÉAL
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AMT
GARE
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CHÂTEAU
CHAMPLAIN
CENTRE BELL
TOUR
WINDSOR
RUE SAINT-ANTOINE
SITE 1
SITE 2
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RUE DE LA MONTAGNE
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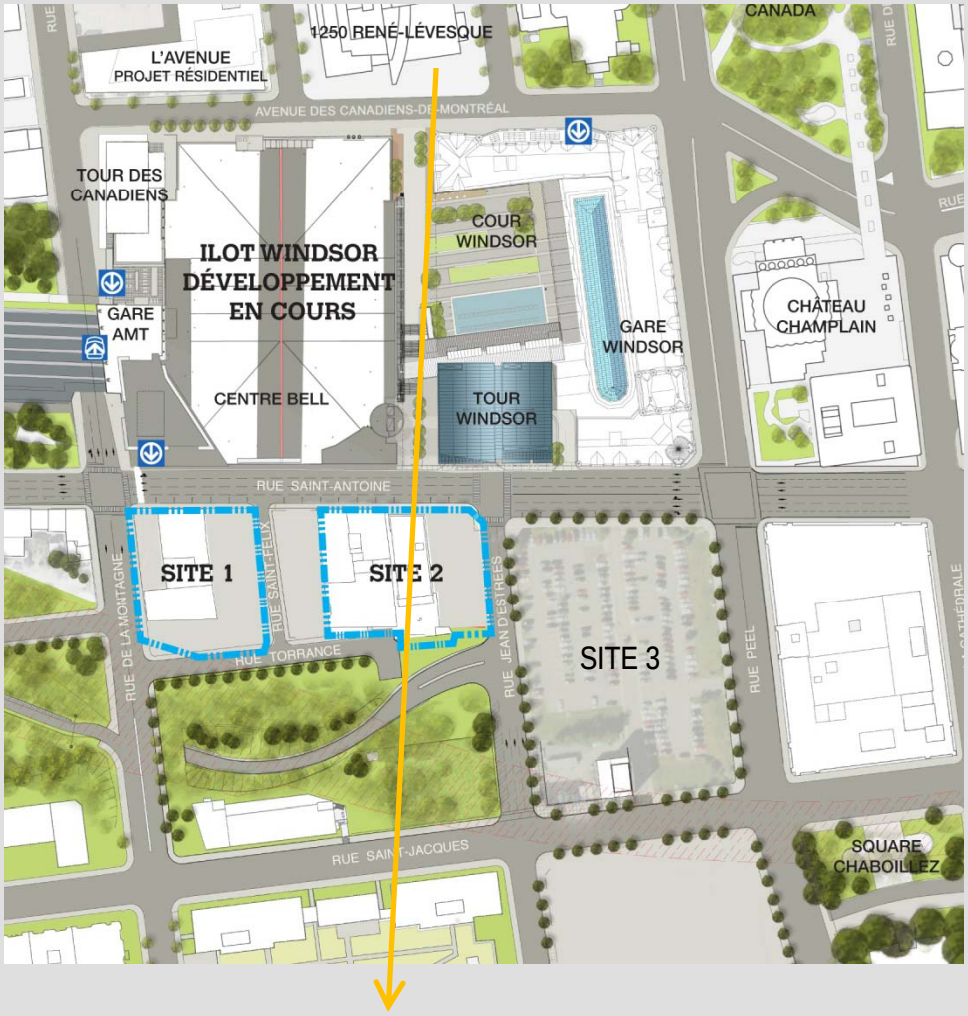
RUE JEAN-DESTREES
RUE PEEL
RUE SAINT-JACQUES
SQUARE
CHABOILLEZ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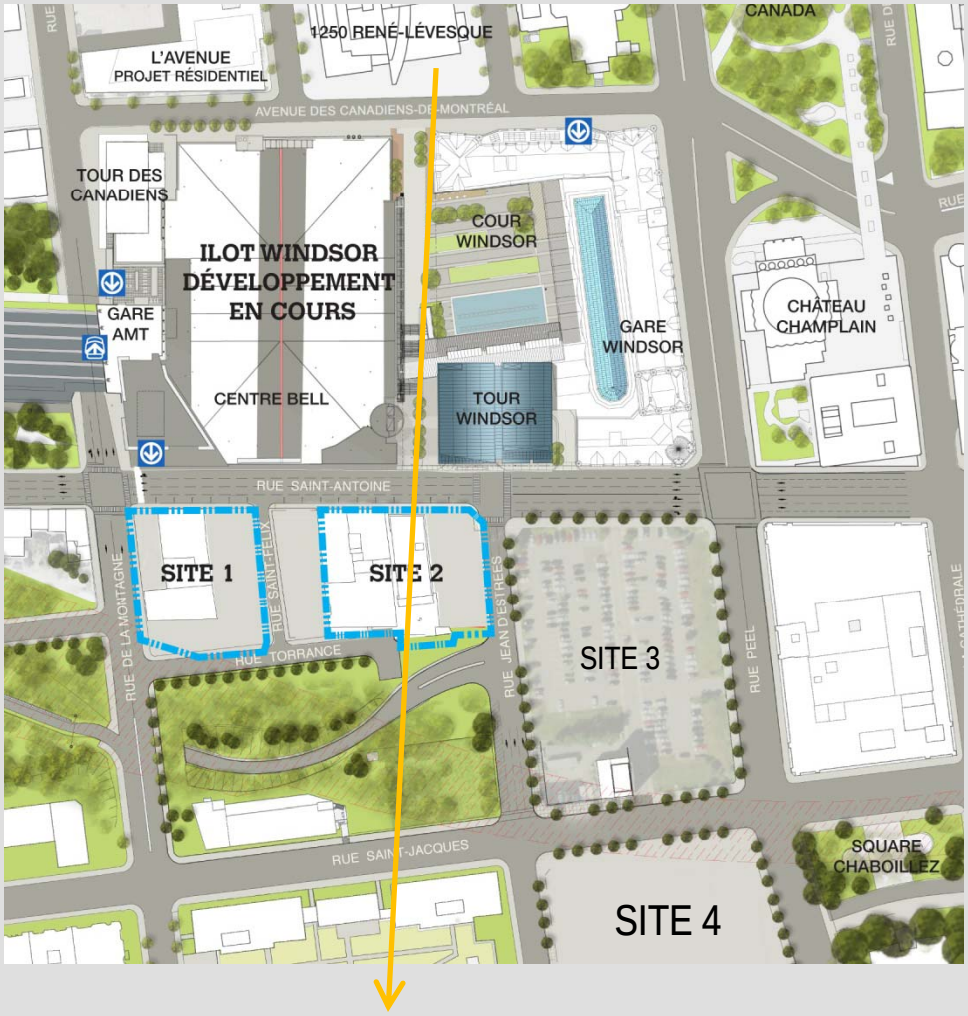
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SITE 2
SITE 3
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RUE DE LA MONTAGNE
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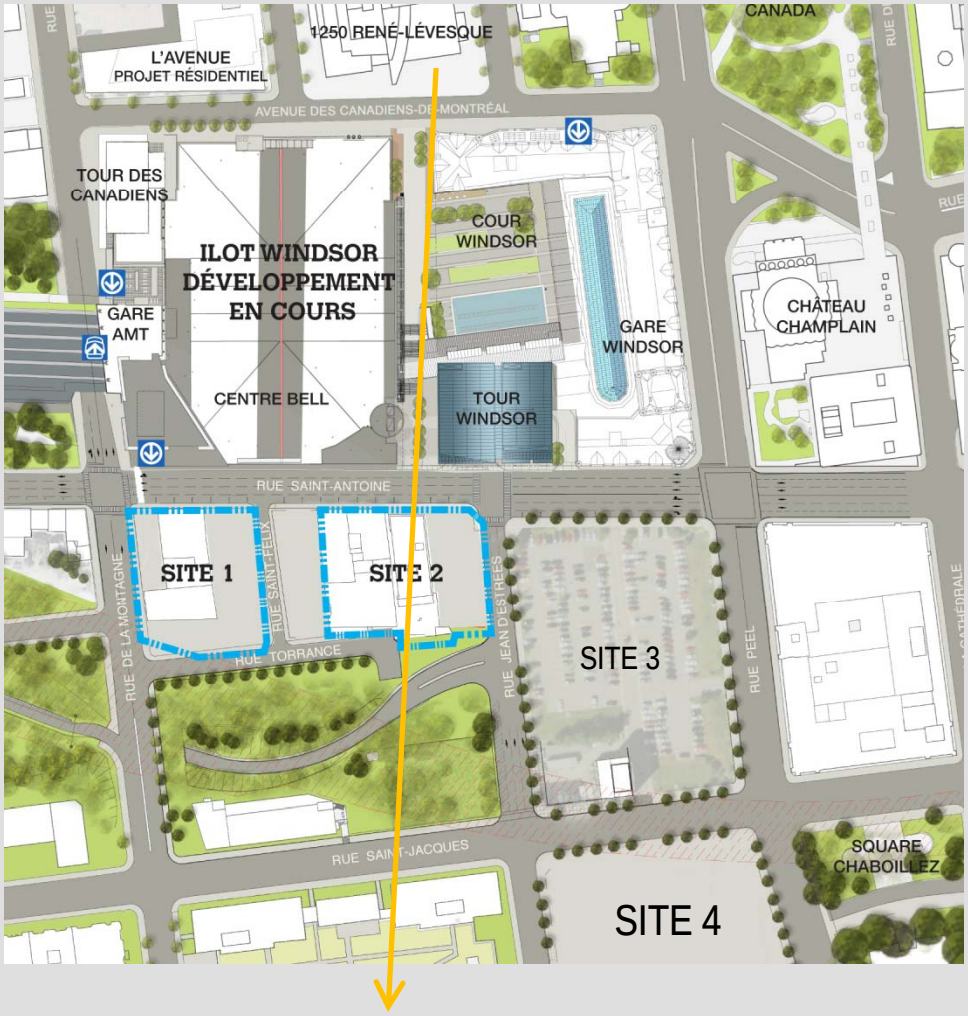
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RUE DE LA MONTAGNE
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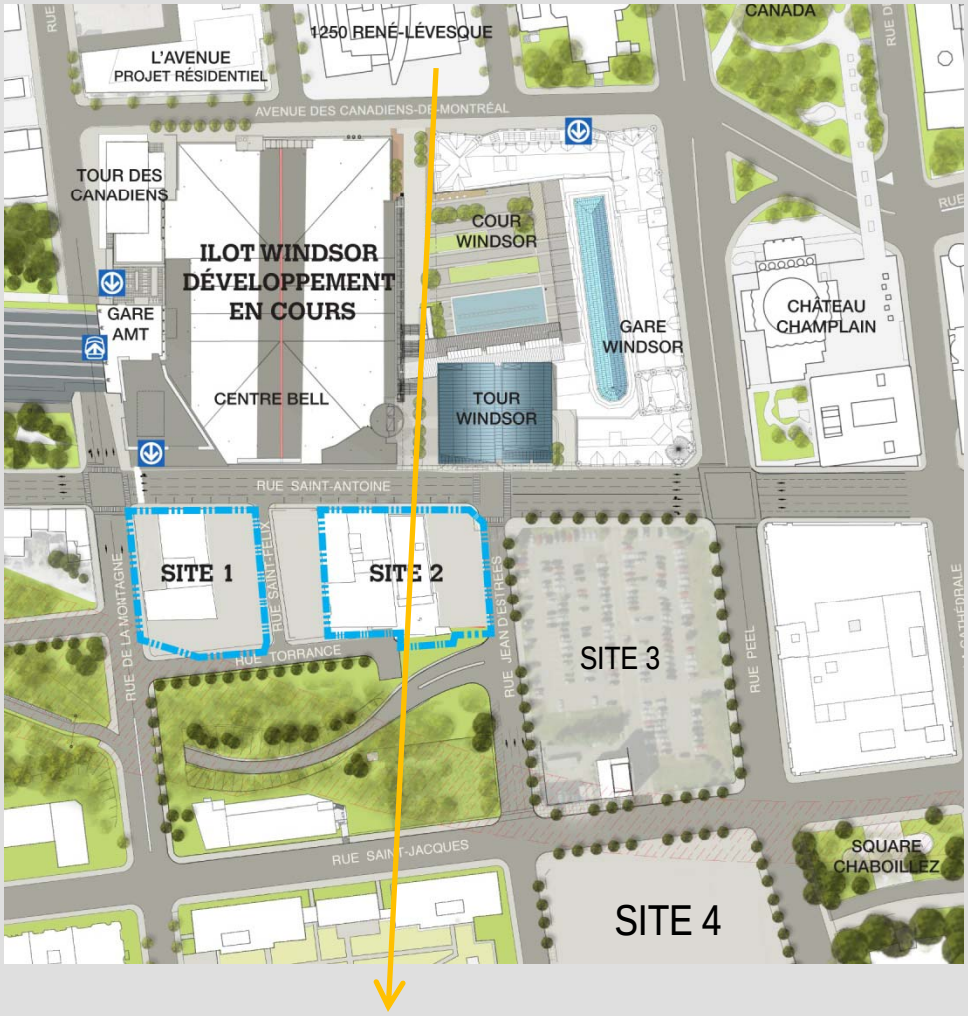
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CHAMPLAIN
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RUE SAINT-FELIX
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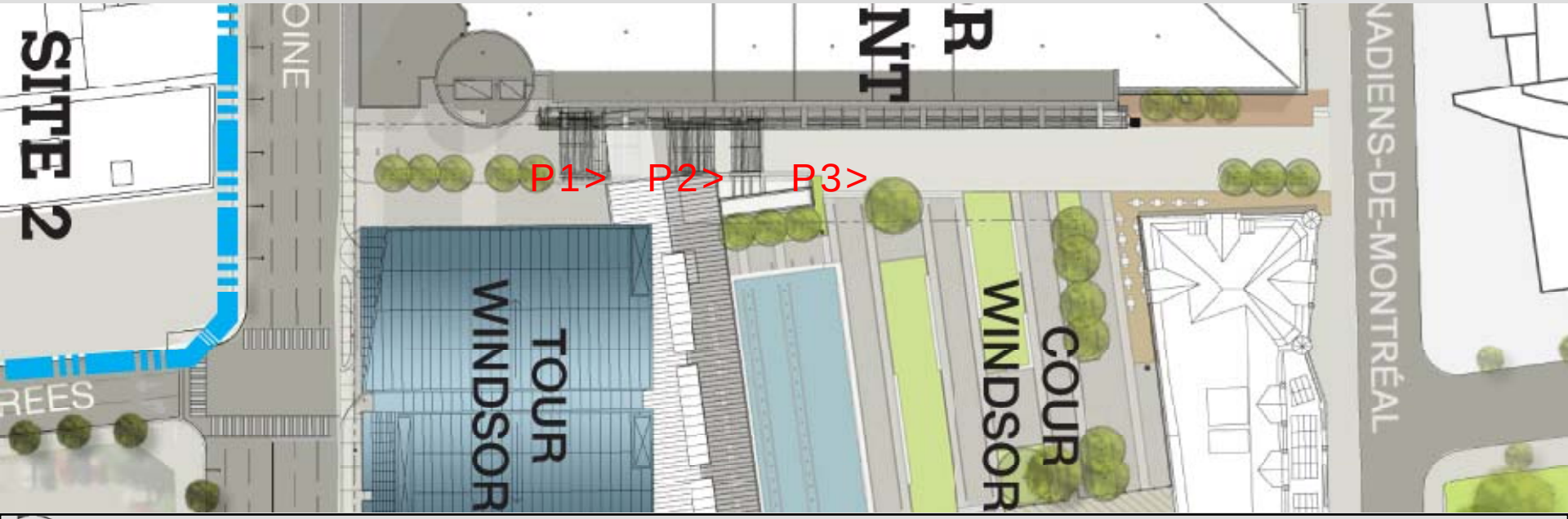
RUE JEAN-DESTREES
RUE PEEL
RUE SAINT-JACQUES
SQUARE
CHABOILLEZ

MORE SITES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P1>
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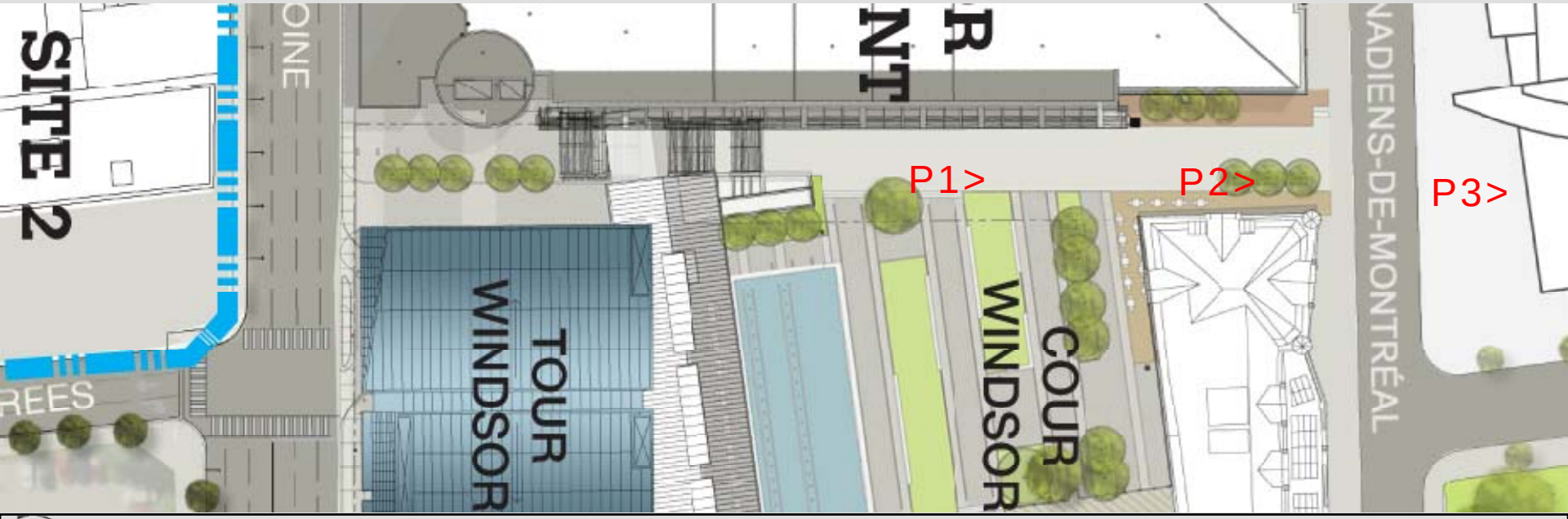
P3>
TOUR WINDSOR
COUR WINDSOR
REES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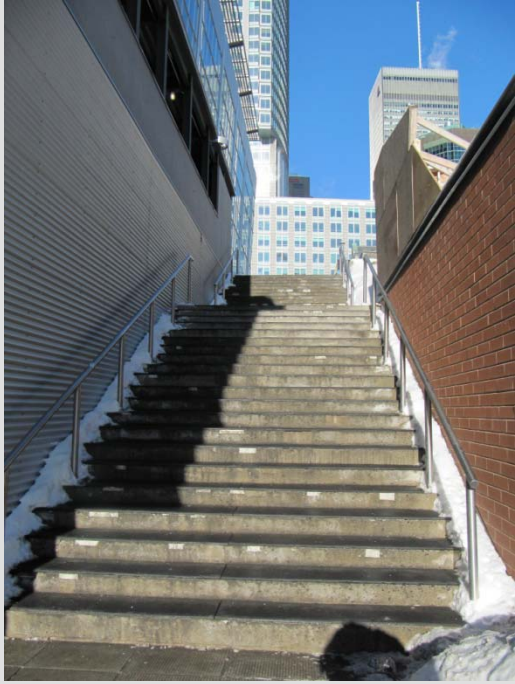

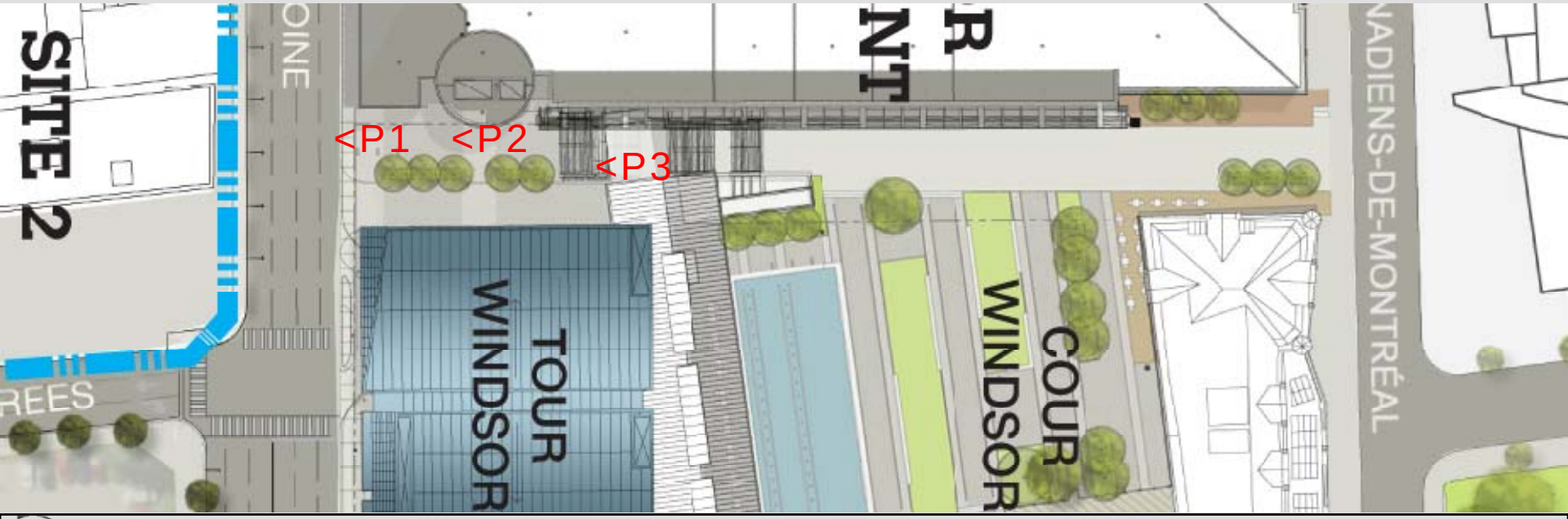
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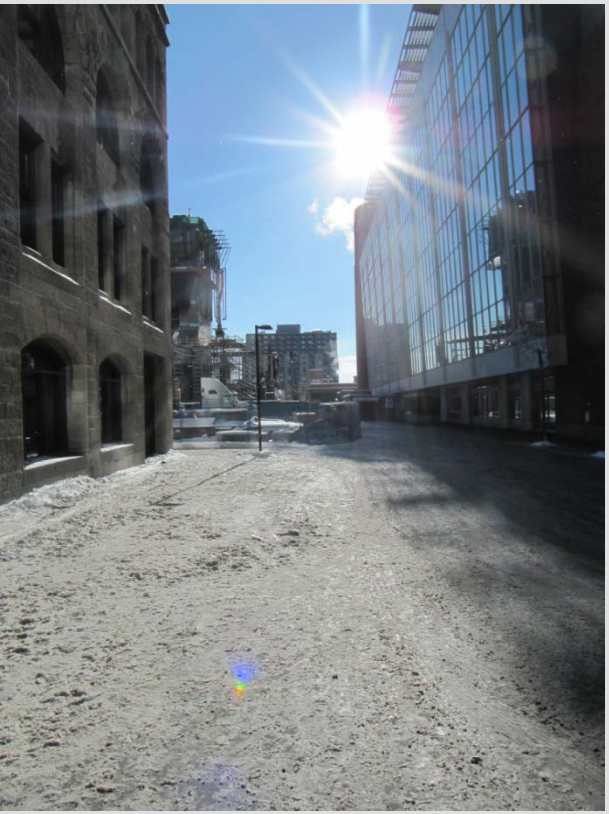
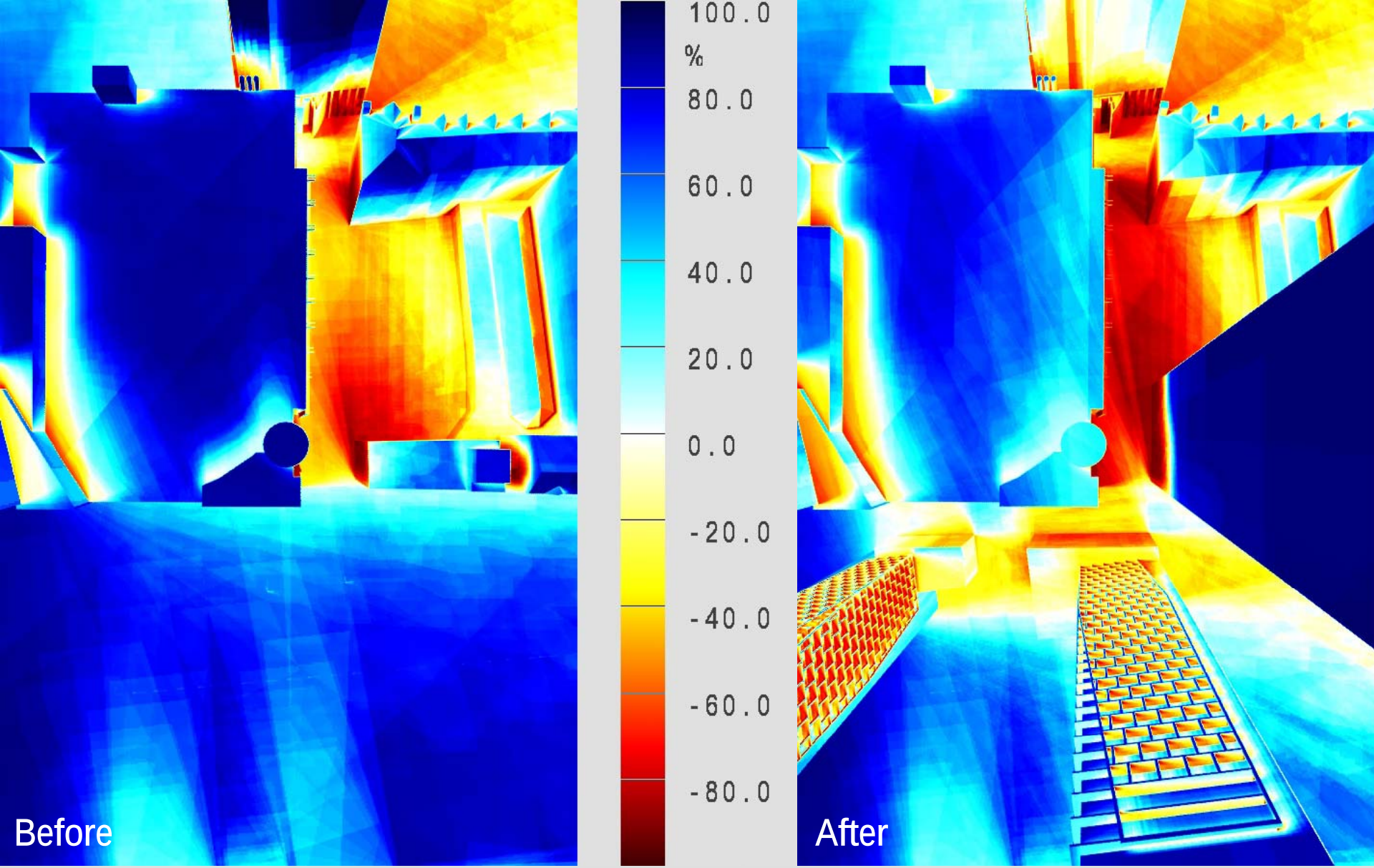
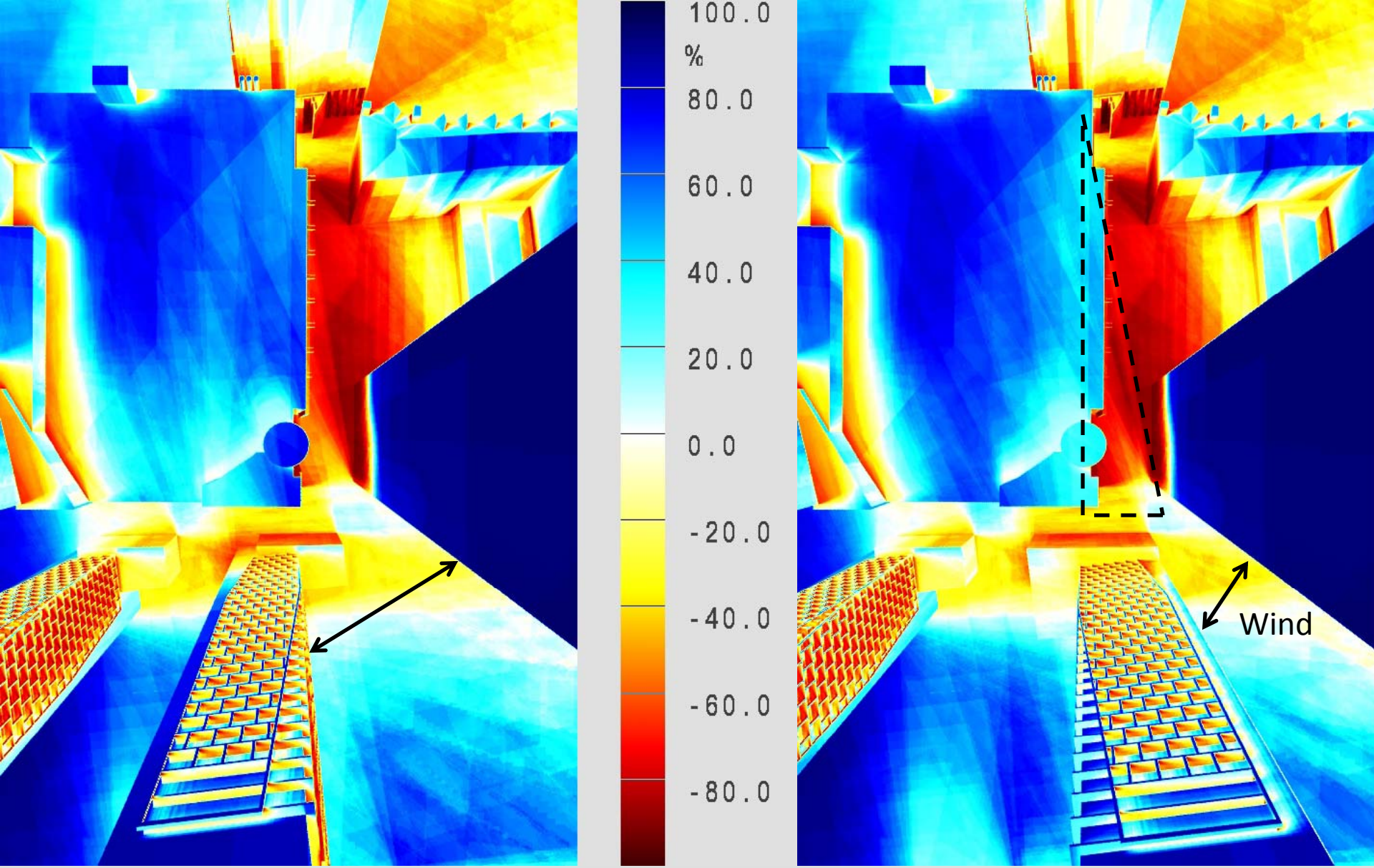


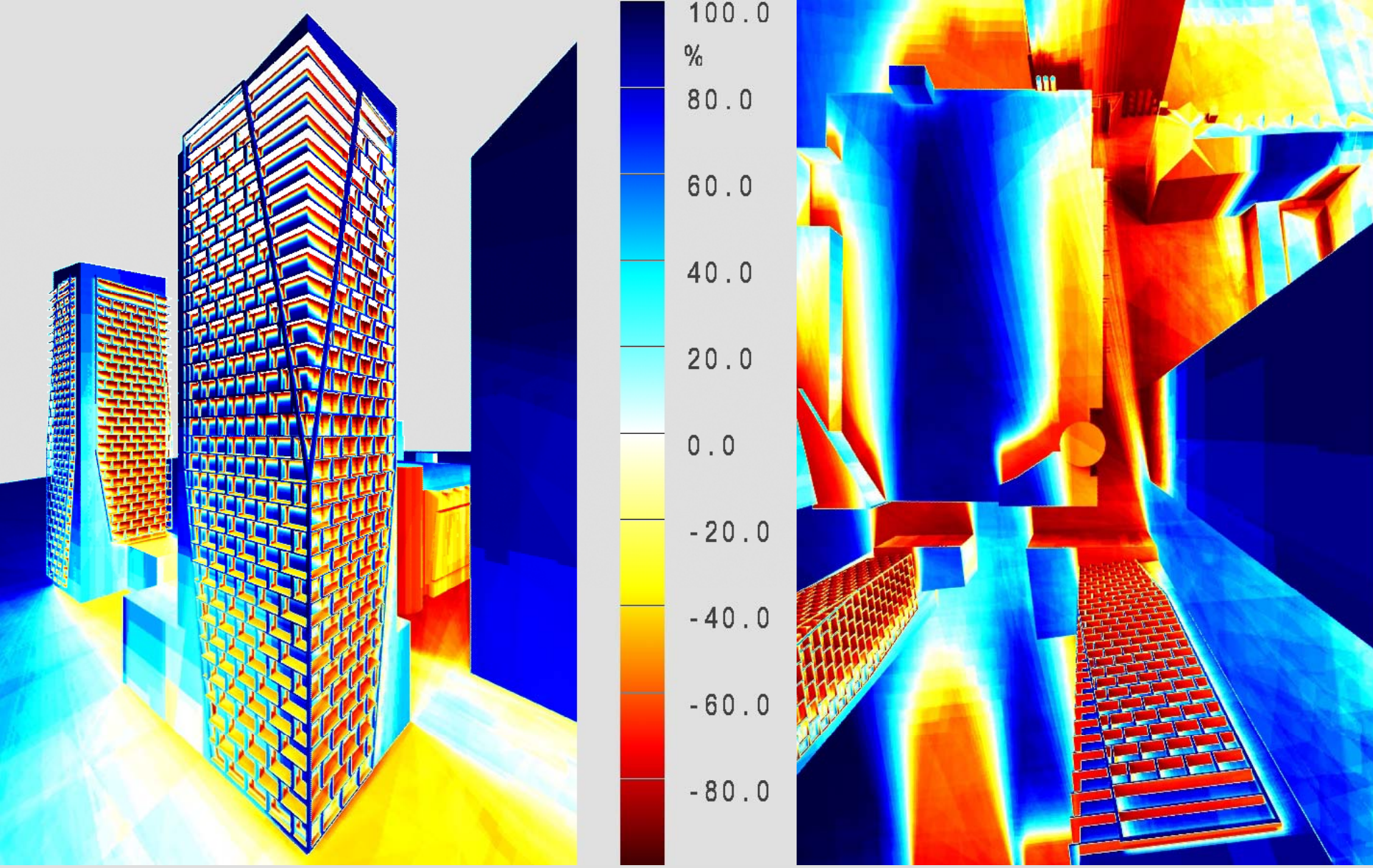


Annual solar-climatic performance analysis

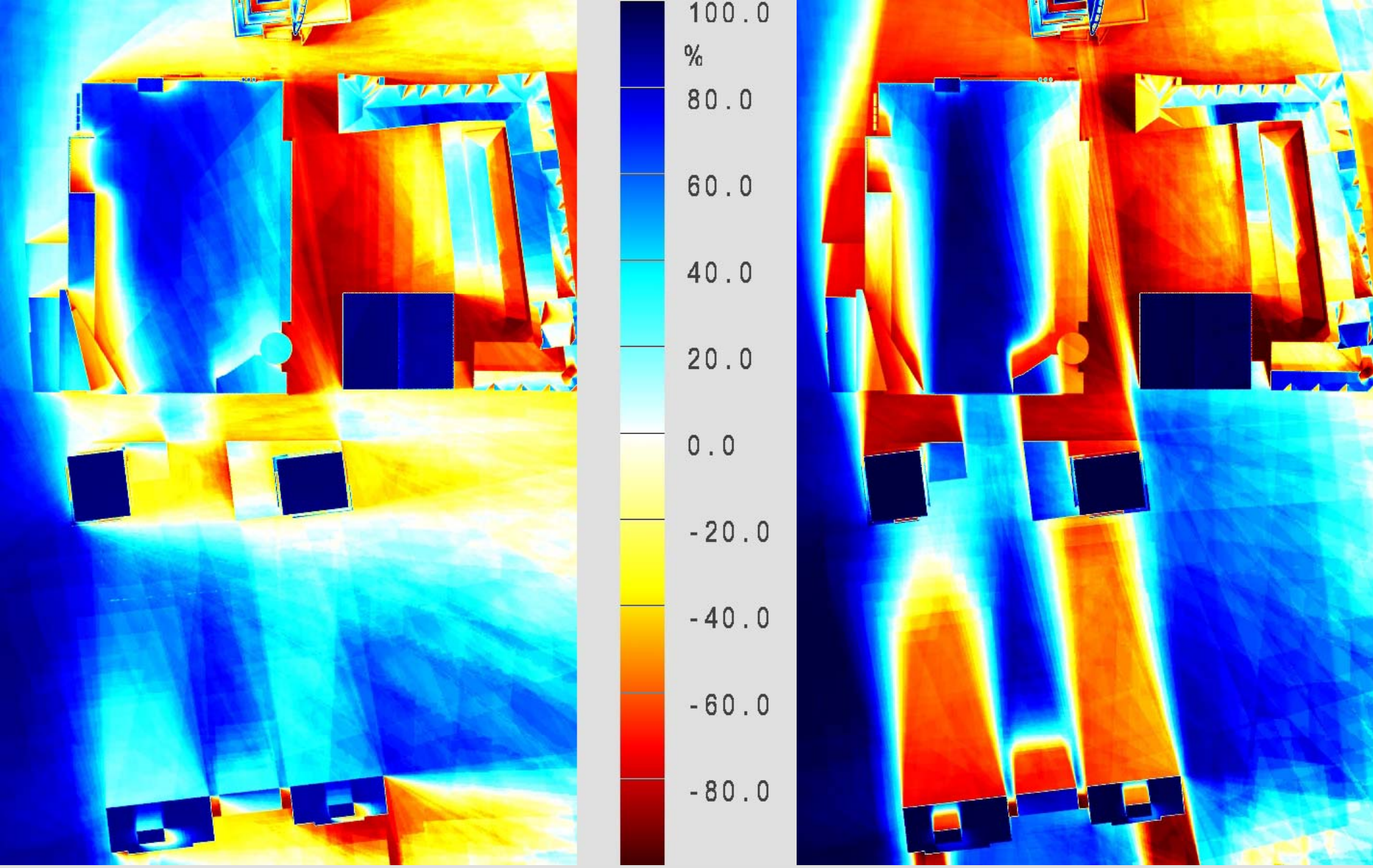


Improved version

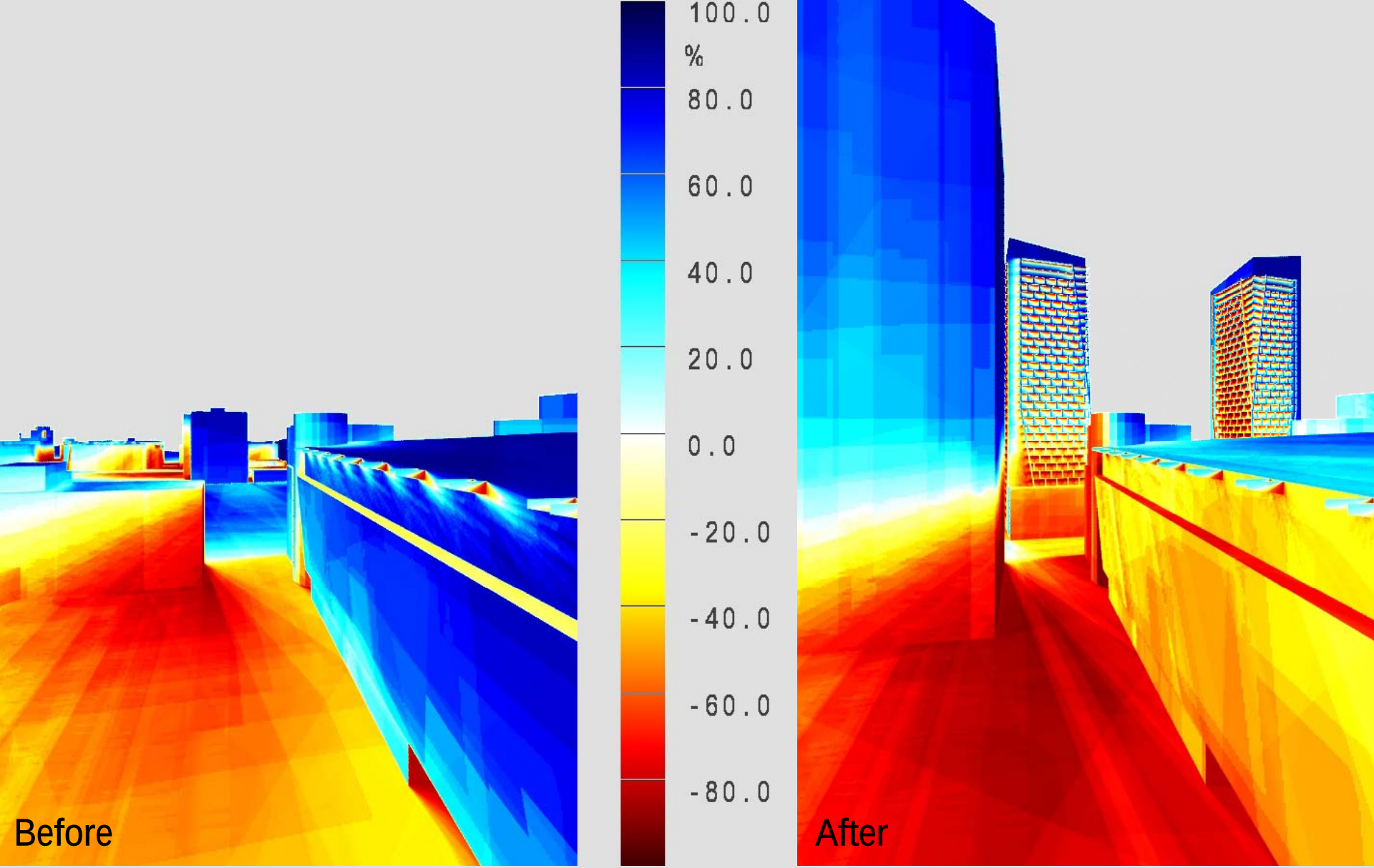
Curent proposal



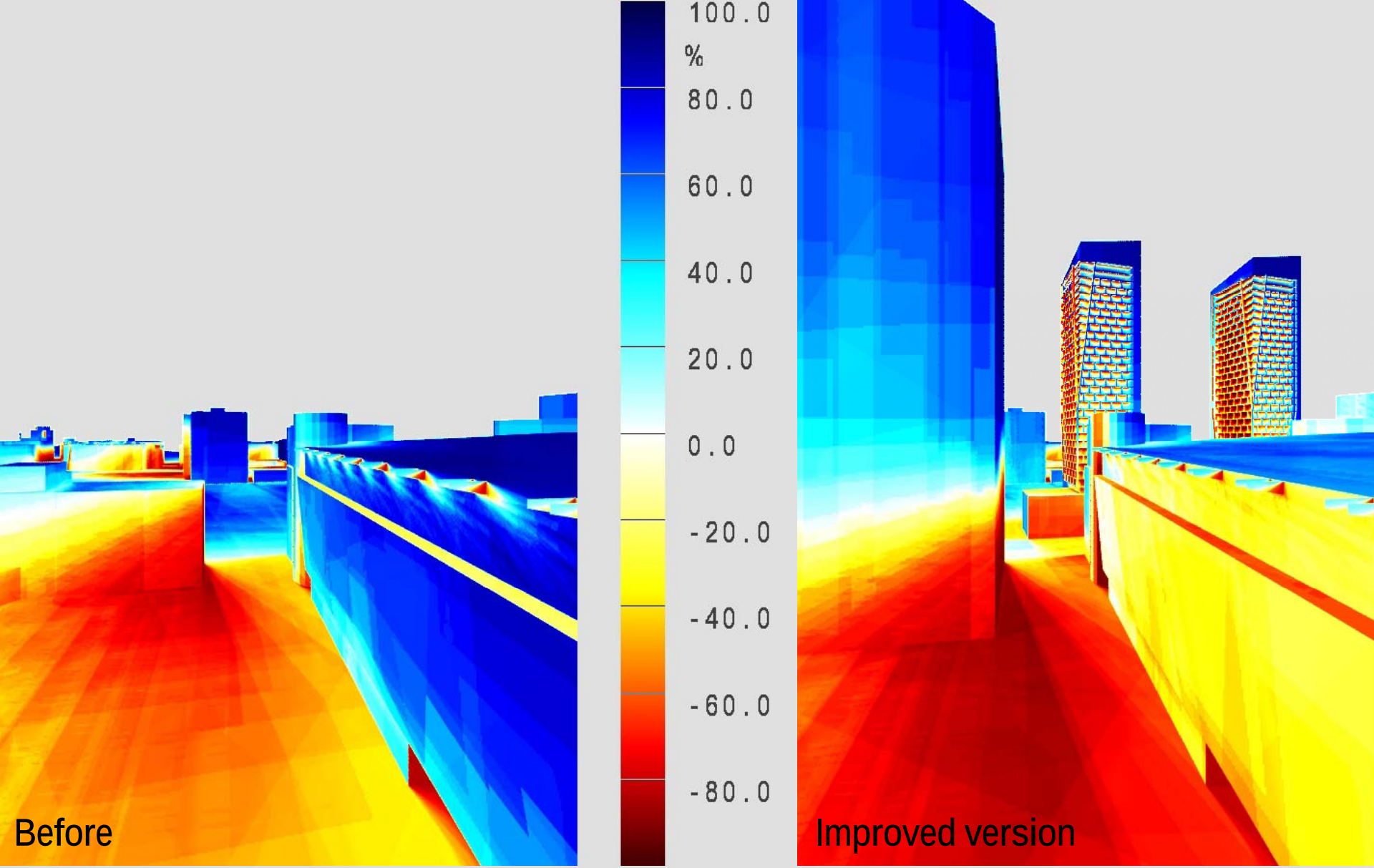
left: annual, right: partial: from 8 a.m. to 10 a.m. between December 21 and September 22



left: annual, right: partial: from 8 a.m. to 10 a.m. between December 21 and September 22



Annual solar-climatic performance analysis



Annual solar-climatic performance analysis

on February 24, 2014

The Office de consultation publique de Montréal makes public the report on the consultation held on the draft **Montréal Development Plan**

After analysis of all the information, the commission considers that Montréal cannot escape the following three challenges:

- **Adapting the city to climate changes**;
- Taking up the demographic challenge;
- Carving out a place in the new economic environment.

In response to these three challenges and to different issues, the commission proposes to achieve 5 targets:

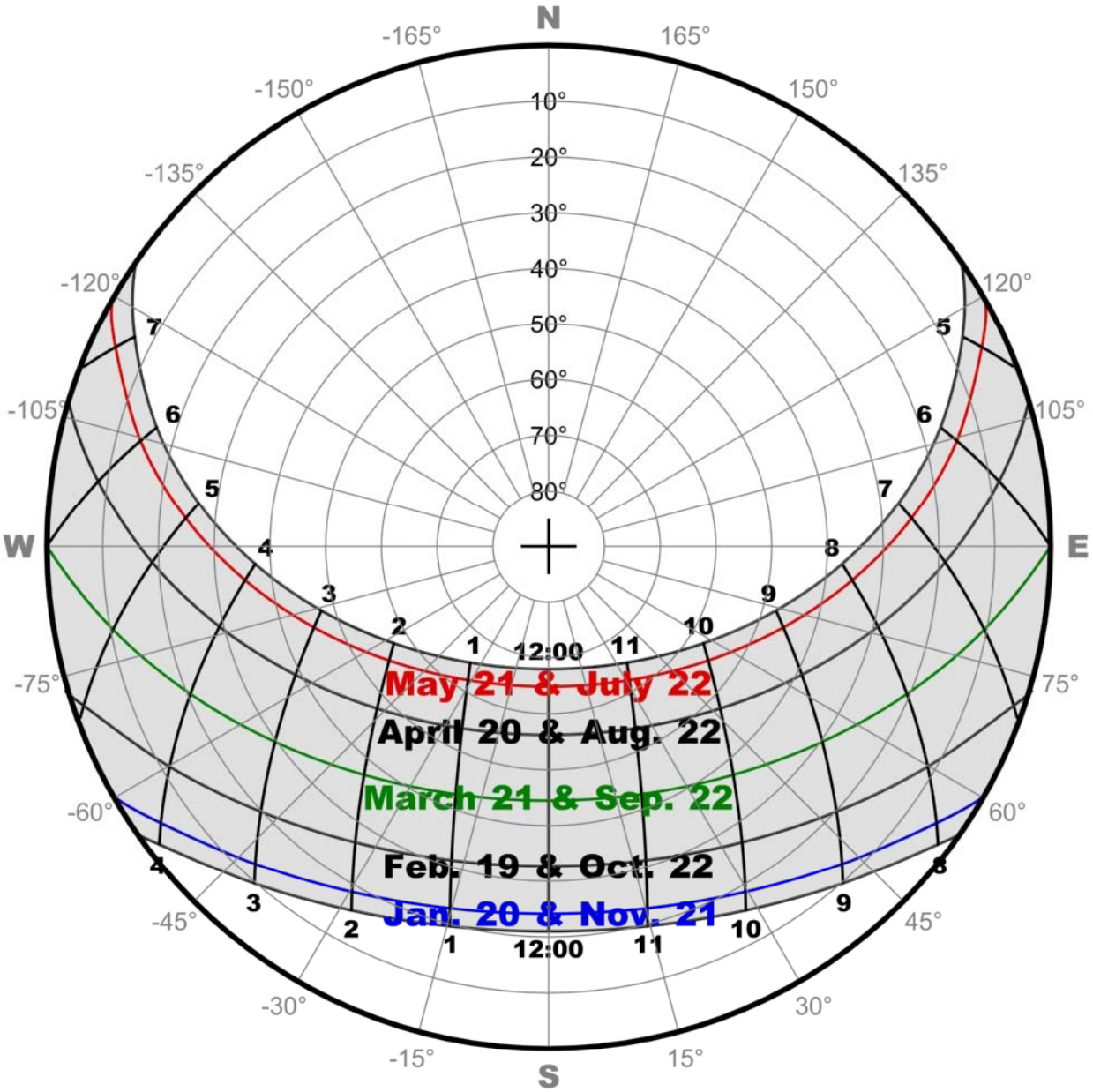
a compact and **efficient** city;
an inclusive and supportive city;
a city of culture and **knowledge**;
a **green** city;
a thriving city.

In terms of adapting the city to climate changes:
Such changes lead to serious problems in terms of public **health**, **life** and property **safety** and **pollution** – a 20 to 30% increase in the mortality rate was recorded in certain heat islands during the latest heat waves, not to mention **the major inconveniences associated with periods of extreme cold**; the drop in air quality during smog episodes; the flooding of certain areas of the city in heavy rains; or the pollution of shorelines and waterways resulting from overflows.

The commission recommends the adoption of a Montréal climate change **adaptation plan that would ensure such consistency**

One of the recommendations:
-Make **pedestrian safety and comfort** the basic principle of Montréal's approach to travel management;

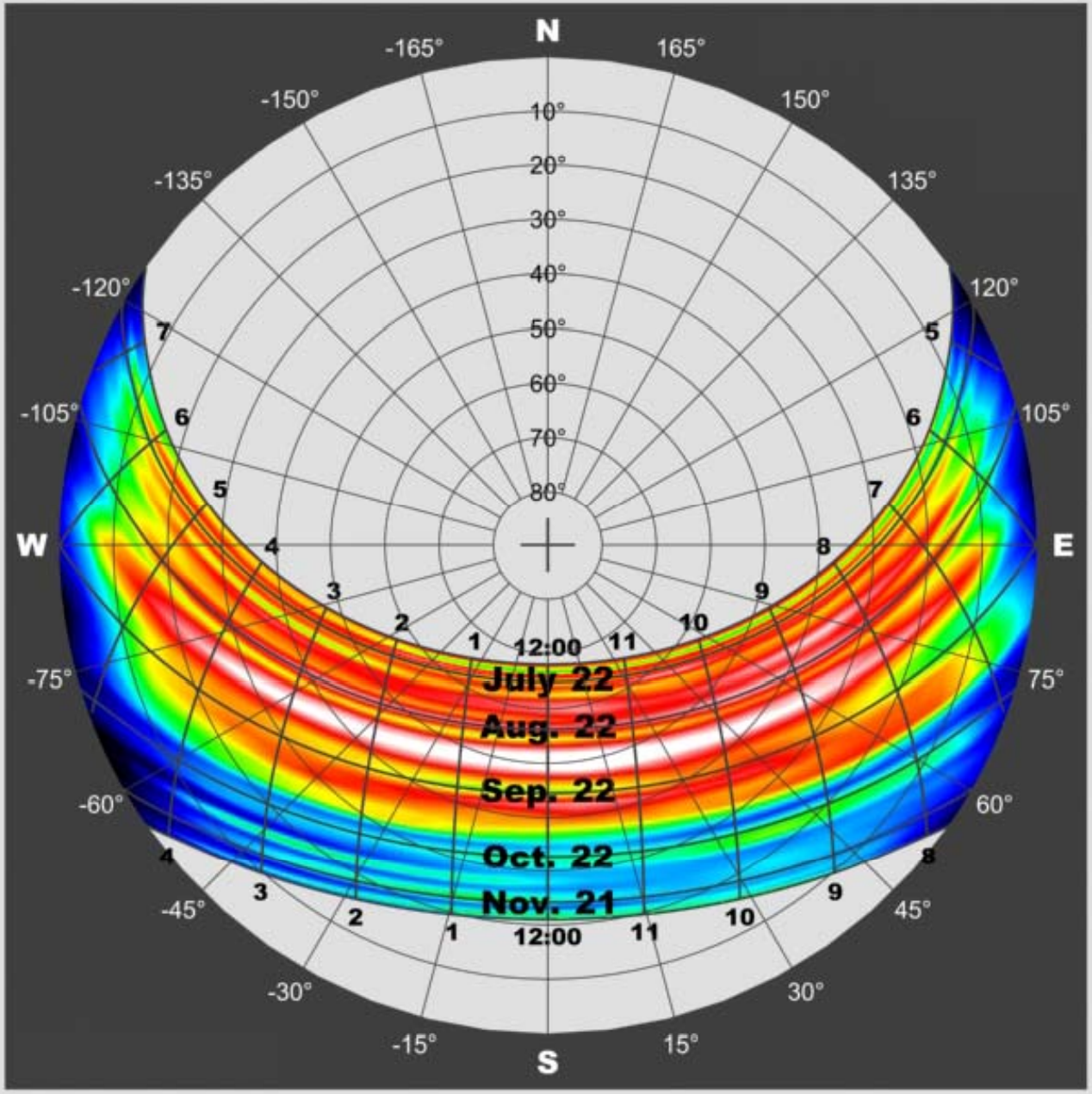
Montréal
Sun Path

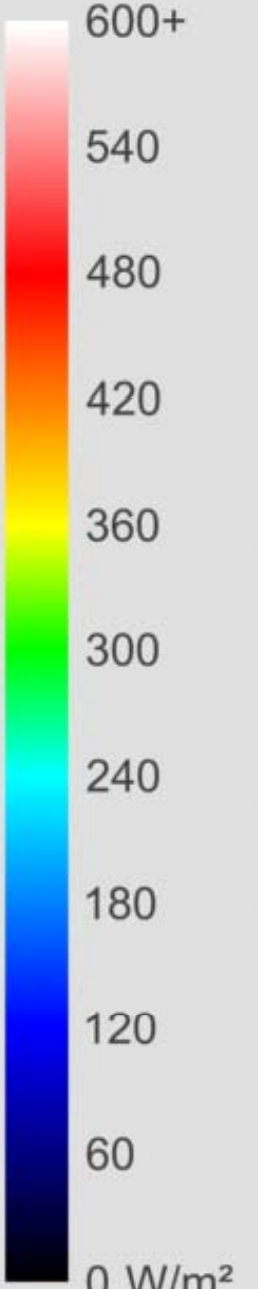


Montréal Solar Radiation Direct Beam

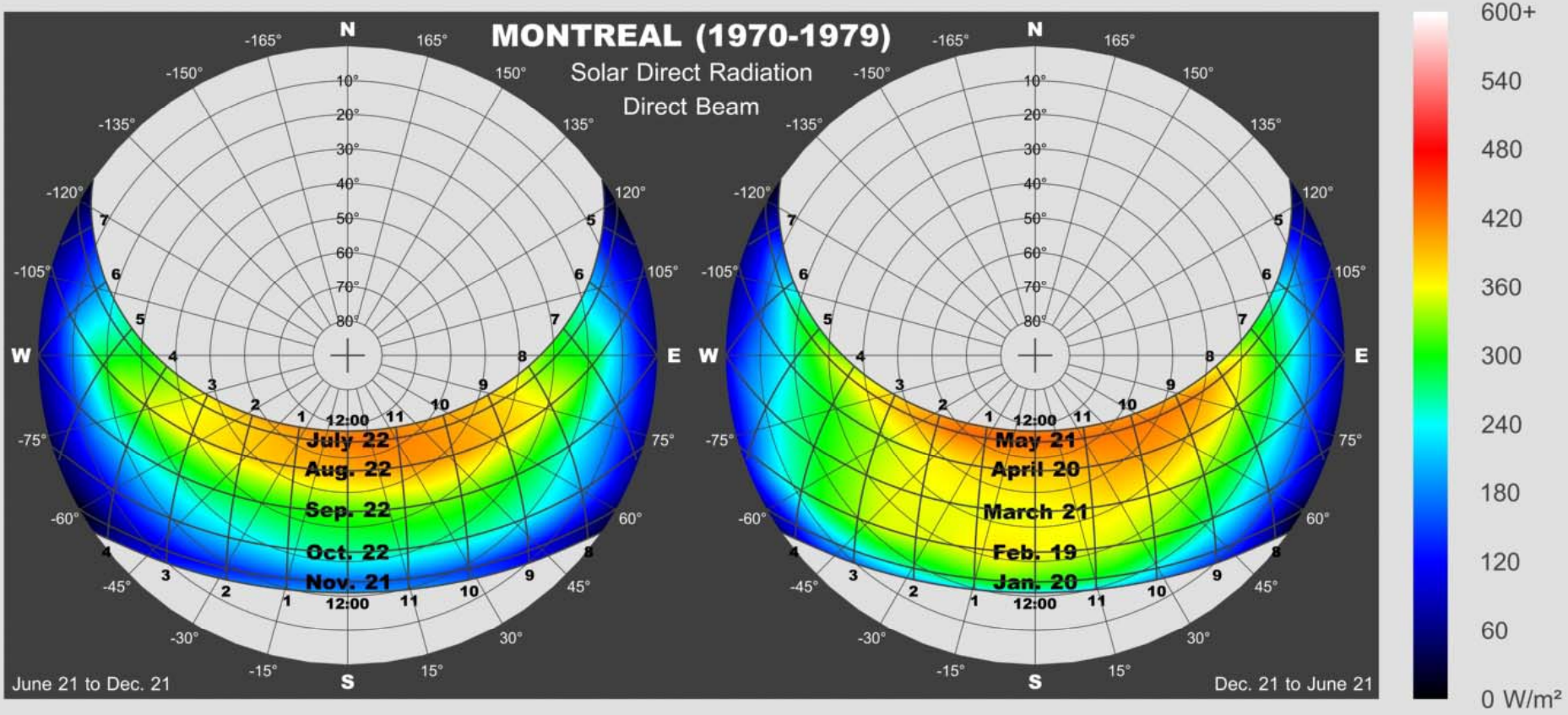
(2001 – 05)

SOLARCHVISION standardization based on Canadian Weather Energy and Engineering Datasets





Montréal
Pattern of Direct Solar Radiation: 1970's
SOLARCHVISION standardization based on Canadian Weather Energy and Engineering Datasets



Montréal
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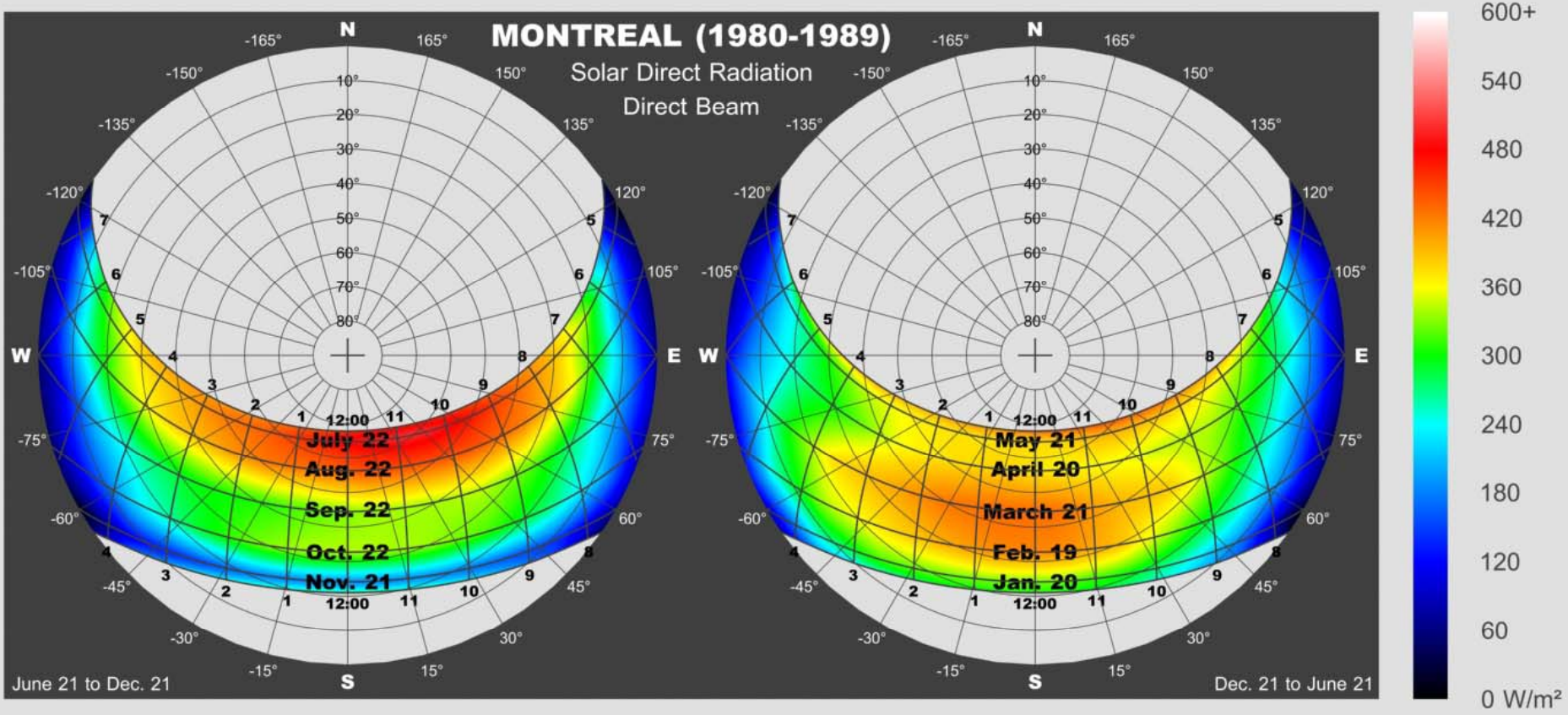
SOLARCHVISION standardization based on Canadian Weather Energy and Engineering Datasets



Montréal
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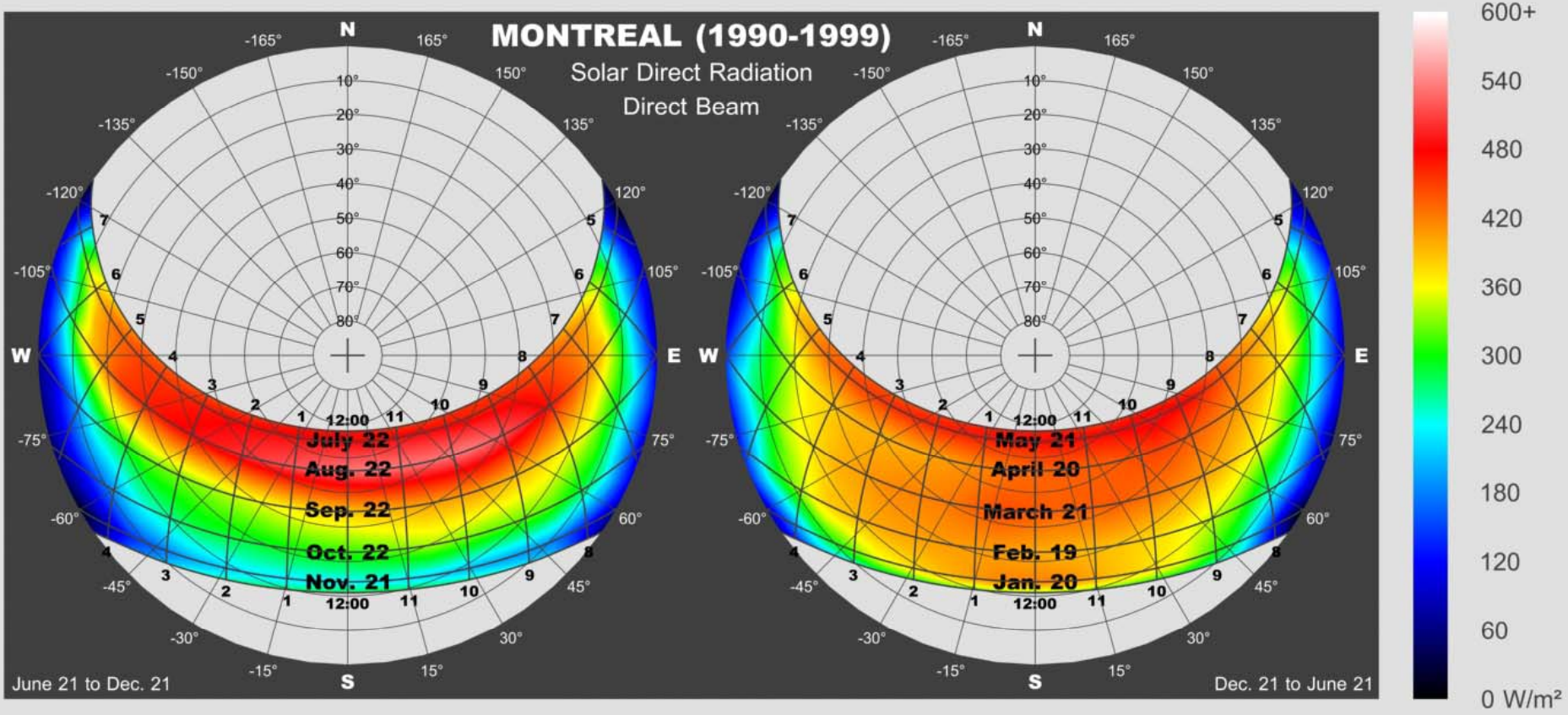
SOLARCHVISION standardization based on
Canadian Weather Energy and Engineering Datasets



Montréal
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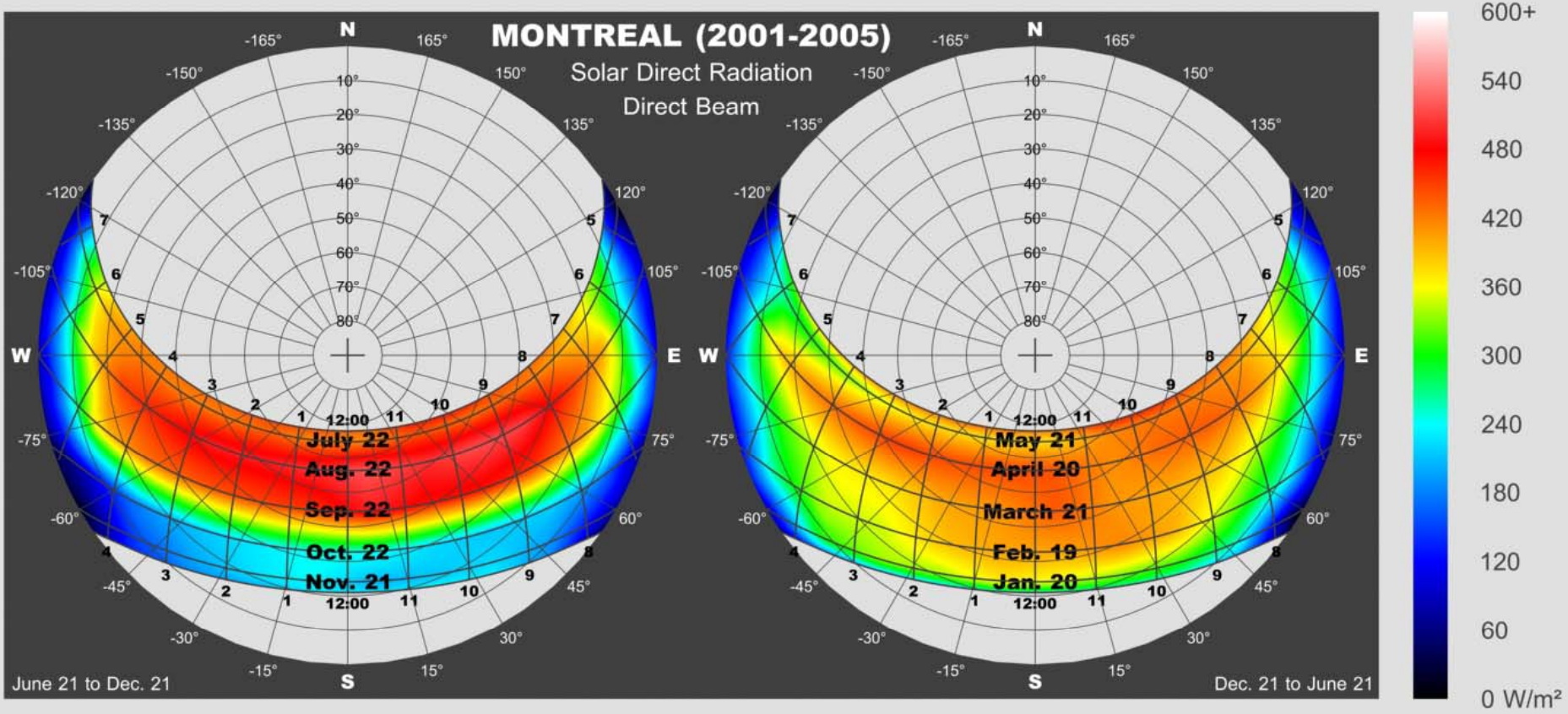
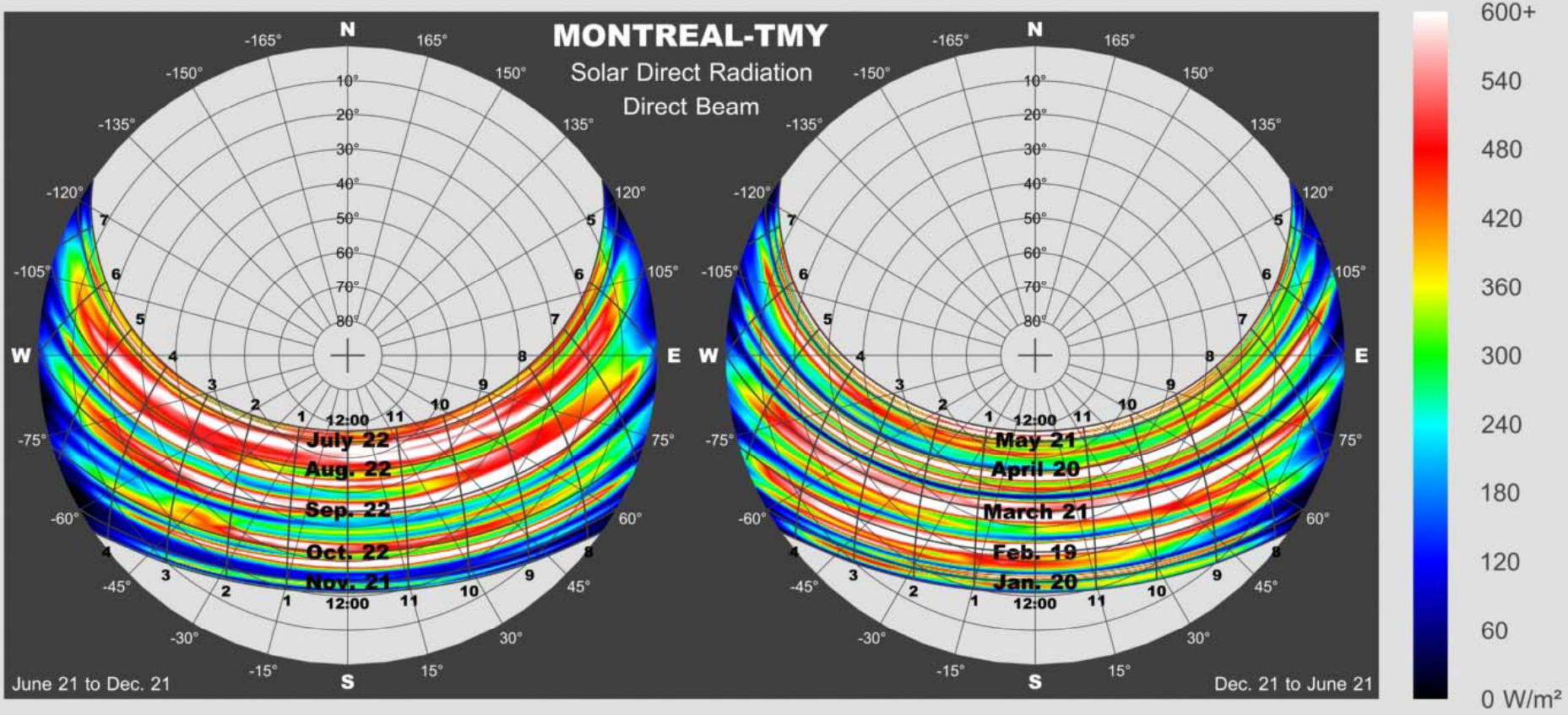
SOLARCHVISION standardization based on
Canadian Weather Energy and Engineering Datasets

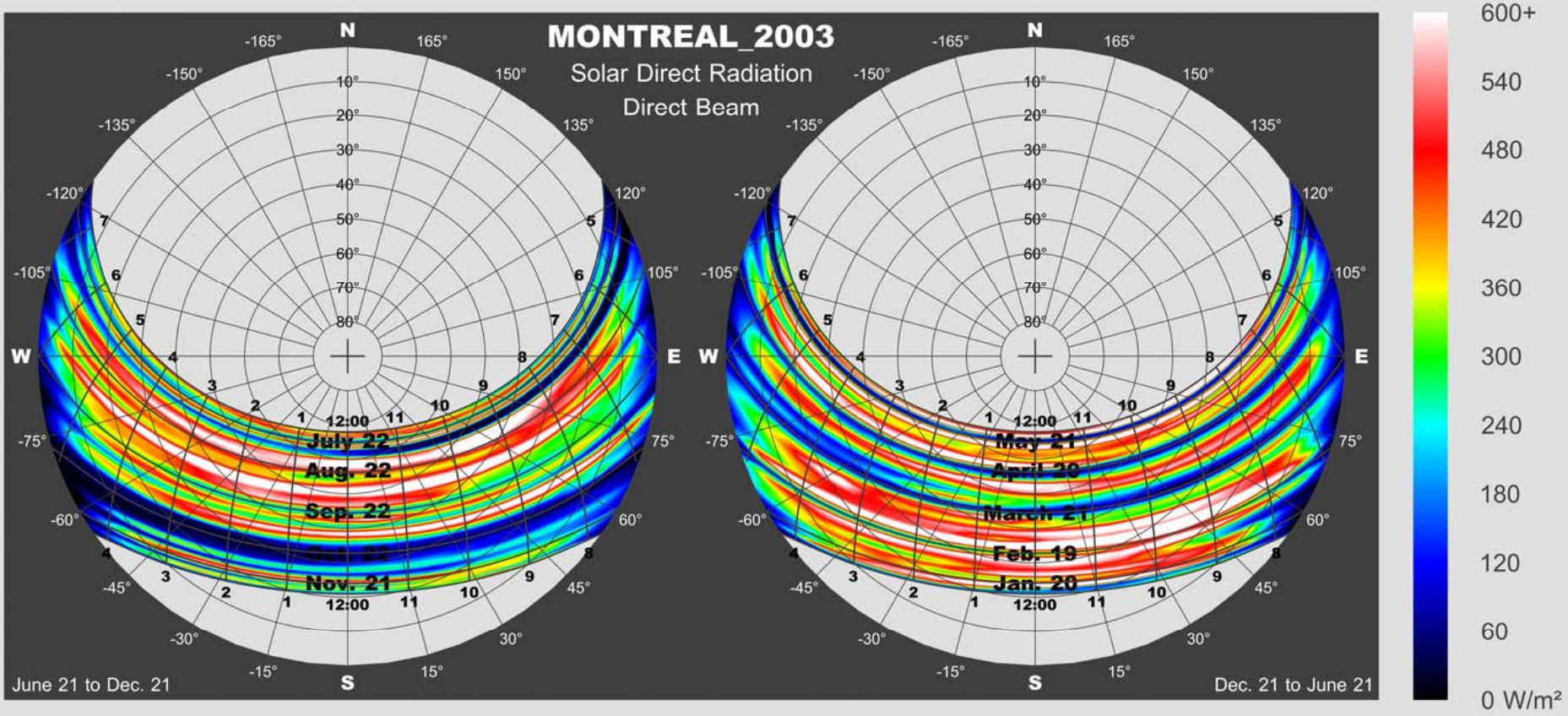


Montréal
Solar Radiation Model in Typical Meteorological Year
SOLARCHVISION standardization based on
U.S. Department of Energy TMY Datasets



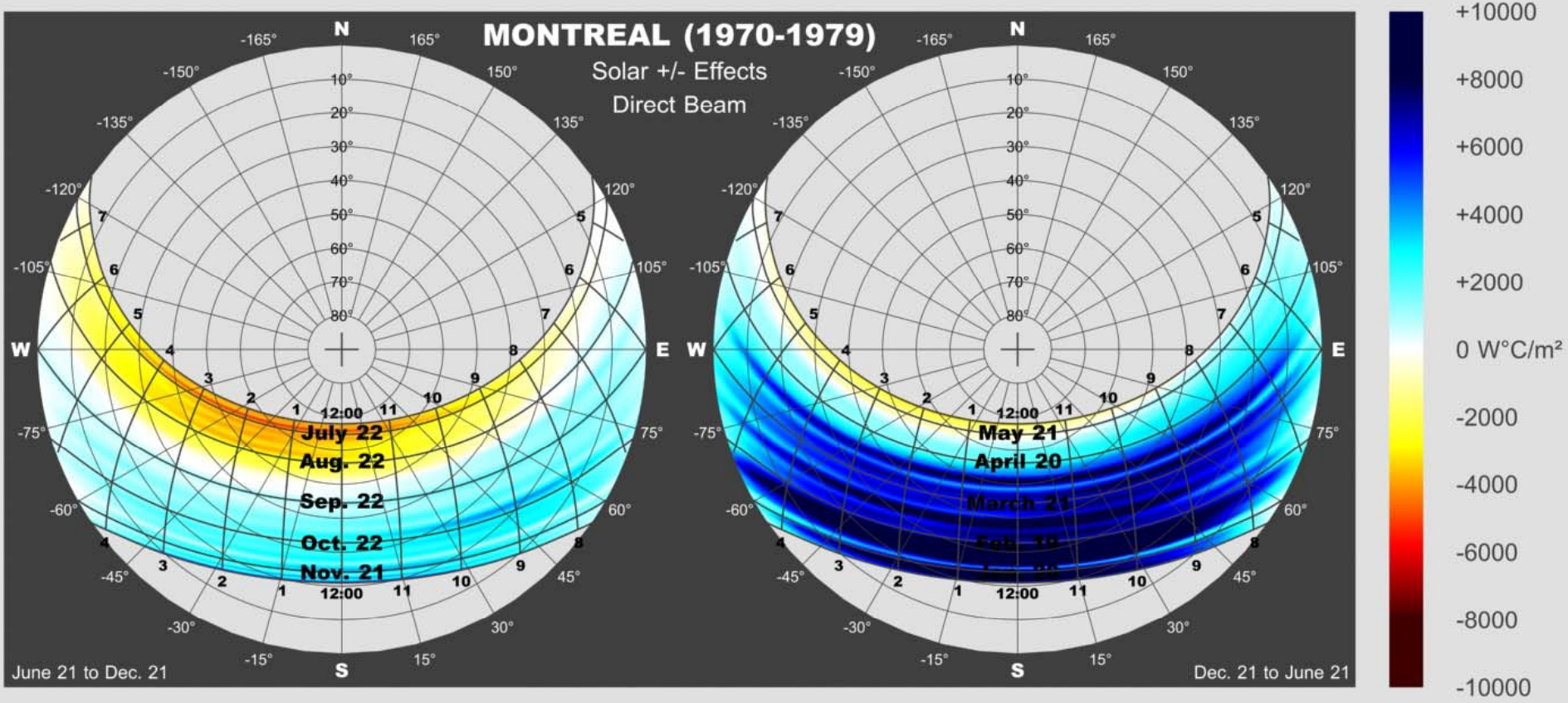
Montréal
Solar Radiation Model in 2003

SOLARCHVISION standardization based on
Canadian Weather Energy and Engineering Datasets



A year with extreme minimum air temperatures is more sunny in winter.

Montréal
1970's Solar Positive and Negative Effects
SOLARCHVISION calculations based on
Canadian Weather Energy and Engineering Datasets



Montréal
2000's Solar Positive and Negative Effects
SOLARCHVISION calculations based on
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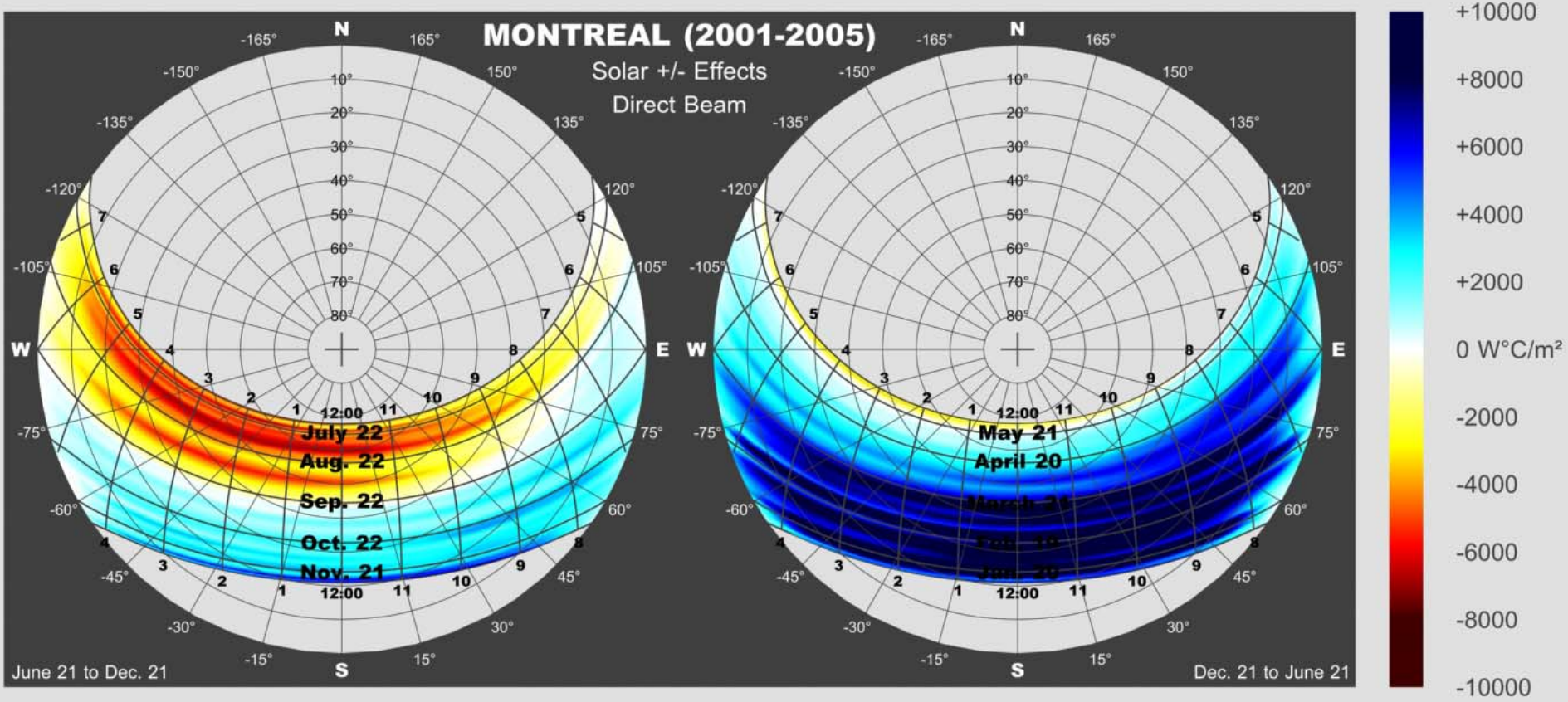
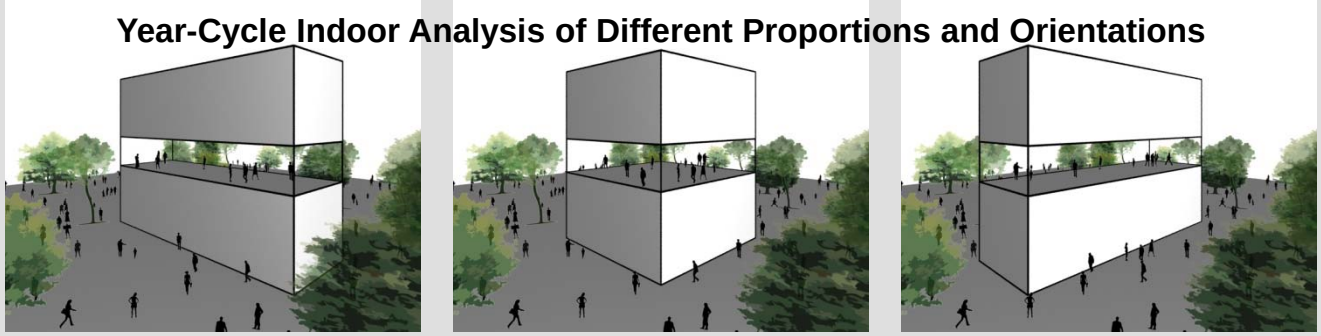
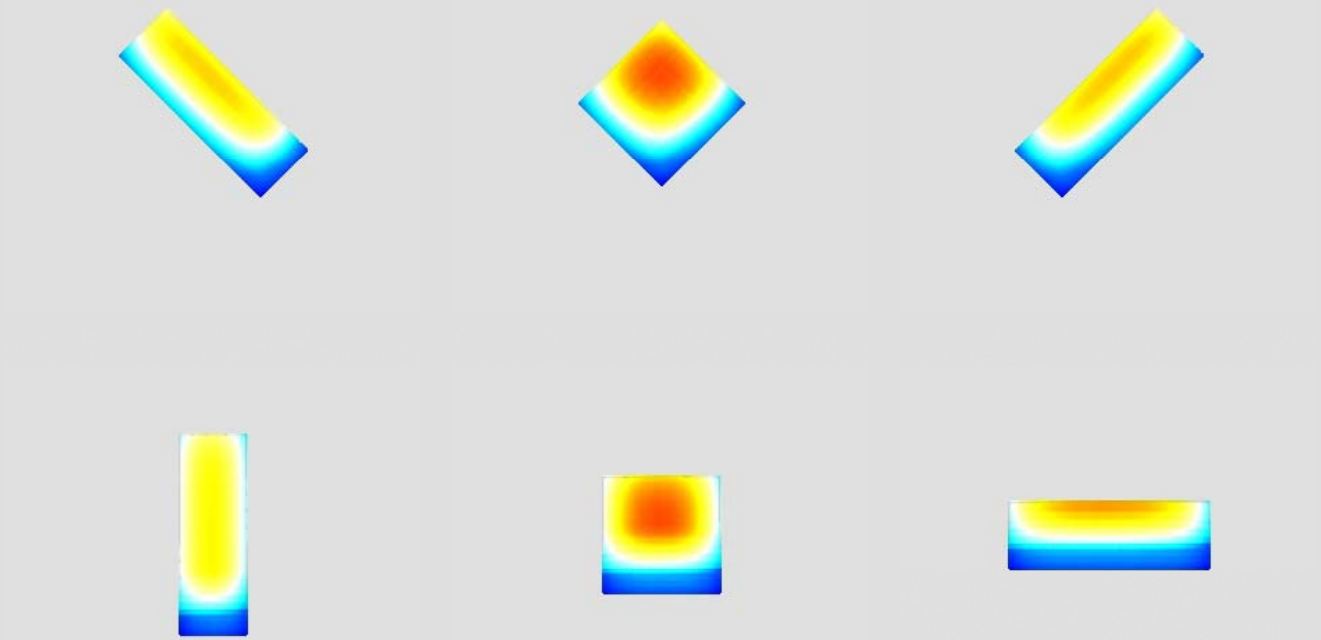


As a result of *Climate Change* significant increase in the amount of direct solar radiation in Montréal increases the negative and positive impacts of the sun BOTH in summer and winter.

Montréal

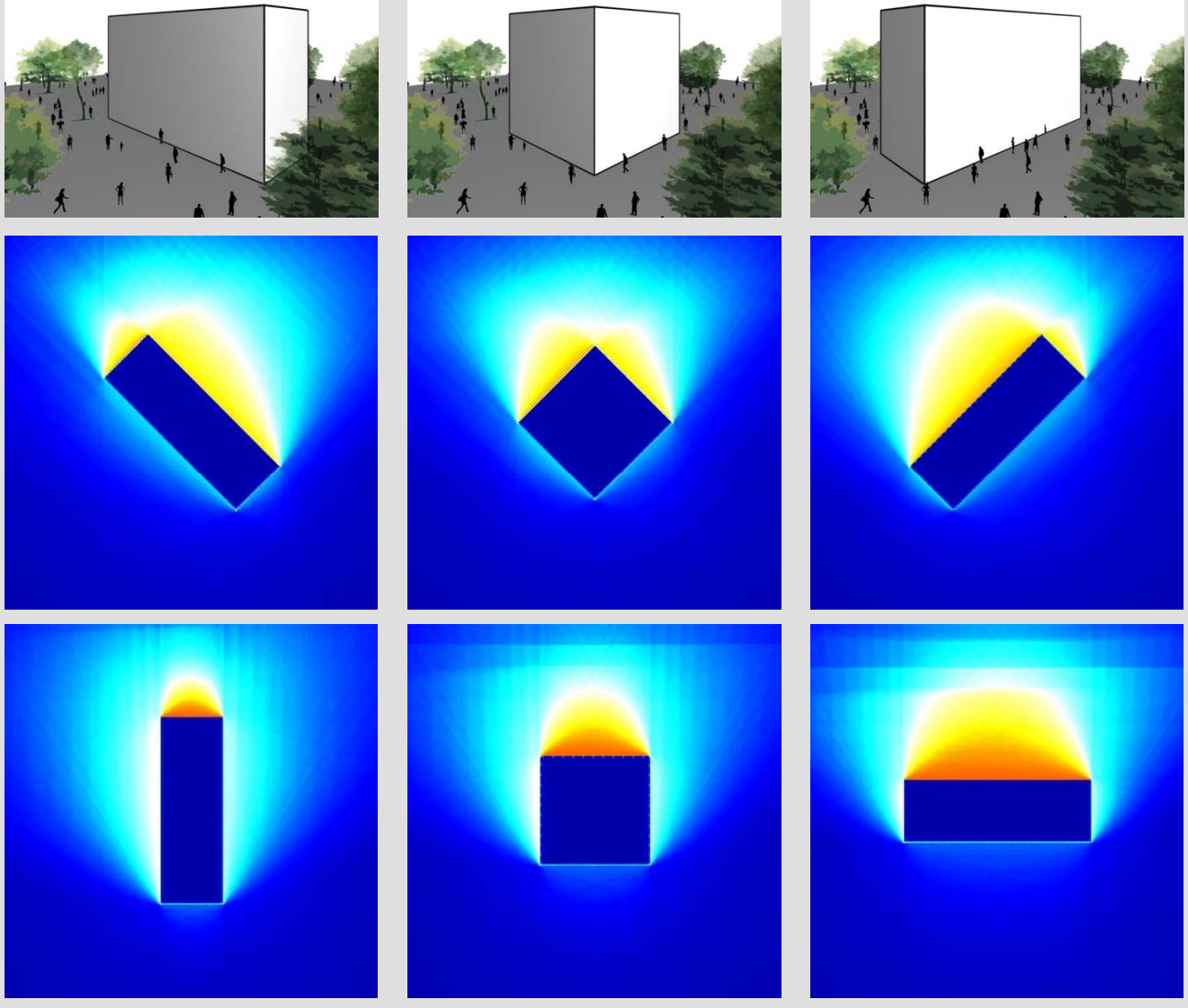
Year-Cycle Indoor Analysis of Different Proportions and Orientations





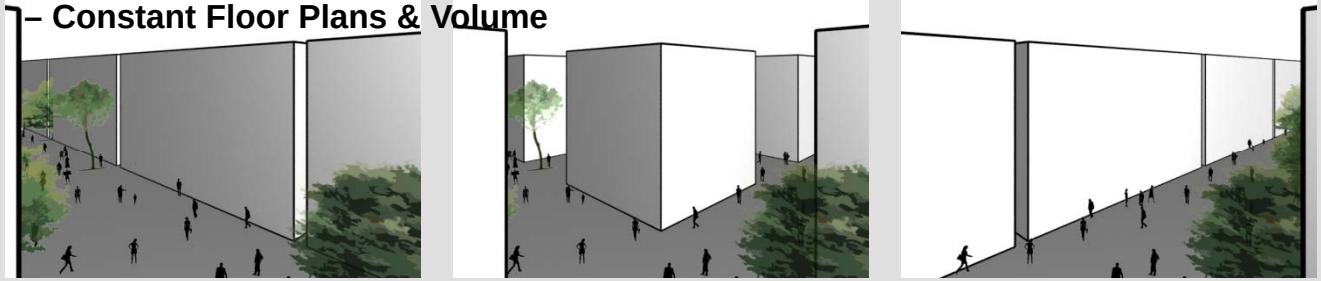
Montréal

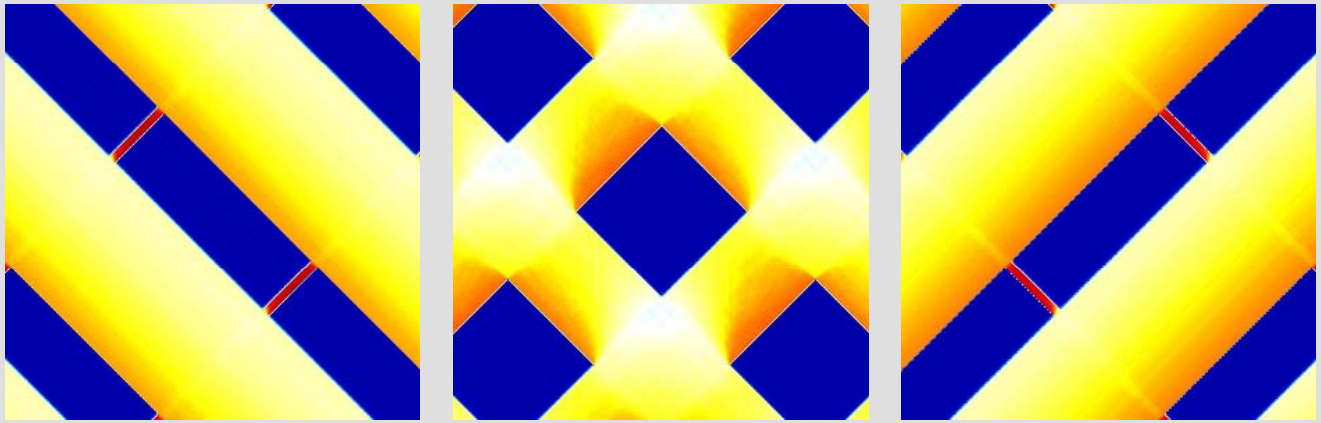
Year-Cycle Outdoor Analysis of Different Proportions and Orientations – Constant Floor Plans & Volume

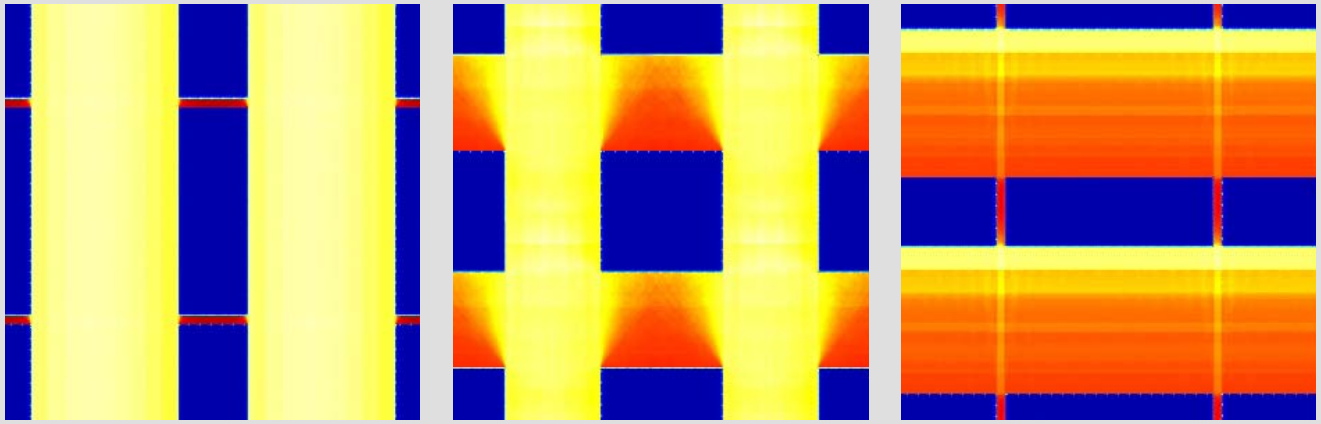


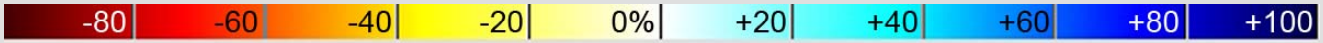
Montréal

Year-Cycle Outdoor Analysis of Different Proportions and Orientations in Fabric – Constant Floor Plans & Volume





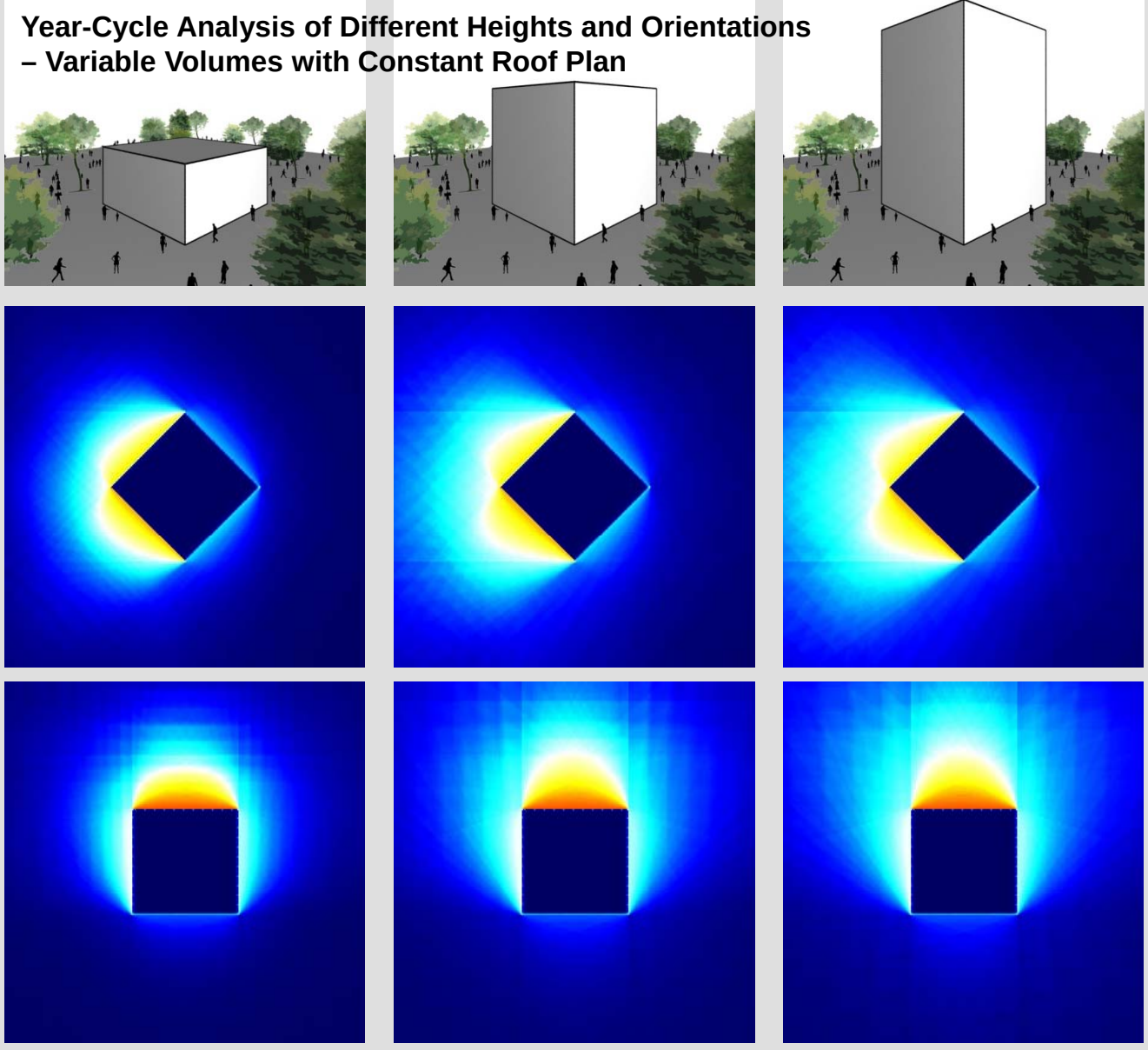




Undesirable **Solar-Climatic Performance** Desirable

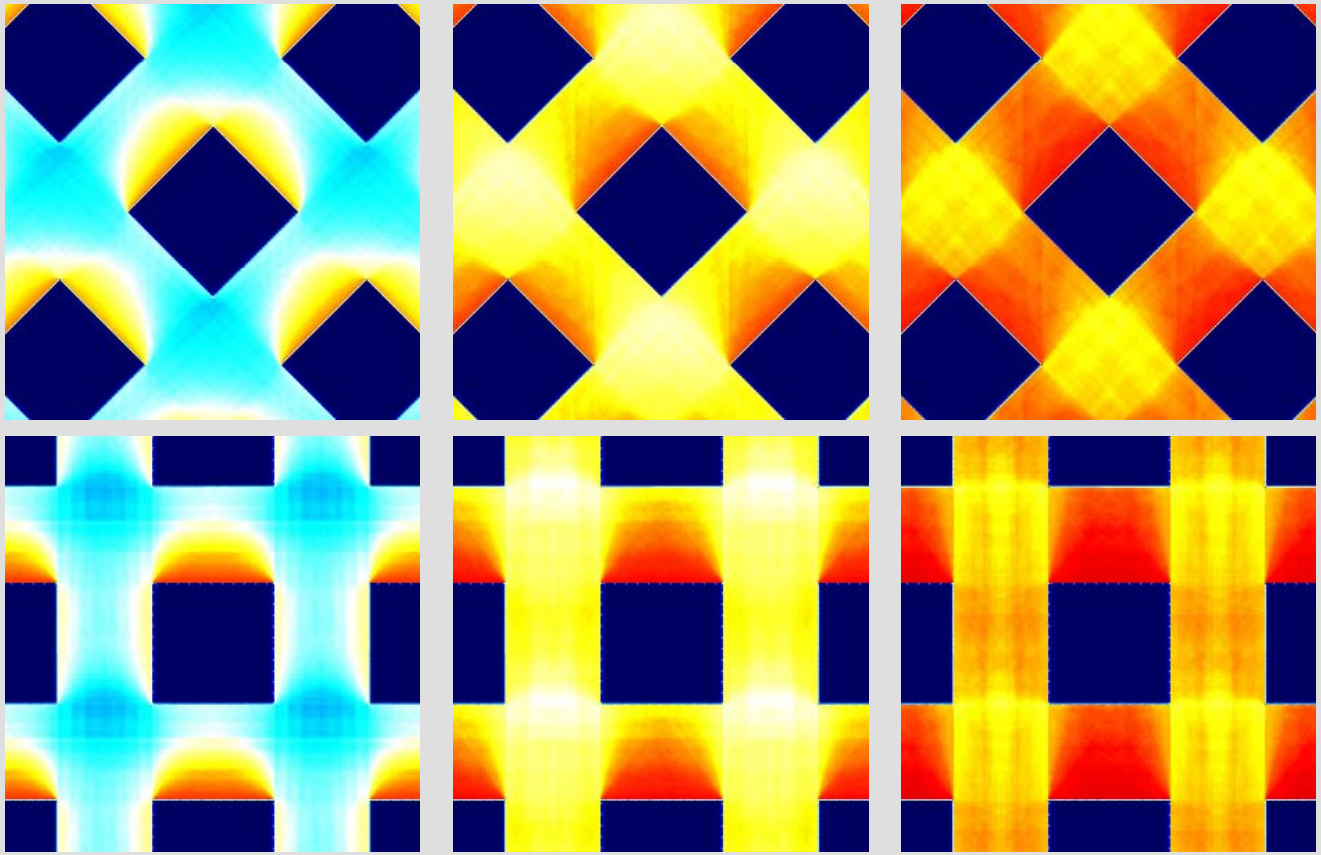
Montréal

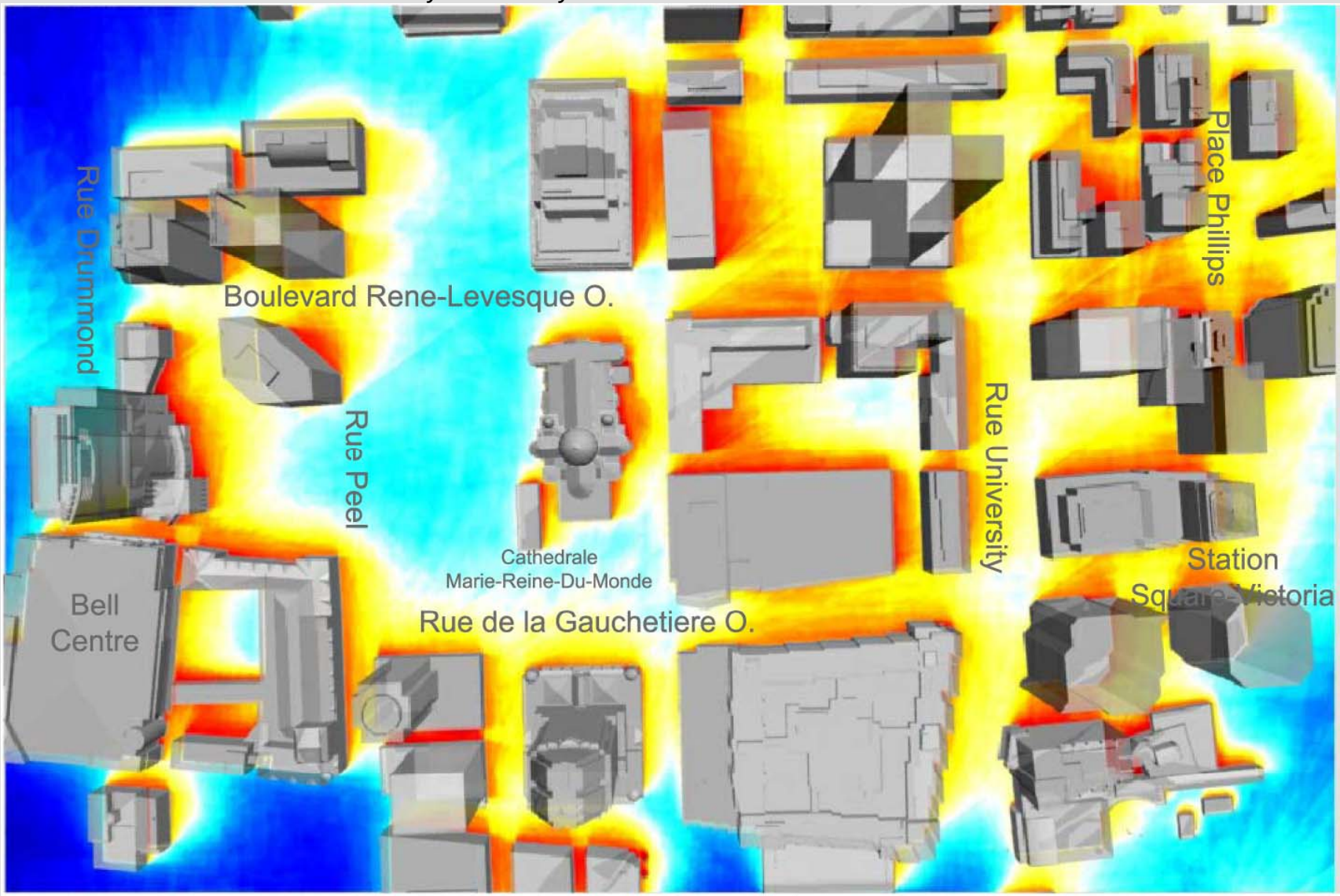
Year-Cycle Analysis of Different Heights and Orientations – Variable Volumes with Constant Roof Plan



Montréal

Year-Cycle Analysis of Different Heights and Orientations in Fabric – Variable Volumes with Constant Roof Plan




Rue Drummond
Boulevard Rene-Levesque O.
Rue Peel
Cathedrale
Marie-Reine-Du-Monde
Rue de la Gauchetiere O.
Bell
Centre
Rue University
Place Phillips
Station
Square-Victoria


-80
-60
-40
-20
0%
+20
+40
+60
+80
+100
Undesirable
Solar-Climatic Performance
Desirable

Merci Beaucoup
Les Montréalaises!

consider a look from the Sun!

The author welcomes further exchanges with the OCPM consultation committee so that additional updates to this type of information and analysis can be shared regarding this project. In addition, similar solar-climatic studies during the processes of building skin and urban design can improve many aspects including the potentials and performances in terms of energy production, energy demand, daylight, health, comfort and safety for long periods of time; with the added benefit that most of these architectural rearrangements and improvements do not necessarily increase the construction costs.

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► Environment Canada: available at: http://www.ec.gc.ca/

► Canadian Weather Energy and Engineering Datasets CWEED: Long term hourly solar radiation and temperature, etc. contains information licensed under the Open Government Licence – Canada. available at: ftp://ftp.tor.ec.gc.ca/Pub/Engineering_Climate_Dataset

► U.S. Department of Energy: Typical Meteorological Year in EnergyPlus weather format (.epw)
http://apps1.eere.energy.gov/buildings/energyplus/weatherdata_about.cfm, based on CWEC: Canadian Weather for Energy Calculations

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