



基于Grasshopper的绿色建筑性能化 分析插件的介绍

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2017年04月07日



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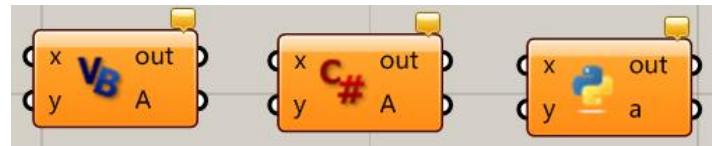
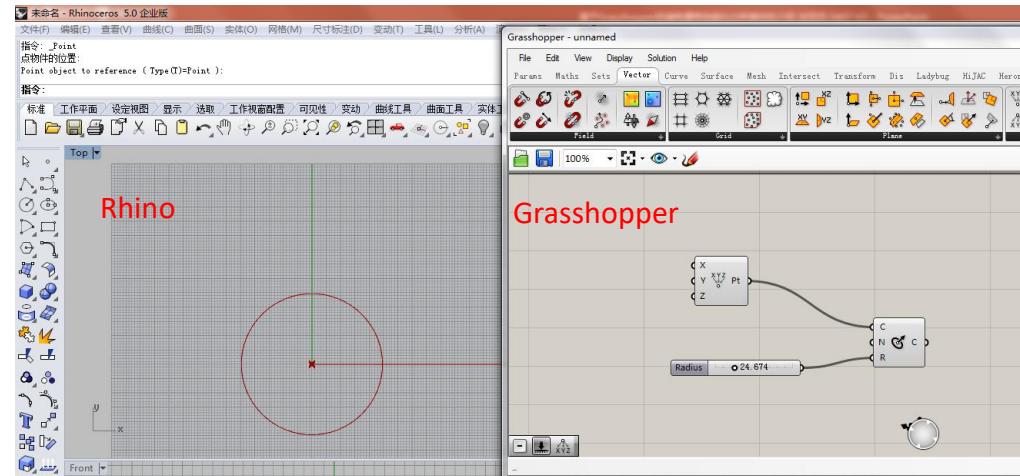
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什么是Grasshopper?

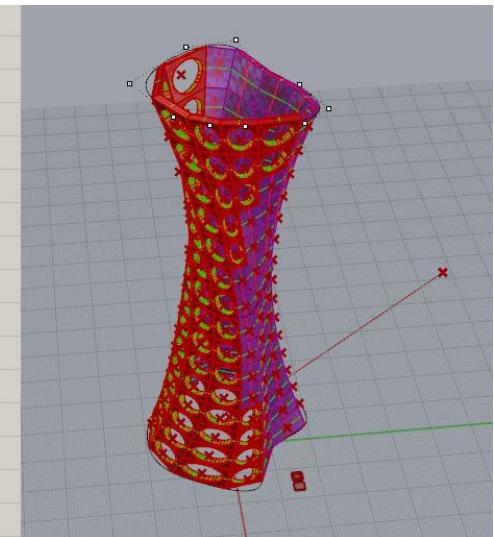
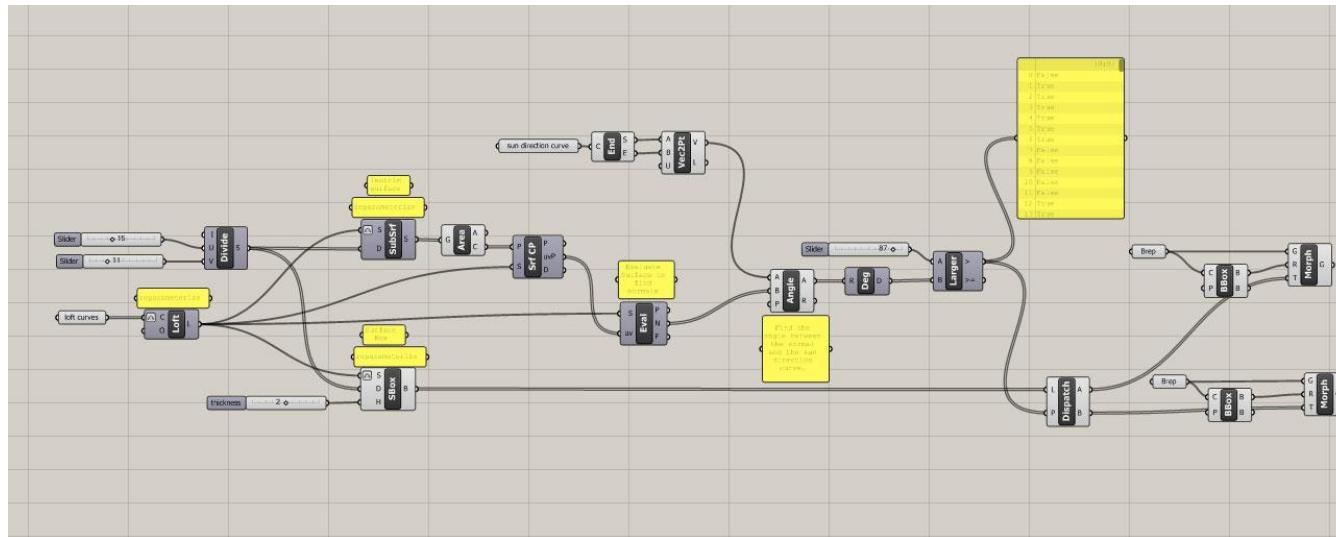
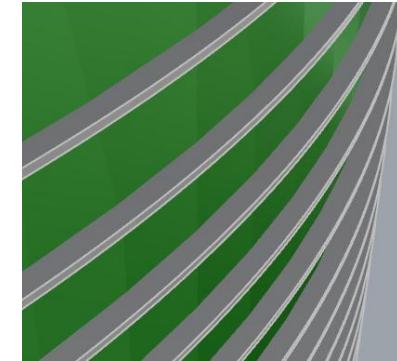
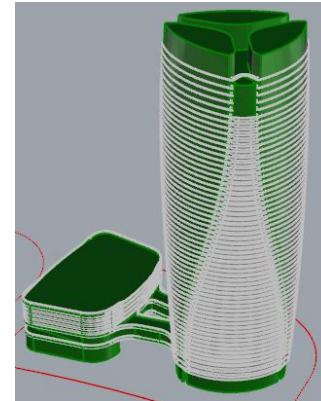
- 犀牛 (Rhinoceros)的插件
- 节点式可视化建模工具 (与其他建模软件相比)
- 建筑方案初期的辅助设计工具 (设计的角度)
- 严谨的数据化建模操作流程
- 开放的用户自定义插件,扩展GH 的性能



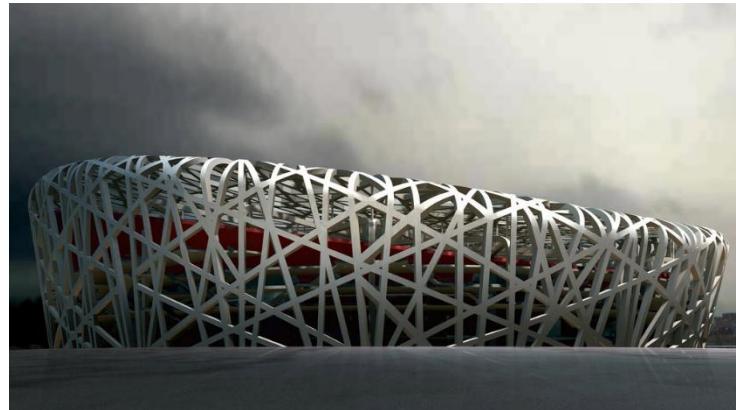
运算器

Grasshopper在建筑方案设计中的应用

- 建筑找形
- 建筑空间的生成
- 建筑结构构件的创建
- 建筑外表皮设计



建筑参数化设计作品



鸟巢



世界最性感建筑:玛丽莲·梦露大厦



阿斯塔纳国家图书馆



凤凰国际传媒中心

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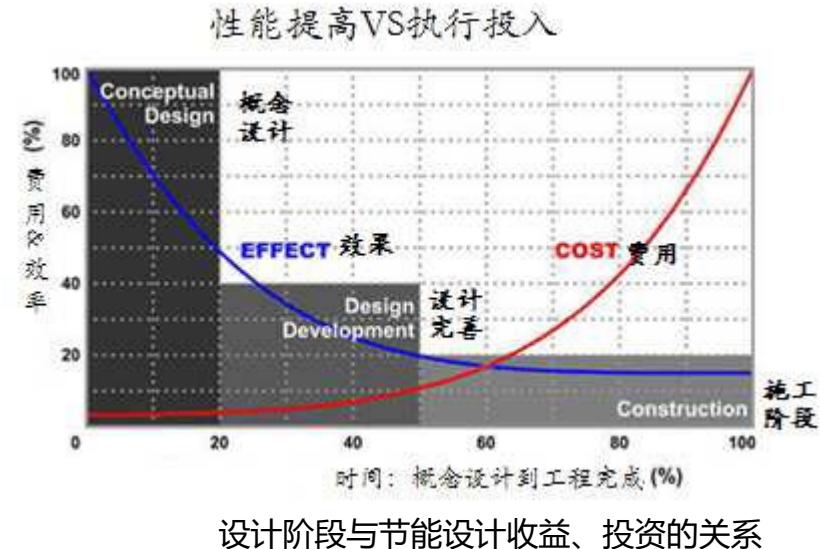
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方案优化设计对提升绿色建筑性能的意义

- 建筑方案设计对建筑能耗有**决定性**的影响
 - 体形、朝向、空间布局、窗墙比等在建筑方案设计阶段确定
 - 40%以上的节能潜力来自于建筑方案初期的规划设计阶段¹
 - 57%的技术措施需要在规划设计和方案设计阶段中落实²



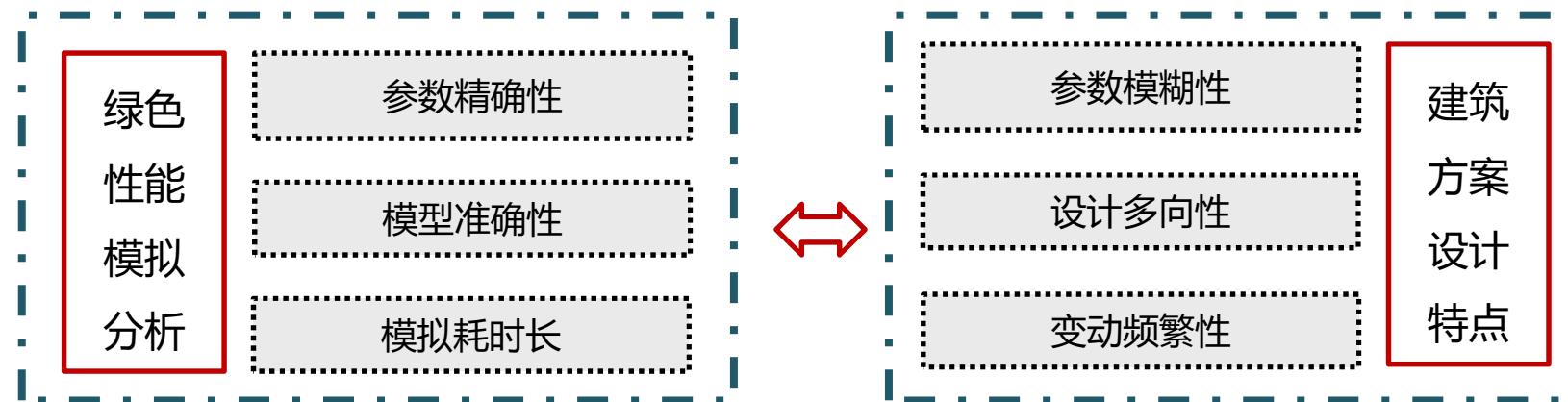
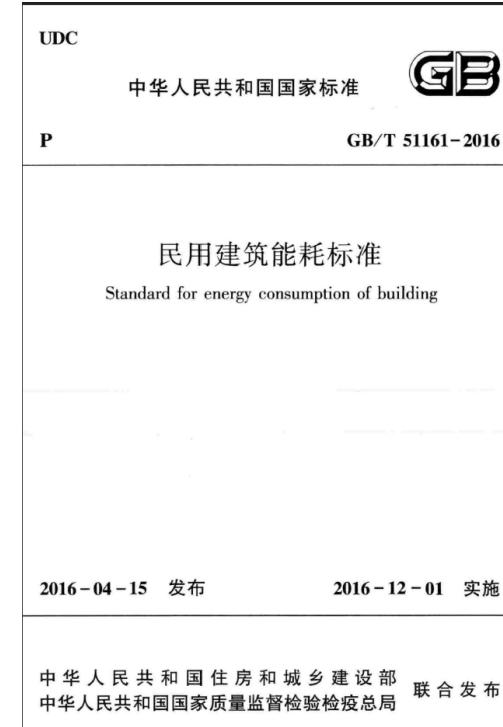
1. 资料来源：IEA ANNEX-30 Bringing Simulation to Application
2. 资料来源：比利时Pieter de Wilde的调查研究



方案阶段的性能分析需求与现状

建筑方案设计性能分析需求

- 绿色、节能已成为当下方案创作争相突出的亮点
- 民用建筑运行能耗管理标准的出台，设置能耗天花板
- 建筑体形、朝向、空间布局、窗墙比等因素与遮阳、采光、通风、能耗的关系较难准确把握
- 方案阶段对于绿色建筑性能分析的要求是“快速、准确、可视化，适应性强”





华建集团
ARCPLUS

方案阶段的性能分析需求与现状

建筑方案设计性能分析现状

- 建筑性能模拟主要集中在方案设计后期，且优化范围有限
- 建筑性能模拟工具繁多，大多不符合设计师的使用习惯，也未集成在建筑设计环境平台
- 不同建筑性能模拟分析，往往需要借助不同的模拟分析工具，与设计模型兼容性差、模型利用度低、建模分
析过程繁琐、周期长、反馈存在滞后等问题

BEST Directory
Building Energy Software Tools
Formerly hosted by US Dept. of Energy

Home FAQ Software Listing About Contact Sign In Register

Search

Software Listing
Total Listed Programs: 153 → 153

Capabilities

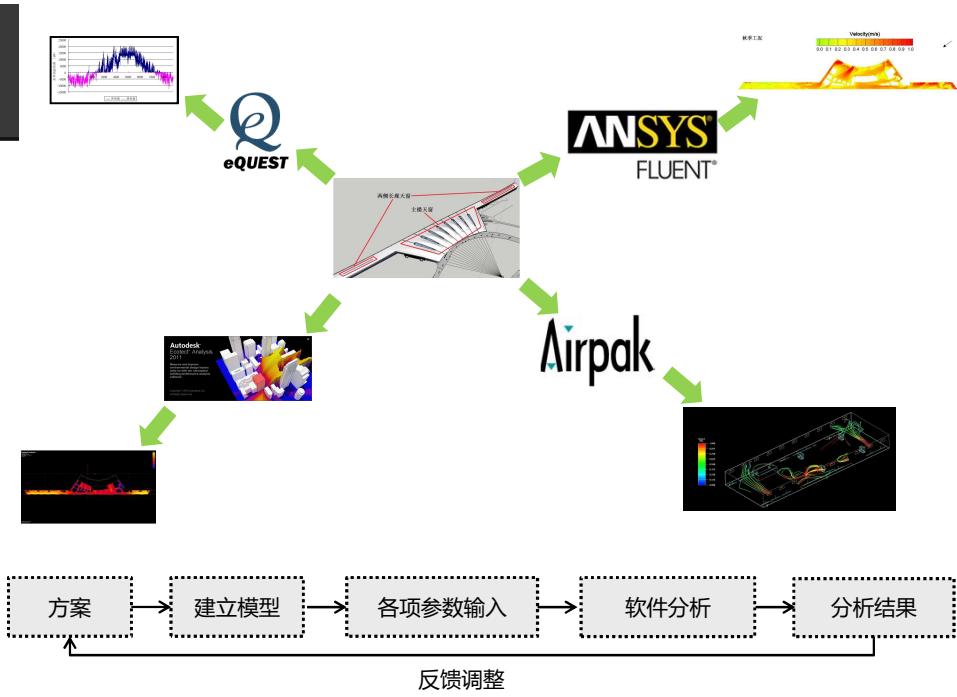
- Whole-building Energy Simulation
- Load Calculations
- HVAC System Selection and Sizing
- Parametric & Optimization
- Modal Input Calibration
- Energy Conservation Measures
- Codes Compliance
- Ratings and Certificates
- Utility Bill & Meter Data Analysis
- Weather Data & Climate Analysis
- Building Energy Auditing
- Building Energy Benchmarking
- Lighting Simulation
- Indoor Air Quality Simulation
- Life-Cycle Analysis
- Detailed Envelope Simulation
- Detailed Component Simulation
- Solar & Photovoltaic Analysis
- Electrical System Simulation
- Water Use Analysis
- Other

Platform: Any
Pricing: Any
Last Software Update: 2010
Language: Any
Sort by: Desc

AcousticCalc - HVAC Noise Prediction Program
HVAC Noise Source-Path-Receiver Acoustical Analysis program.
HVAC System Selection and Sizing | Parametrics & Optimization | Other
Last Software Update: 15 January 2016 | Last Entry Update: 01 June 2016
Ratings ★★★★☆ | Reviews 0 | Add to compare

Climate Consultant
Graphically analyzed EPW climate data in dozens of different ways of particular value to designers.
Weather Data & Climate Analysis
Last Software Update: 19 September 2015 | Last Entry Update: 16 December 2015
Ratings ★★★★☆ | Reviews 0 | Add to compare

QwickLoad Residential & Commercial HVAC Load Calculations
QuickLoad Residential & Commercial HVAC Load Calculations for up to 500 Zones!
Whole-building Energy Simulation | Load Calculations | HVAC System Selection and Sizing
Last Software Update: 15 January 2016 | Last Entry Update: 01 June 2016
Ratings ★★★★☆ | Reviews 0 | Add to compare



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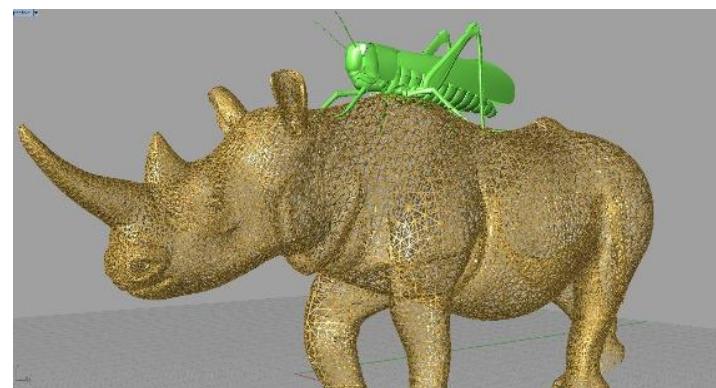
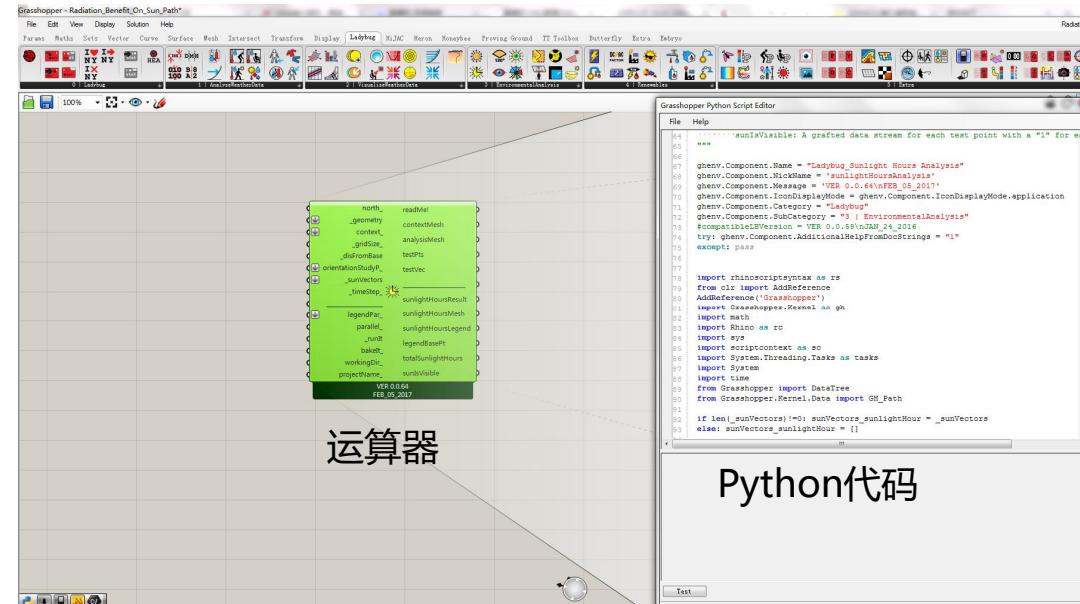
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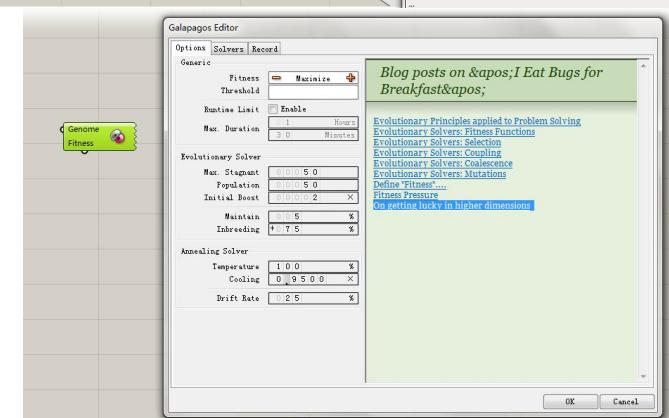
Grasshopper插件介绍

Grasshopper绿色建筑性能化分析的优势

- 大幅度缩短模拟时间，给建筑师更多的思考空间
- 符合建筑师的使用习惯
- 简化建模过程，模型利用度高
- 保留设计和分析逻辑
- 实现计算结果的优化选择
- 可视化效果更佳



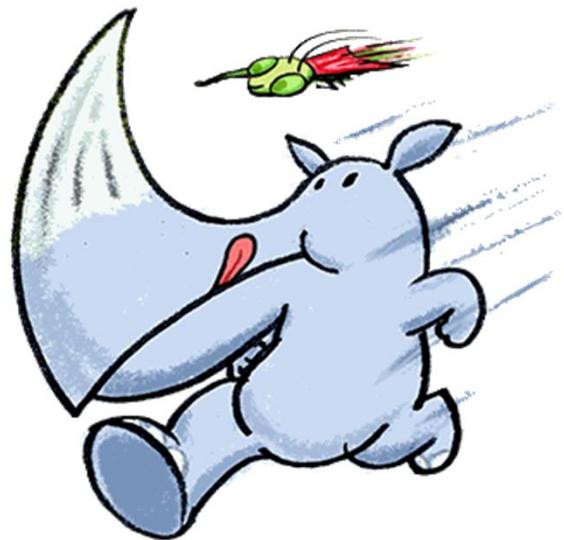
Rhino+GH



优化算法运算器Galapagos

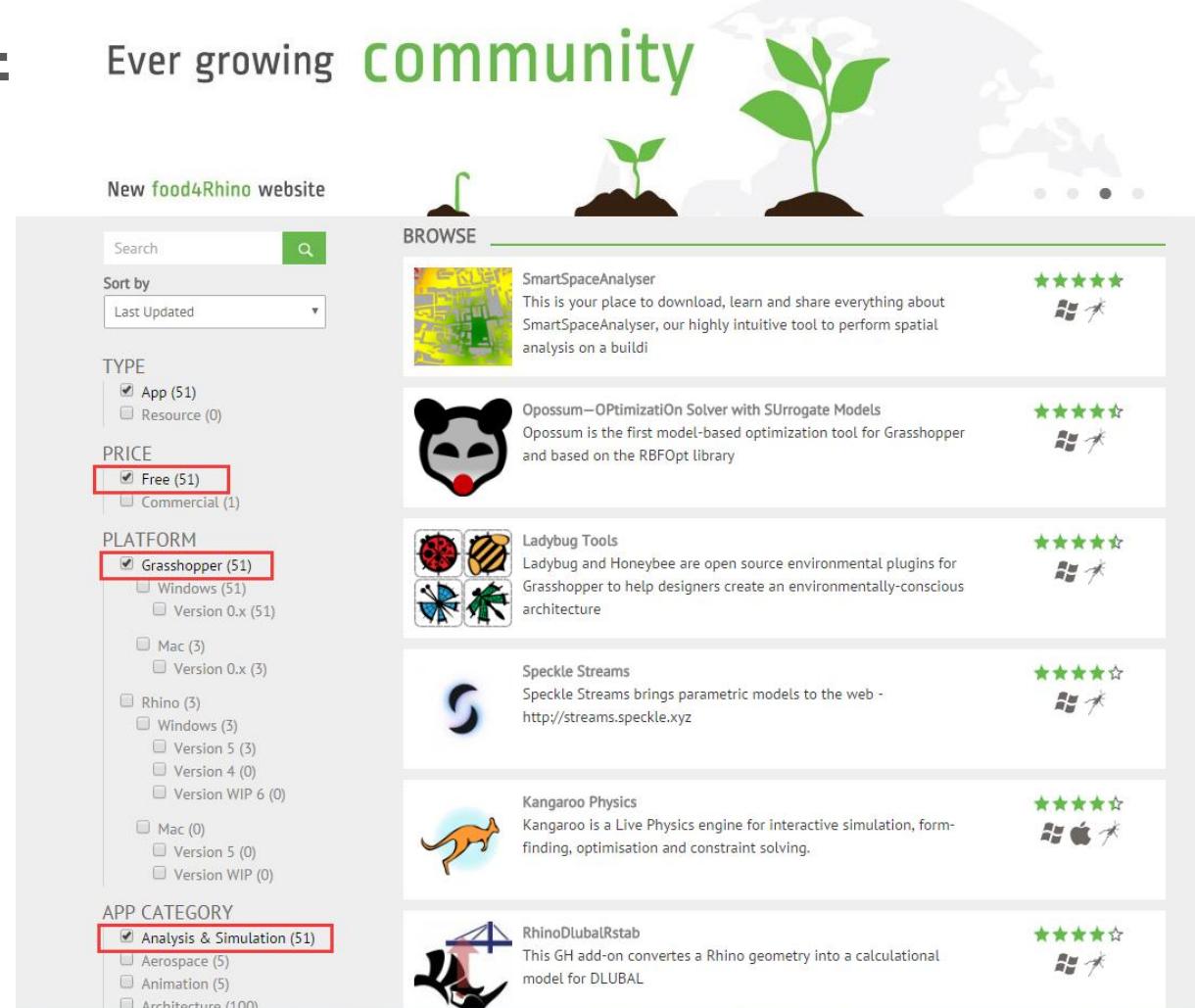
Grasshopper插件介绍

Grasshopper分析插件



<http://www.food4rhino.com/>

Ever growing **community**



New food4Rhino website

Search

Sort by

TYPE
 App (51) Resource (0)

PRICE
 Free (51) Commercial (1)

PLATFORM
 Grasshopper (51)
 Windows (51) Version 0.x (51)
 Mac (3) Version 0.x (3)
 Rhino (3) Windows (3)
 Version 5 (3) Version 4 (0)
 Version WIP 6 (0)
 Mac (0) Version 5 (0)
 Version WIP (0)

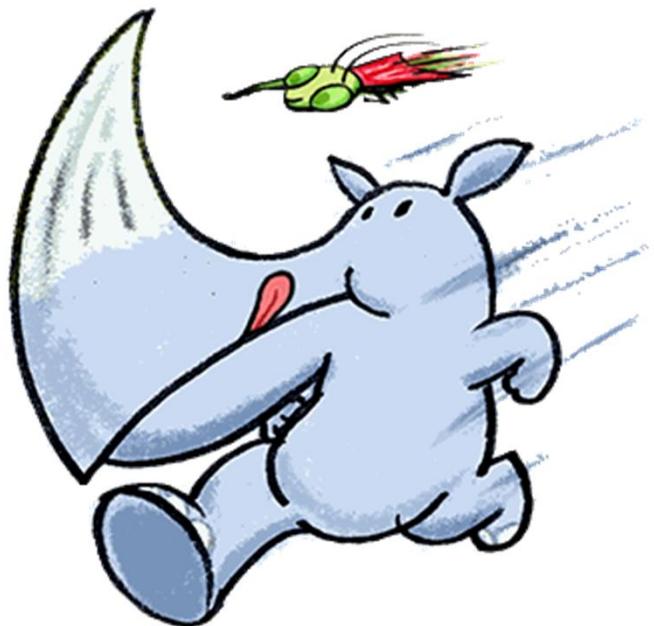
APP CATEGORY
 Analysis & Simulation (51)
 Aerospace (5)
 Animation (5)
 Architecture (100)

BROWSE

Plugin	Description	Rating	Compatibility
SmartSpaceAnalyser	This is your place to download, learn and share everything about SmartSpaceAnalyser, our highly intuitive tool to perform spatial analysis on a buildi	★★★★★	Windows, Mac
Opossum—OPtimizatiOn Solver with SURrogate Models	Opossum is the first model-based optimization tool for Grasshopper and based on the RBFOpt library	★★★★★	Windows, Mac
Ladybug Tools	Ladybug and Honeybee are open source environmental plugins for Grasshopper to help designers create an environmentally-conscious architecture	★★★★★	Windows, Mac
Speckle Streams	Speckle Streams brings parametric models to the web - http://streams.speckle.xyz	★★★★★	Windows
Kangaroo Physics	Kangaroo is a Live Physics engine for interactive simulation, form-finding, optimisation and constraint solving.	★★★★★	Windows, Mac
RhinoDlubalRstab	This GH add-on converts a Rhino geometry into a calculational model for DLUBAL	★★★★★	Windows

Grasshopper插件介绍

Grasshopper插件下载量



LADYBUG TOOLS (by Mostapha Sadeghipour Roudasri)



Ladybug allows you to import and analyze standard weather data in Grasshopper; draw diagrams like Sun-path, wind-rose, radiation-rose, etc; customize the diagrams in several ways; run radiation analysis, shadow studies, and view analysis.

Honeybee connects Grasshopper3D to validated simulation engines such as EnergyPlus, Radiance, Daysim and OpenStudio for building energy, comfort, daylighting and lighting simulation.

Licensed under @license GPL-3.0+: (<http://spdx.org/licenses/GPL-3.0+>) Read more here about the license.

[Download](#)



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72668

[Website](#)

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DIVA-FOR-RHINO (by klagios)



DIVA-for-Rhino is a highly optimized daylighting and energy modeling plug-in for Rhino and Grasshopper. The plug-in was initially developed at the Graduate School of Design at Harvard University and is now distributed and developed by Solemma LLC. DIVA-for-Rhino allows users to carry out a series of environmental performance evaluations of individual buildings and urban landscapes.

DIVA includes these simulations:

- Radiation Maps
- Photorealistic Renderings including HDR file formats
- Point-in-Time Illuminance
- Daylight Autonomy
- Continuous Daylight Autonomy

[Download](#)



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GECO (by uto)



Ecotect is a highly visual software for architects to work with environmental performance issues. It is designed for early stages of conceptual design, and encourages play to understand environmental factors and interactions.

So making use of Grasshopper [uto] developed a new interface named **GECO**, which offers a direct link between Rhino/Grasshopper models and Ecotect. The Plug-in allows you to export complex geometries very quickly, evaluate your design in Ecotect and access the performances data, to import the results as feedback to Grasshopper. This could be done as single process or loop to improve performance and the design of a building in the context of its environment. The single results of the process could be saved inside Rhino in the vertices of the analysis mesh to store data for later use inside different design approaches.

If you encounter any problems or you need help, join our discussion now:

To install:

[Download](#)



Downloads:

31538

[Website](#)

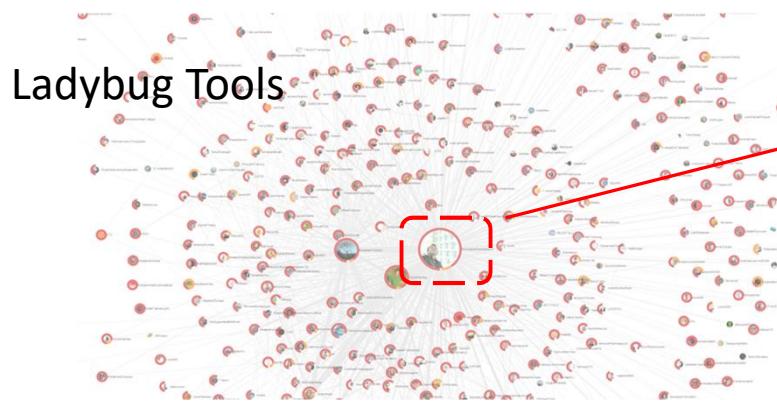
[Support Email](#)

[Support Forum](#)

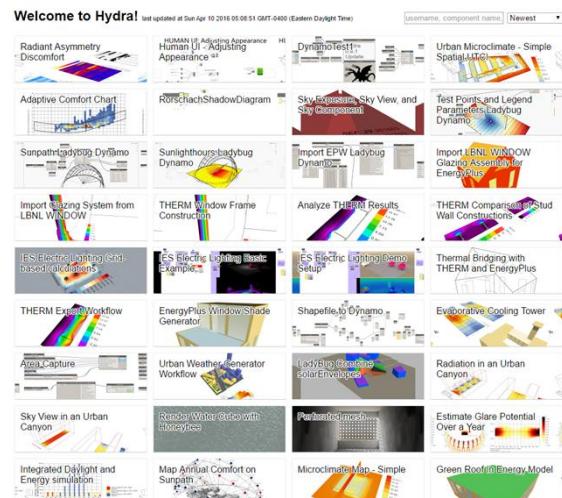
[License](#)

Grasshopper插件介绍

开发团队及相关网址



Ladybug Tools



<http://hydrashare.github.io/hydra/>

Mostapha Sadeghipour Roudsari's Page

Mostapha Sadeghipour Roudsari's Photos

Grasshopper

ALGORITHMIC MODELING FOR RHINO

Home View Get Learn Talk Attend My Page

Welcome to Grasshopper

Start Here:

Download and install Grasshopper... There are many resources available to learn more about Grasshopper.

Introduction to Grasshopper Videos by David Rutten.

Rhino WIP for Windows now available

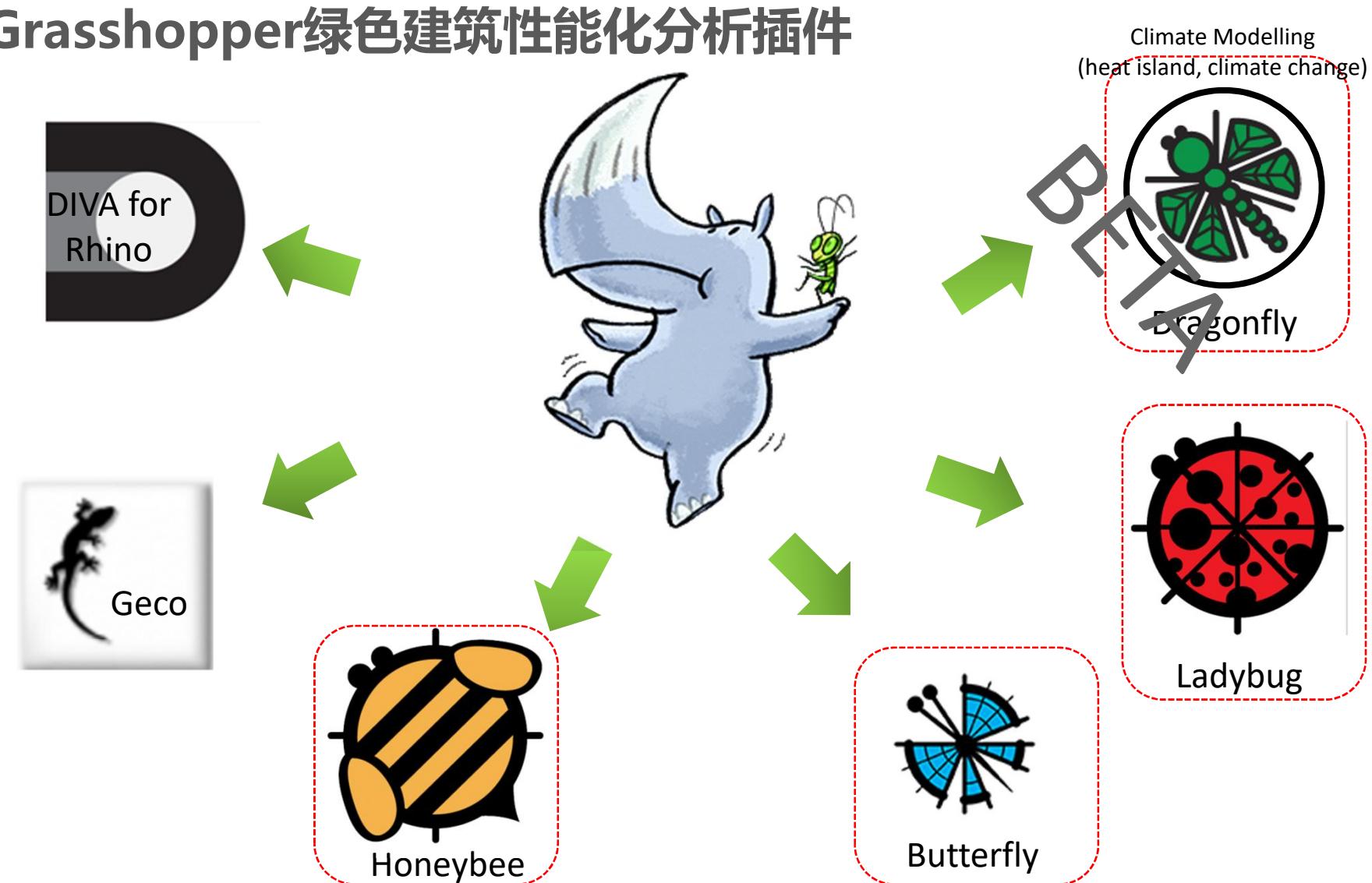
Rhino 5 for Windows users are invited to Serengeti, where Rhino is developed. We are inviting current users to try, test, and provide feedback on the work-in-progress (WIP) release while it is still in development.

You will need:

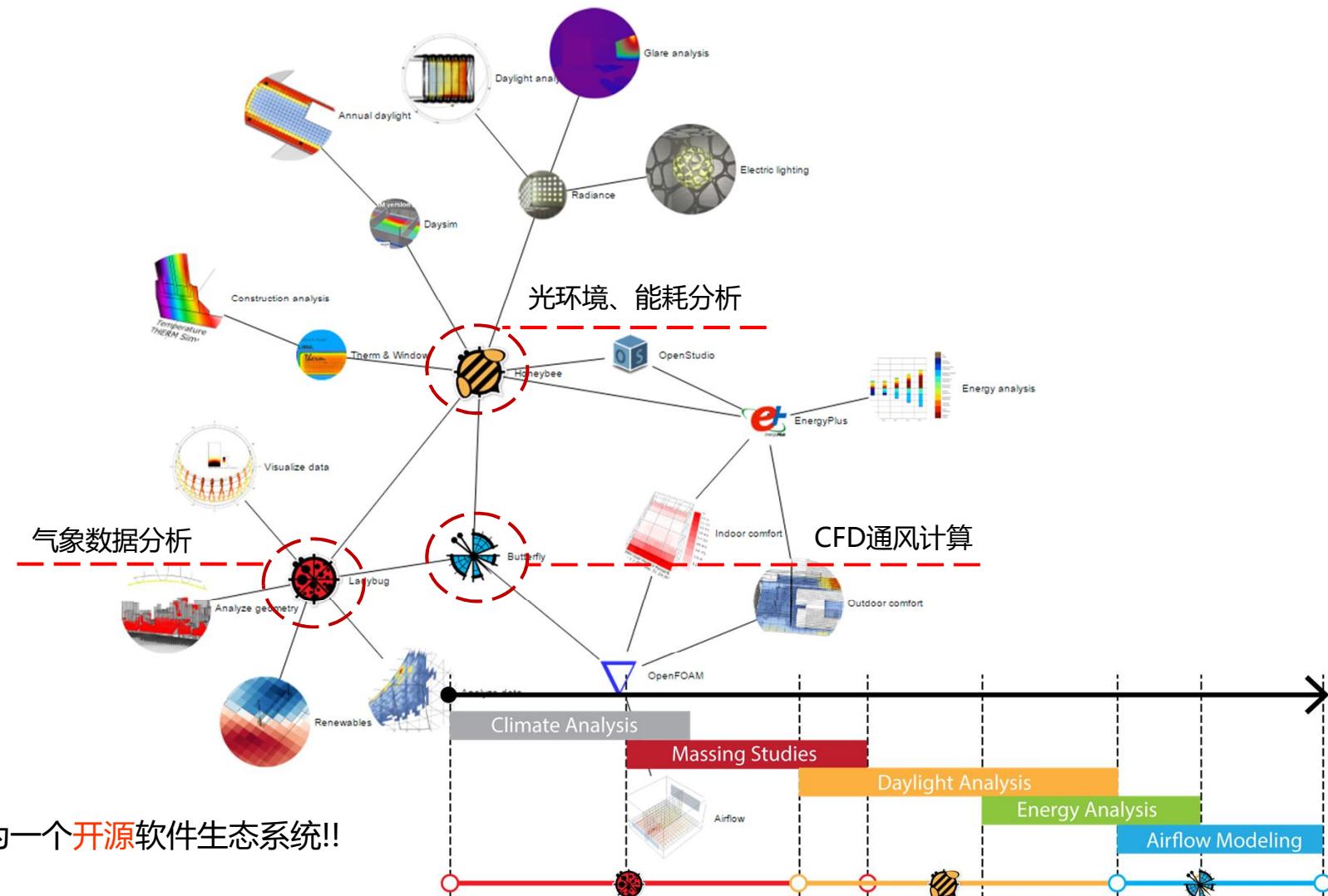
- 64-bit Windows 7 or above
- Your Rhino 5 for Windows license key. You can find it [here](#).

<http://www.grasshopper3d.com>

Grasshopper绿色建筑性能化分析插件

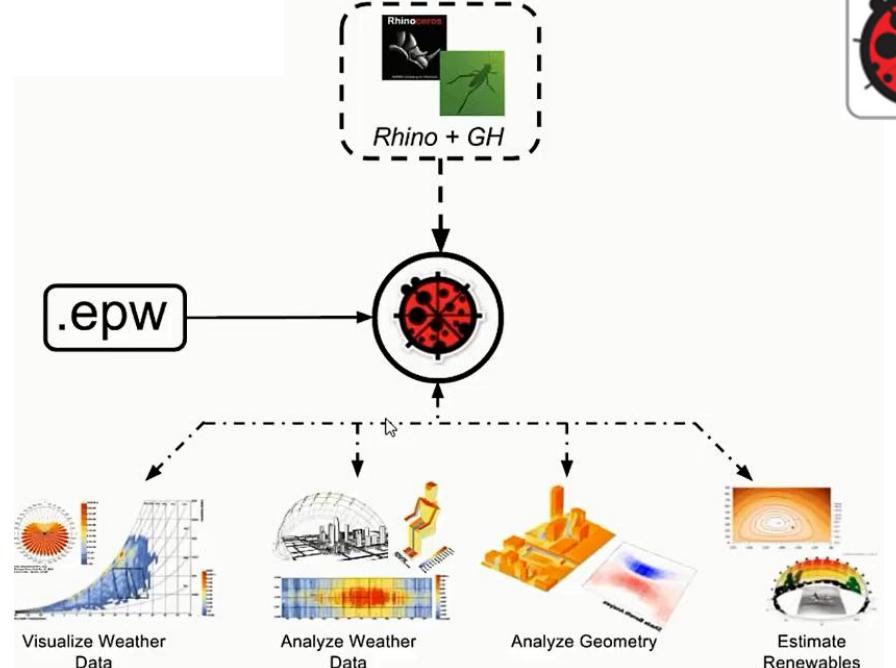


Grasshopper绿色建筑性能化分析插件



什么是Ladybug?

- Ladybug是一款Grasshopper的环境分析插件，可以帮助设计师在建筑方案初期，完成气象参数分析，包括气象参数可视化、太阳路径、风玫瑰，遮阳分析、室内PMV计算、室外舒适性指标UTCI计算、运行辐射分析、阴影分析等。

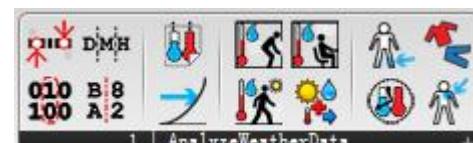


Ladybug特点

- 使得建筑环境分析过程变得更简单和快速
- 将环境分析整合到方案设计过程
- 满足方案设计过程中个性化的可视化展示
- 采用GHPython编程，开源



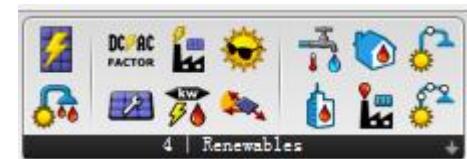
气象参数读取



气象参数分析



气象参数可视化



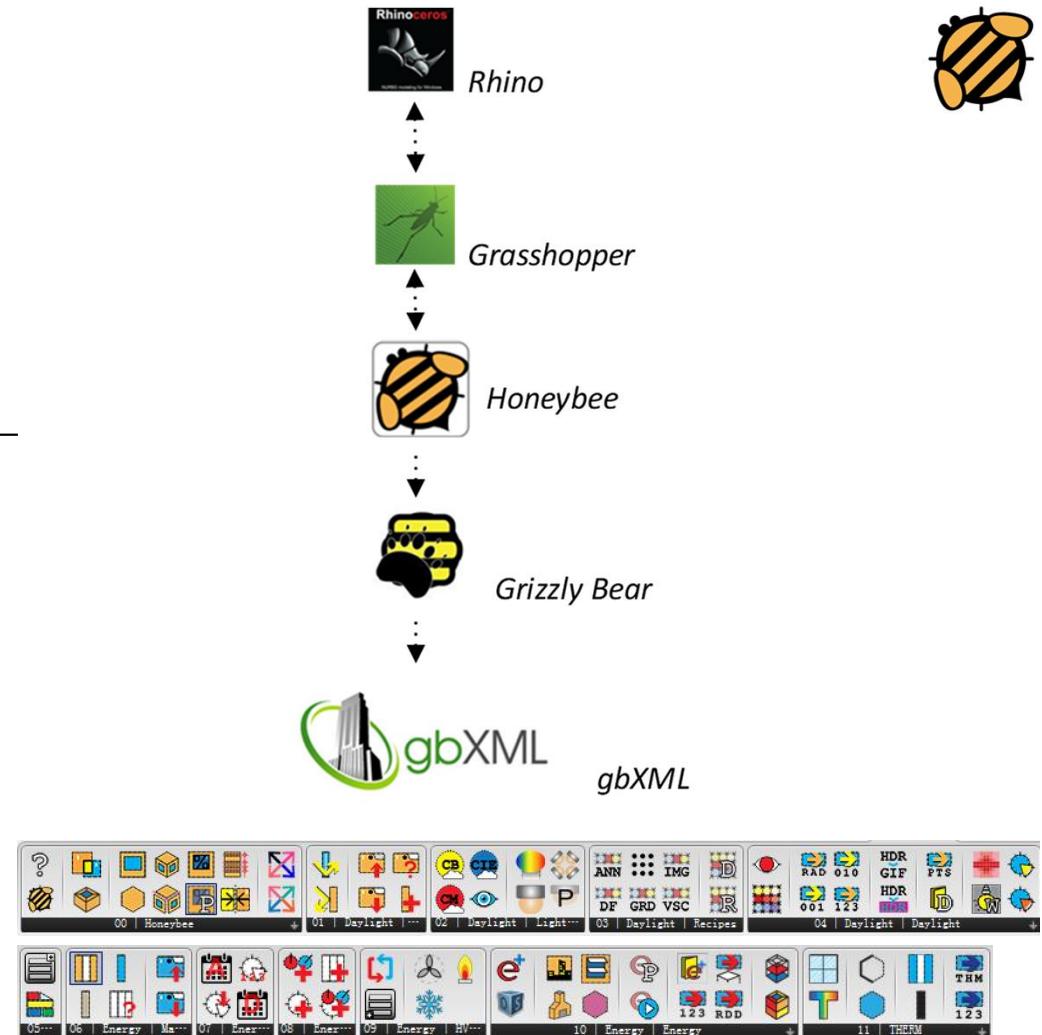
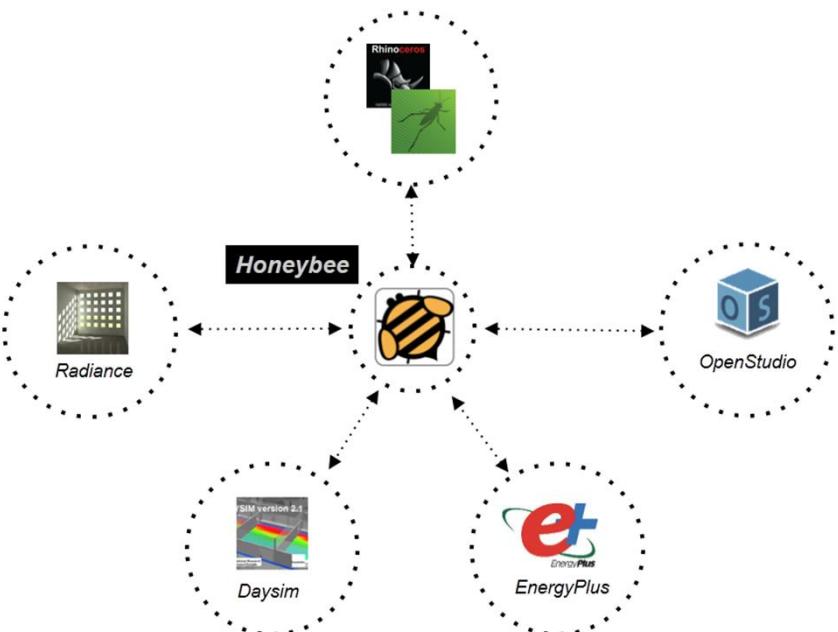
可再生能源评估

Ladybug运算器



什么是Honeybee?

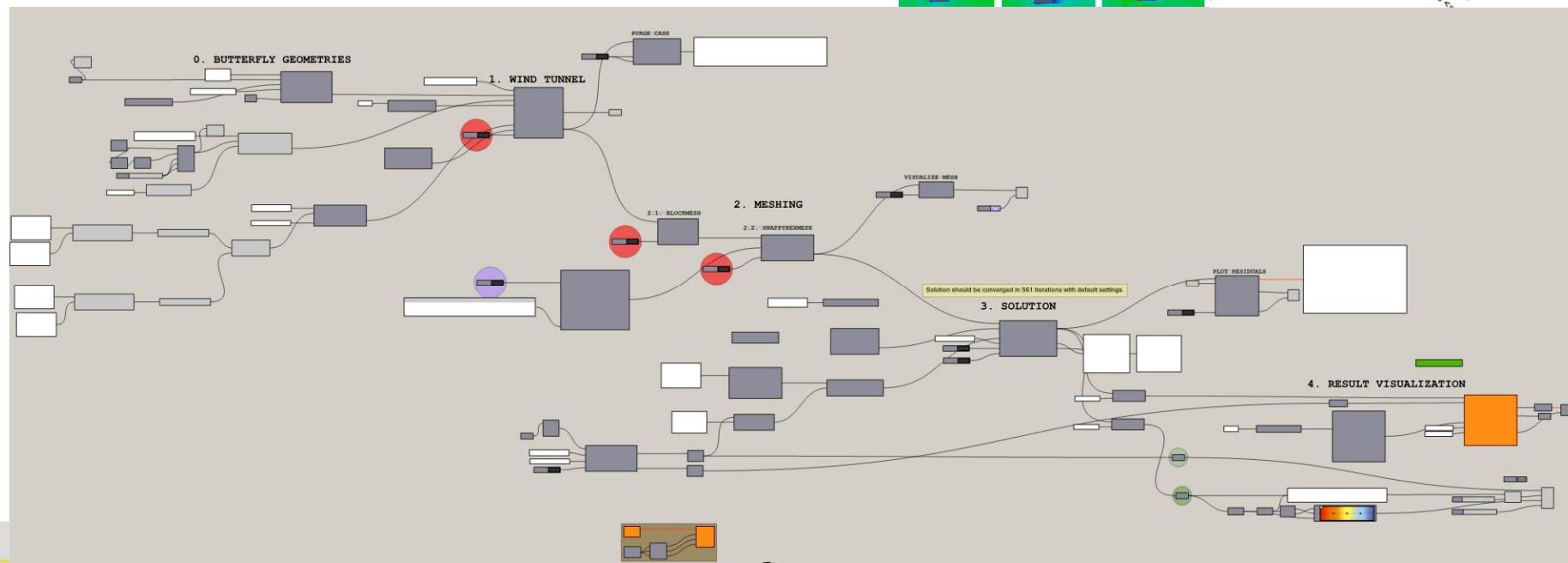
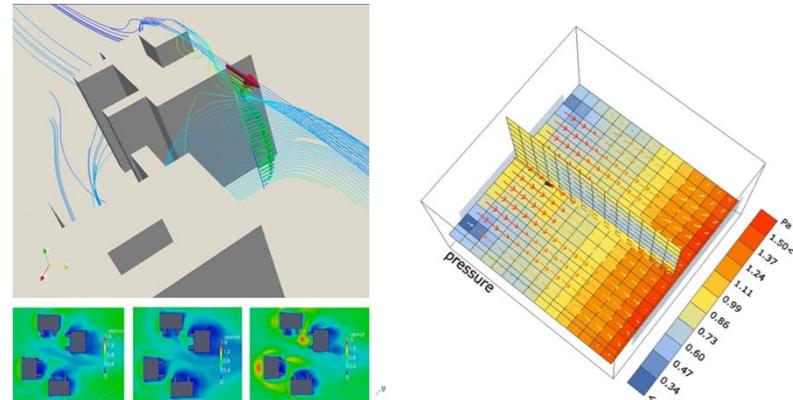
- Honeybee连接Grasshopper模型和仿真引擎，可以采用参数化的方式调用这些模拟分析工具引擎,进行建筑能耗及采光模拟。Honeybee可以通过参数化的方式设置系统类型、分区方案、运行时间表、日光感应器的布置和控制等。



Honeybee运算器

什么是Butterfly?

- Butterfly = Grasshopper + OpenFoam
- Butterfly是一个用Python编写的GH插件，用来生成OpenFOAM的执行文件



Butterfly 0.0.04
2017-Mar-19

First public release of Butterfly. Download the zip file. Unzip the file and open and run the installer.gh. You need to install OpenFOAM to use butterfly. Follow the installation instruction here: <https://github.com/ladybug-tools/butterfly/wiki>

Log in

Free Installer

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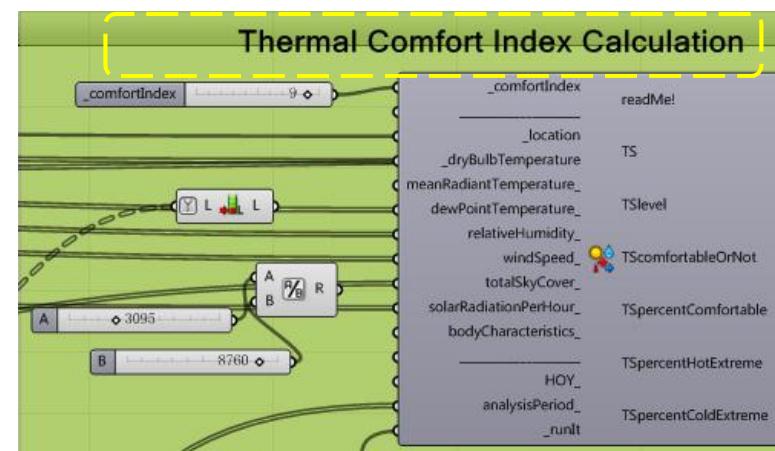
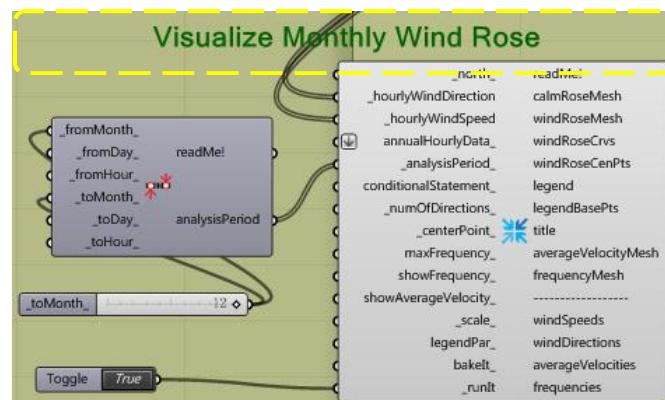
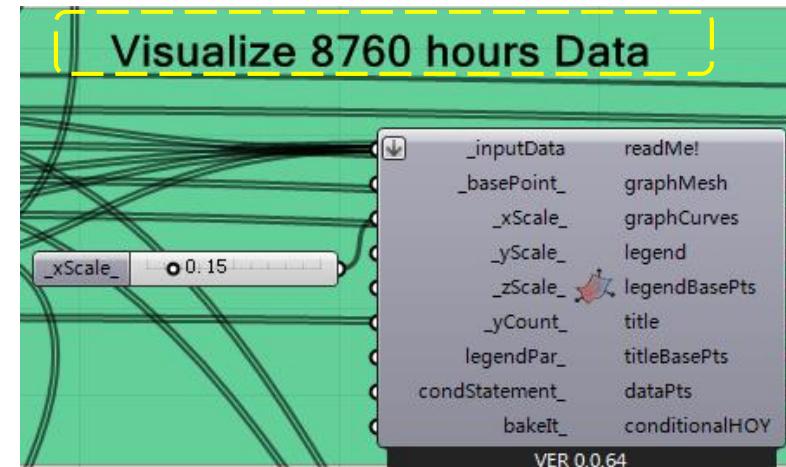
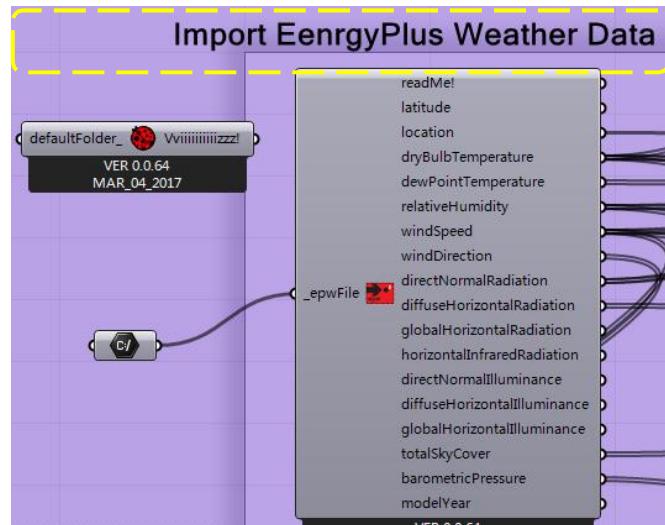
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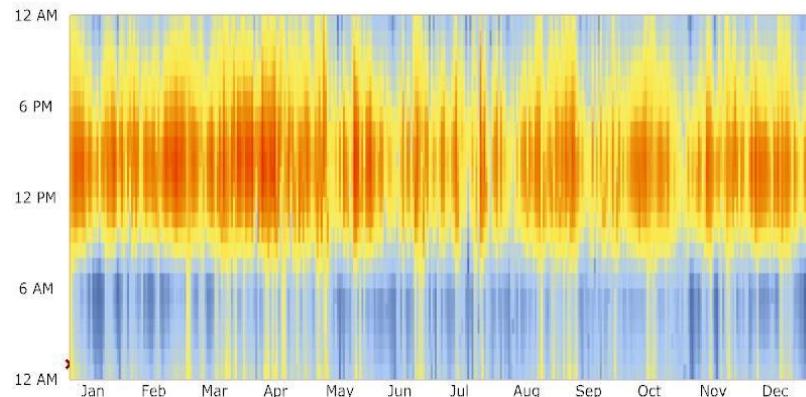
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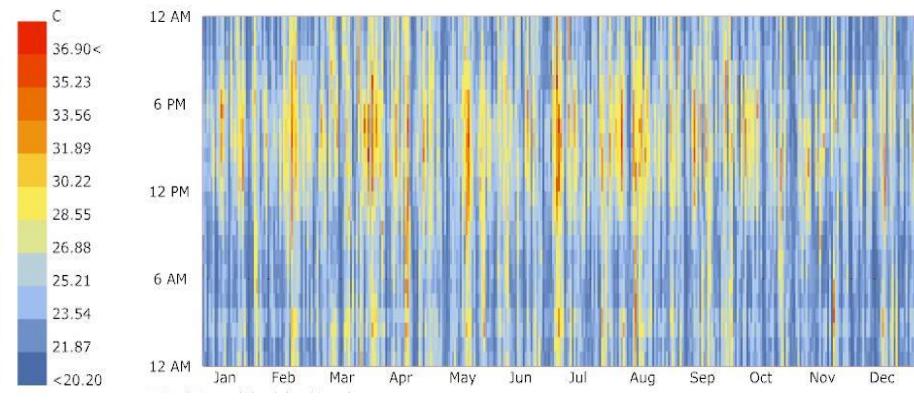
Ladybug气象数据分析



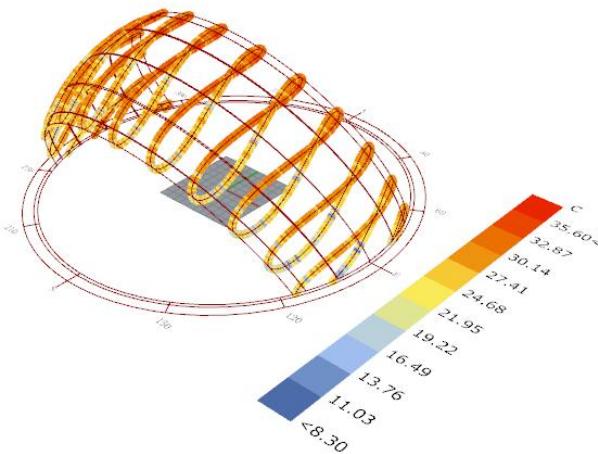
Ladybug可视化气象数据



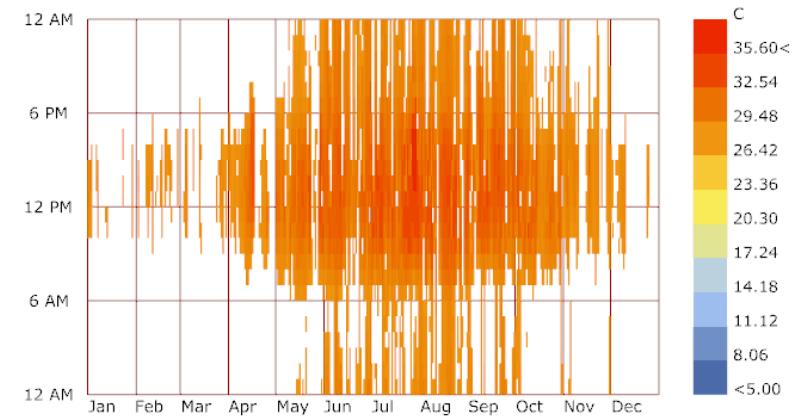
全年干球温度分布



全年风速分布



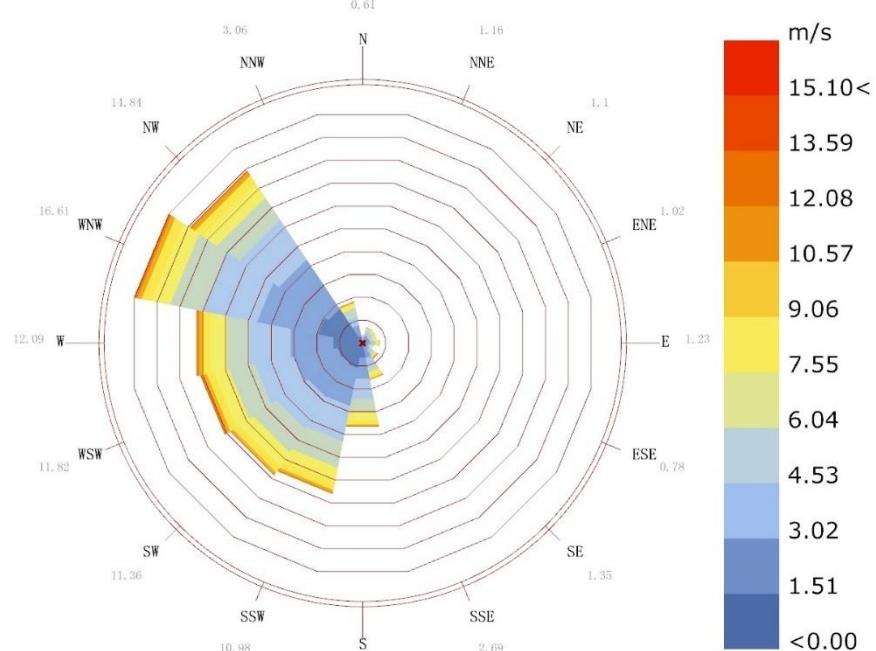
全年干球温度和太阳轨迹结合显示



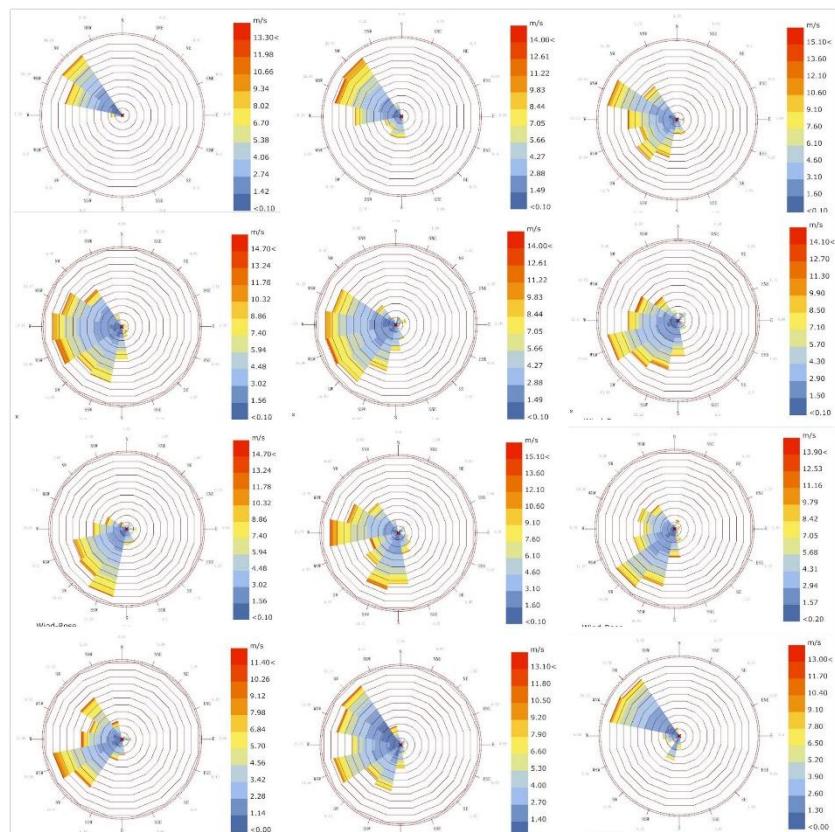
气象数据筛选

Ladybug气象数据分析

全年风玫瑰图



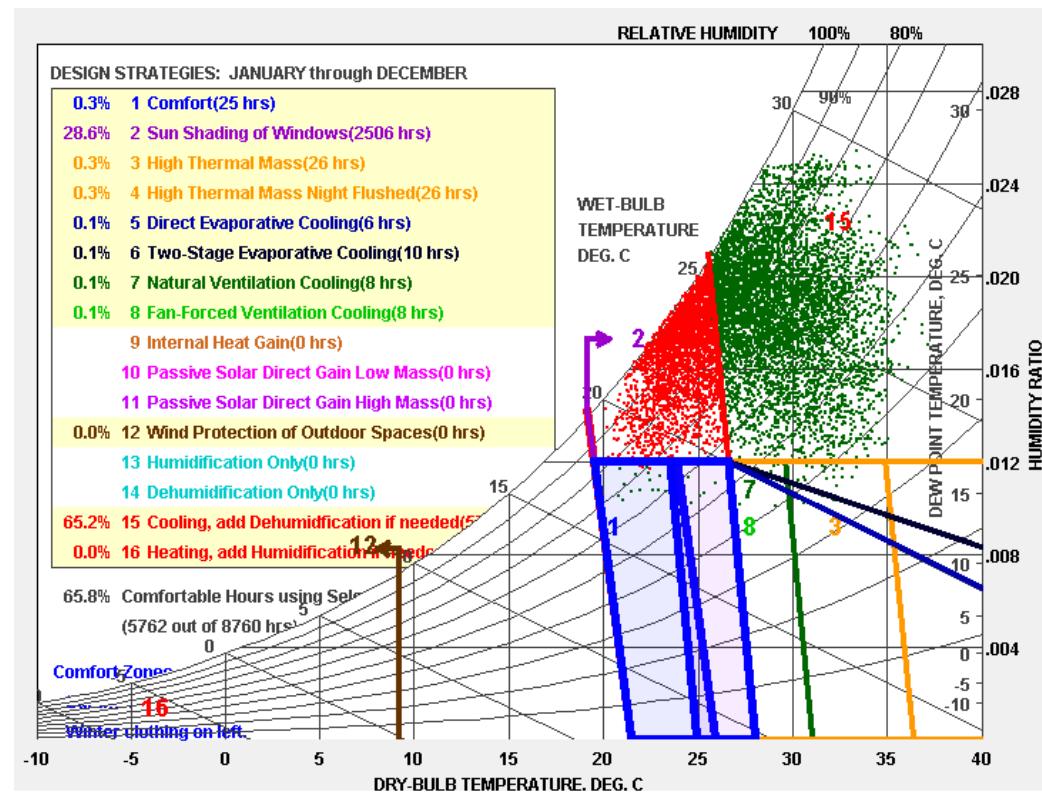
逐月风玫瑰图



Ladybug气象数据分析

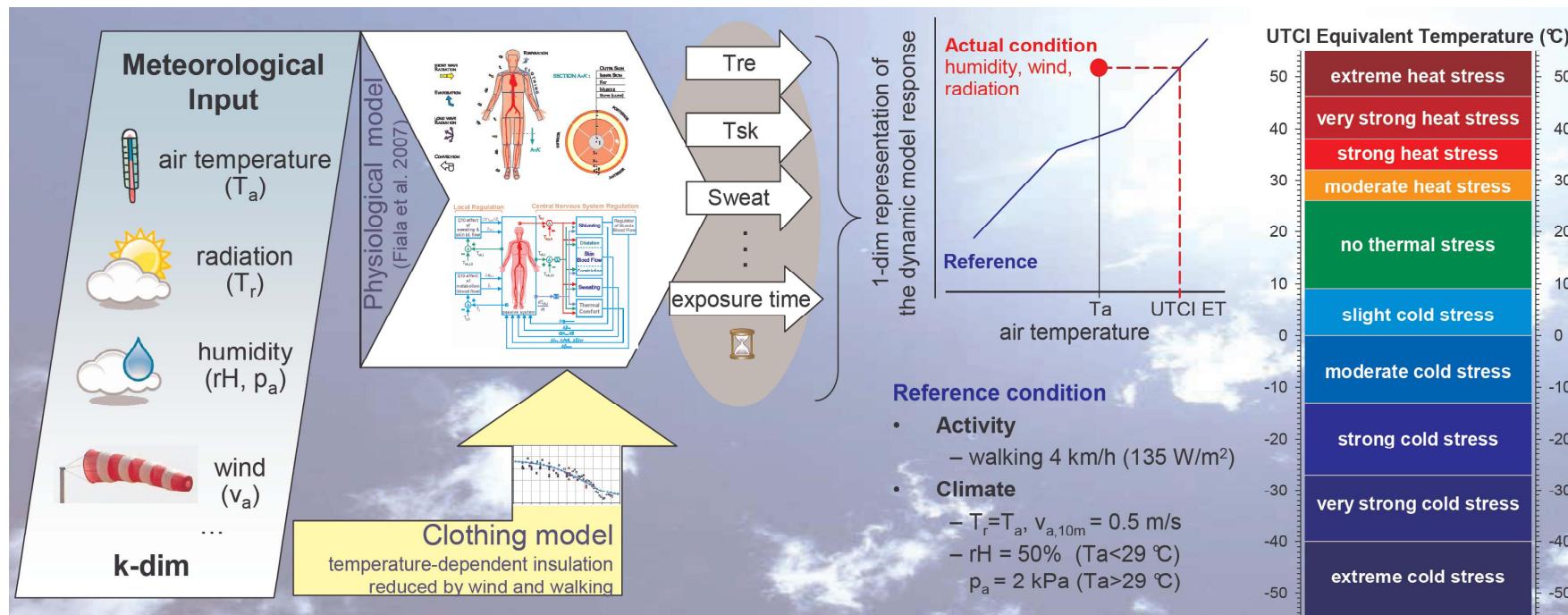
- 0.3% -舒适
- 28.6%-外窗遮阳
- 0.1%-自然通风
- 0.1%-直接蒸发冷却
- 65.2%-需要降温和除湿

焓湿图



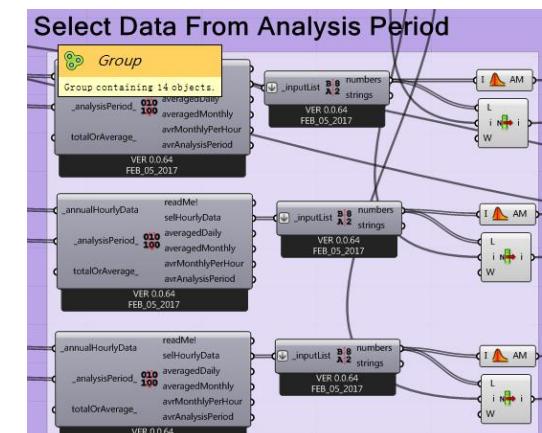
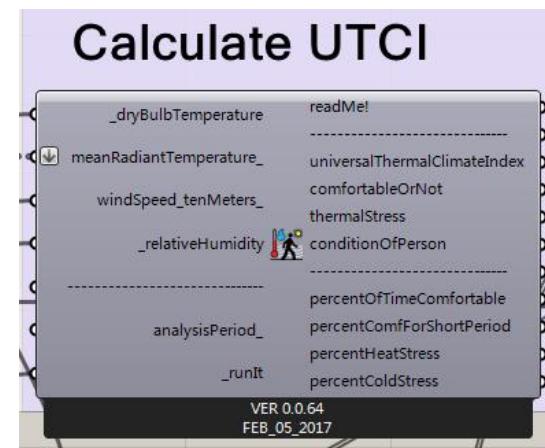
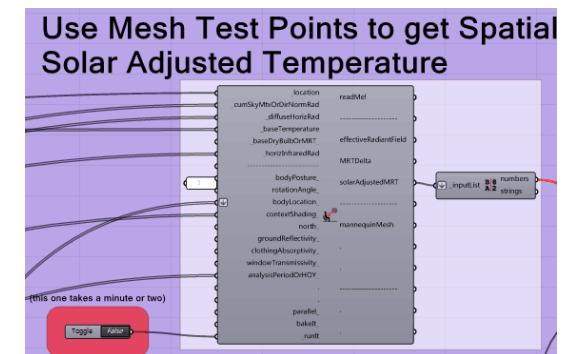
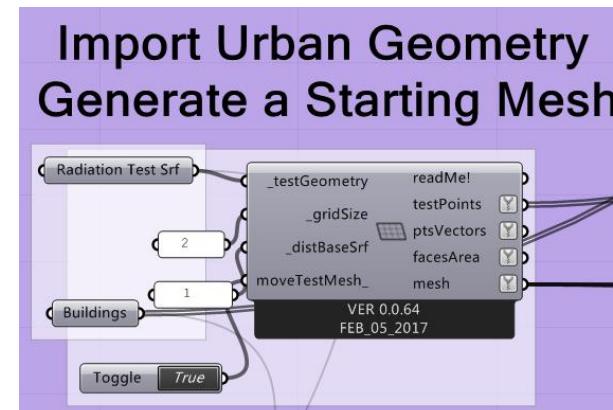
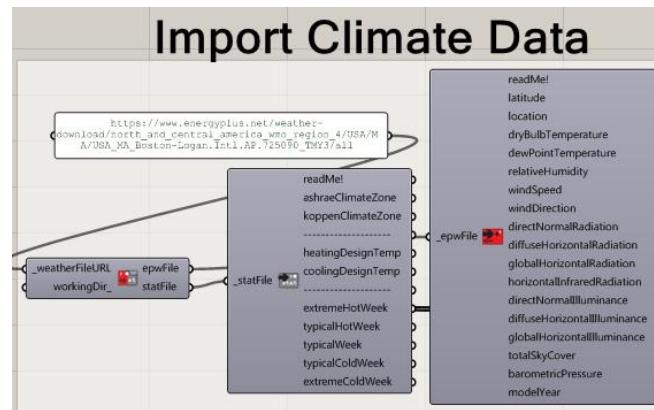
Ladybug室外热舒适指标UTCI计算

- 国际通用的热舒适评价指数UTCI：选择Fiala 的多节点人类生理和热舒适模型作为基础模型，可详细地描述人体与外界环境的热交换，适用于不同气候、不同季节，不同纬度地区



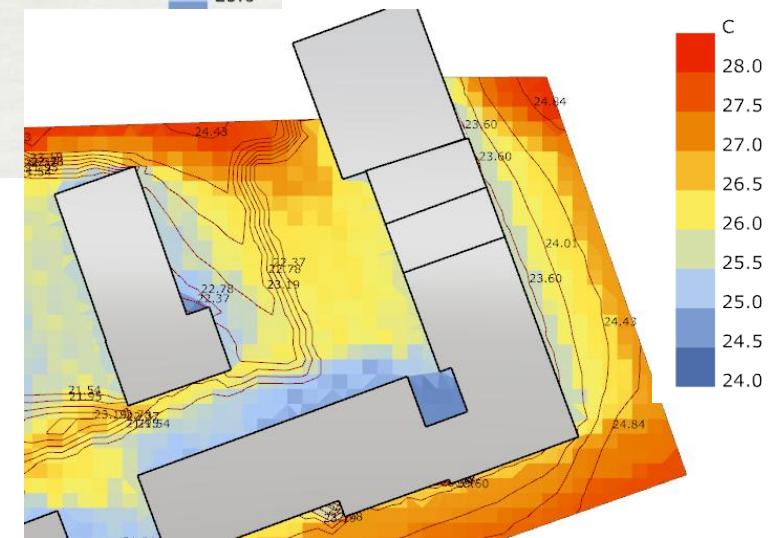
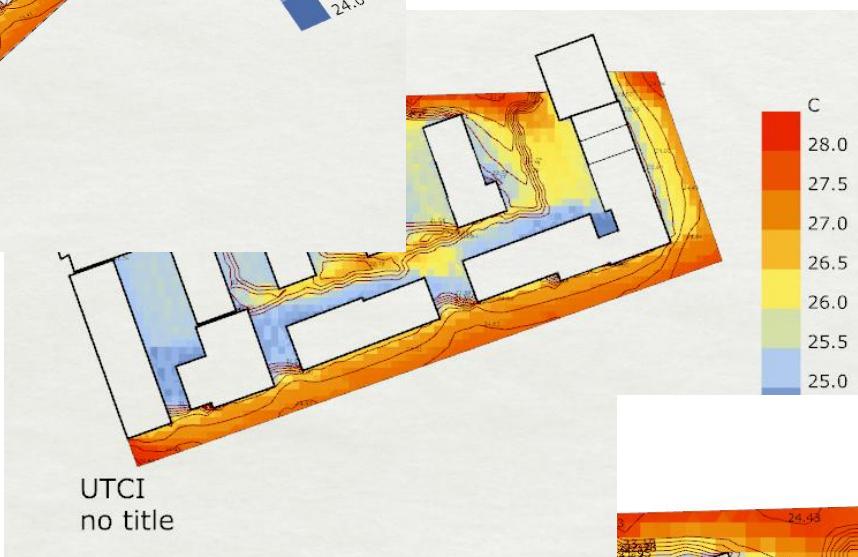
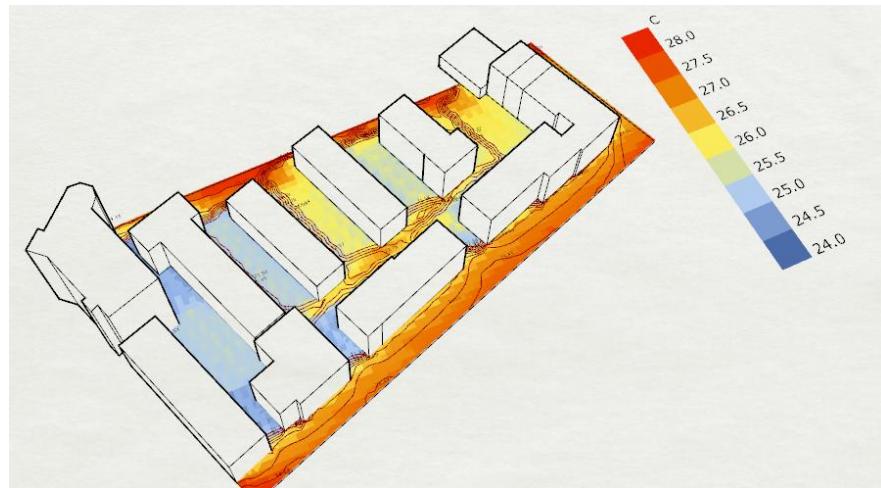
案例实践

Ladybug室外热舒适指标UTCI计算

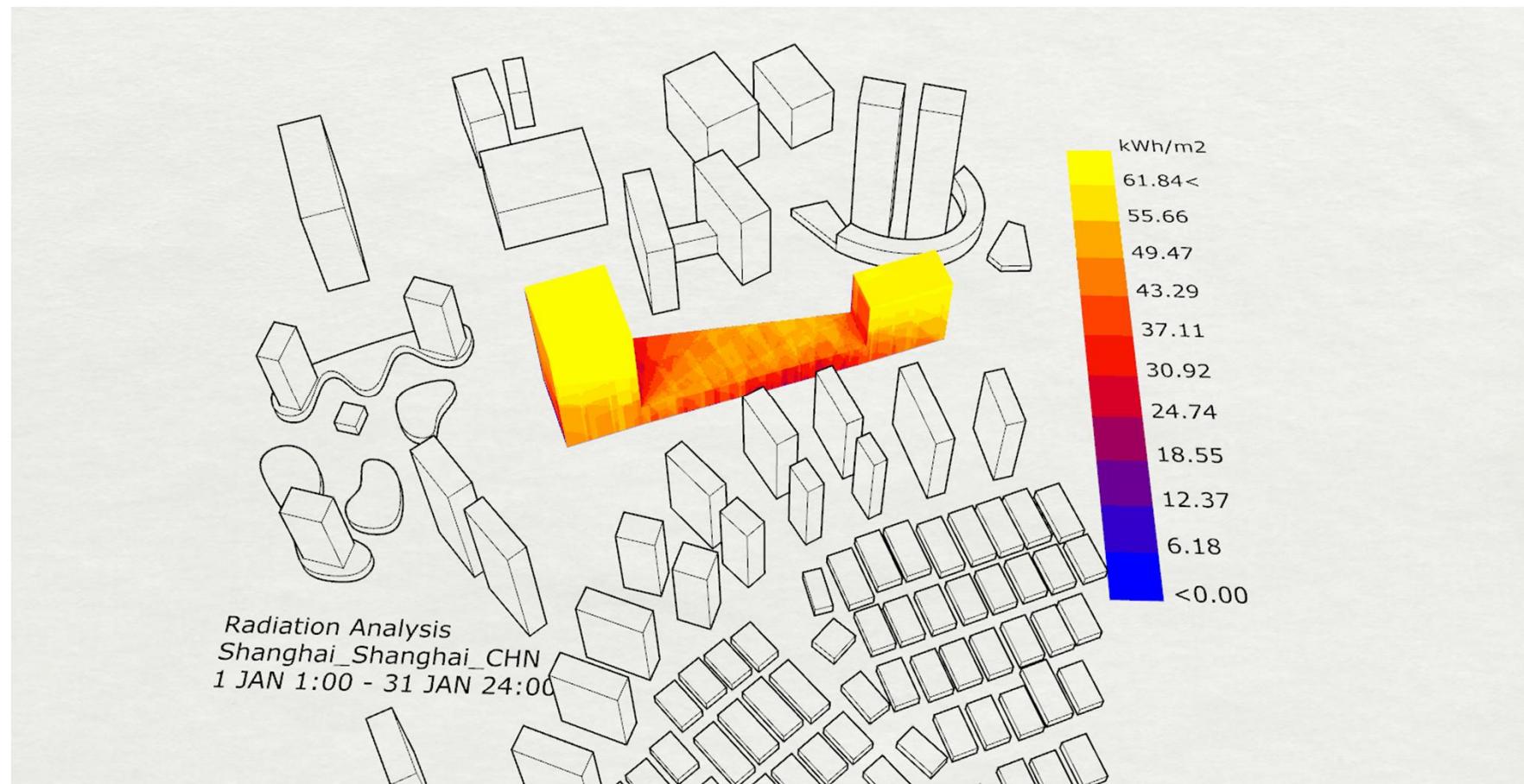




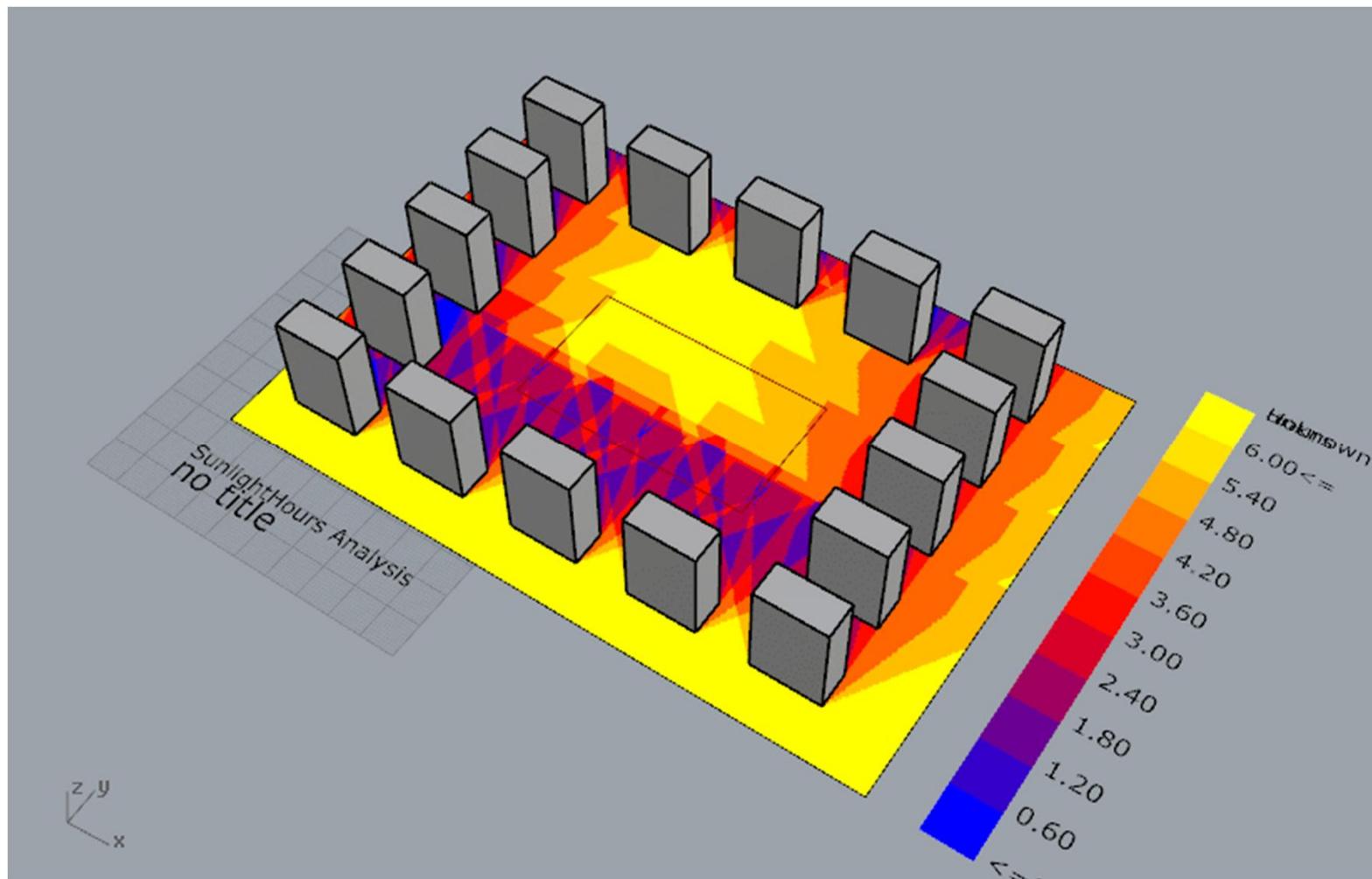
案例实践



辐射分析



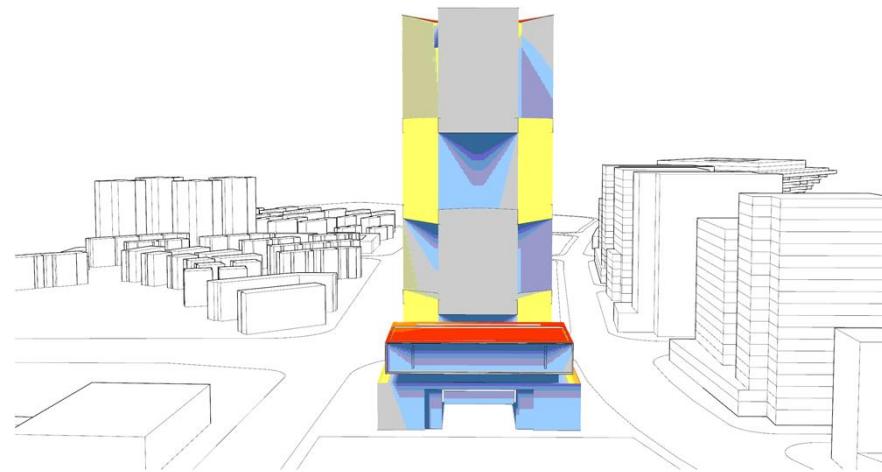
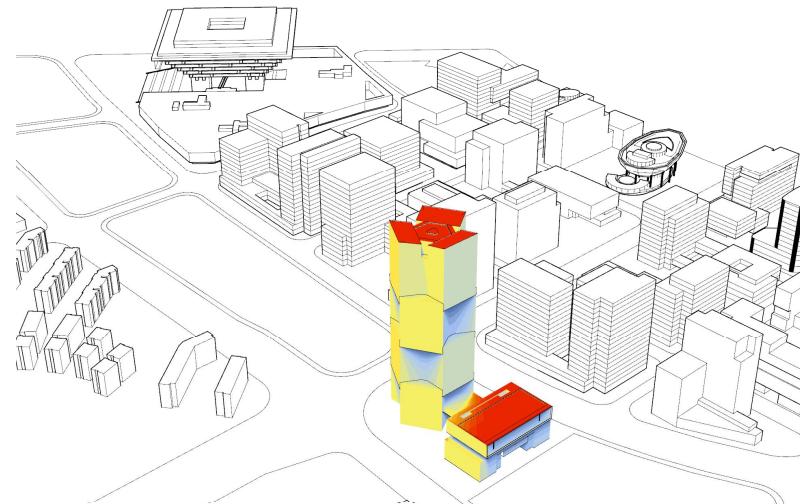
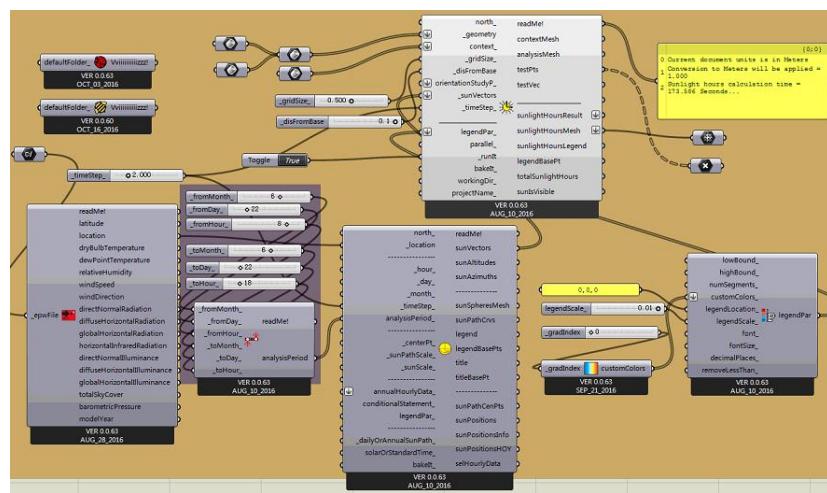
日照分析





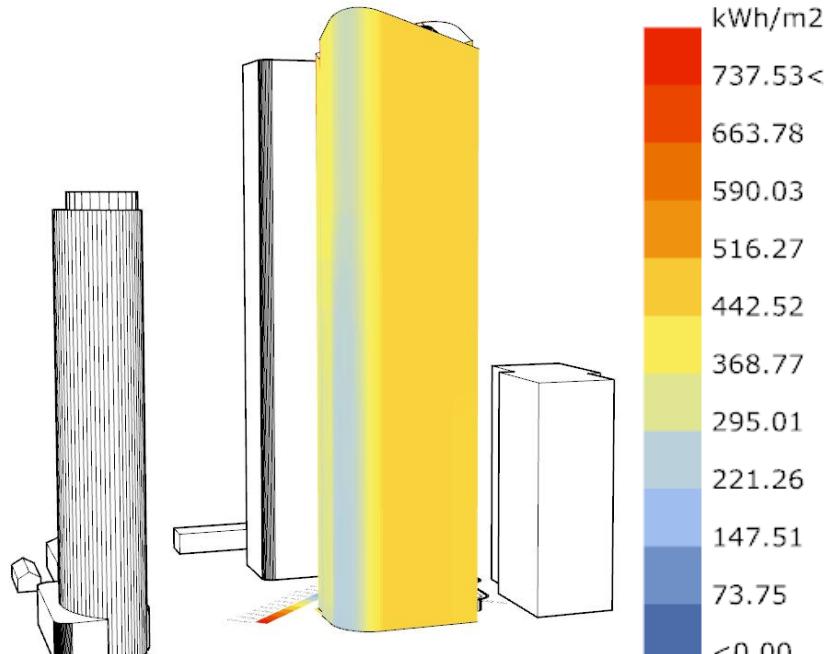
案例实践

某办公楼方案分析

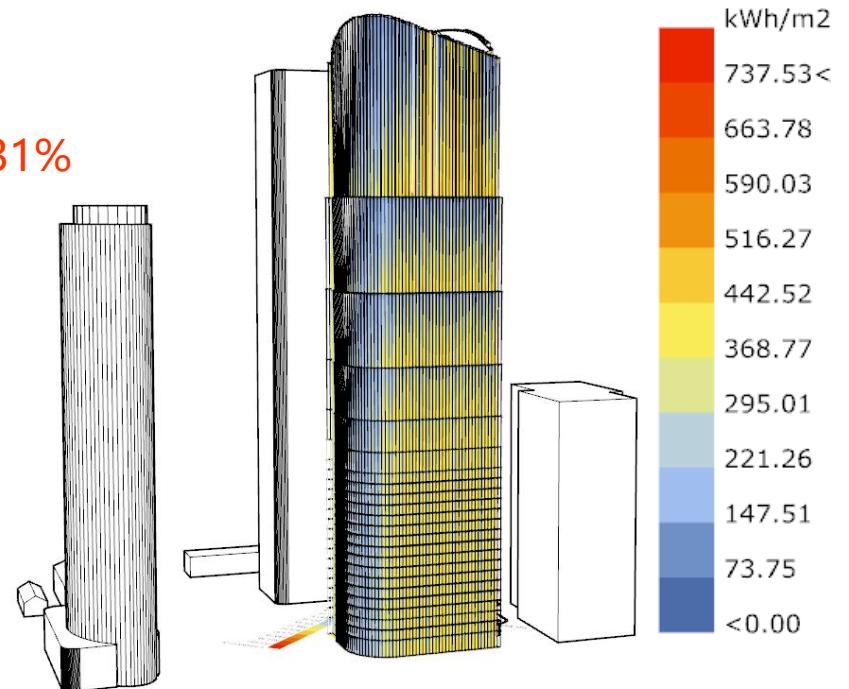


某方案遮阳优化分析

No Shading Panel 无遮阳板



With Shading Panel 有遮阳板



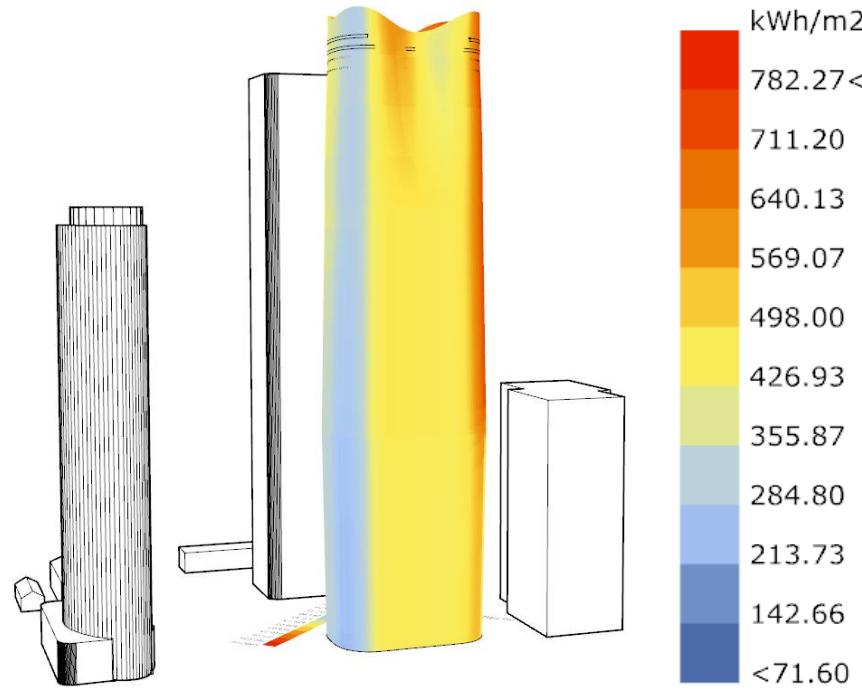
Annual Average Solar Radiation: 373.77kWh/m²

Annual Average Solar Radiation: 284.65kWh/m²

31.31%

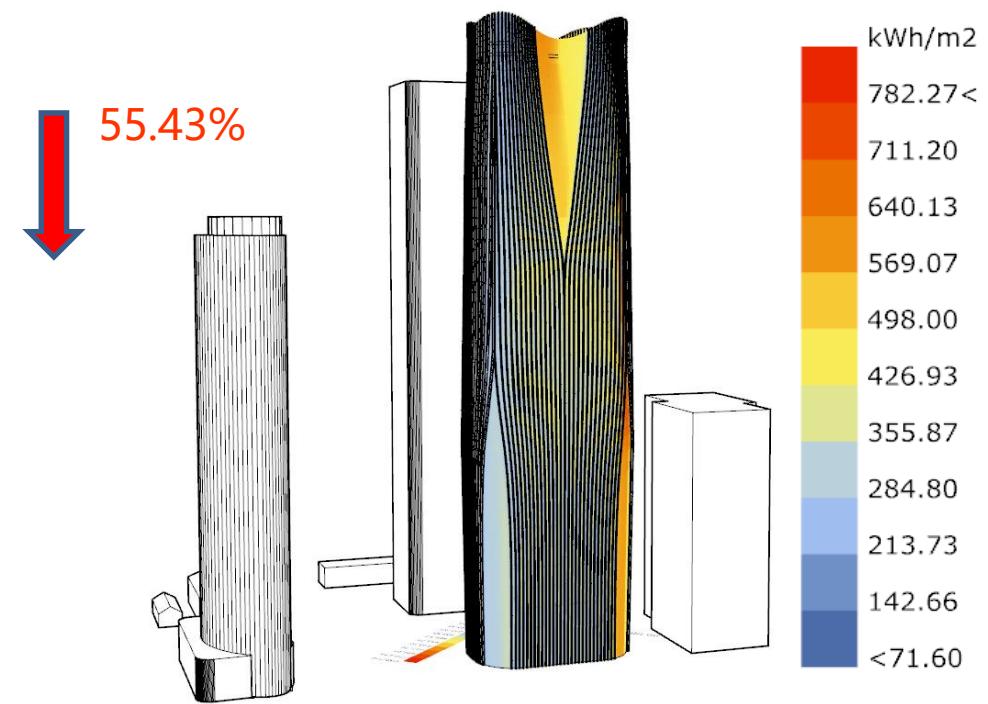
某方案遮阳优化分析

No Shading Panel 无遮阳板



Annual Average Solar Radiation: 373.77kWh/m²

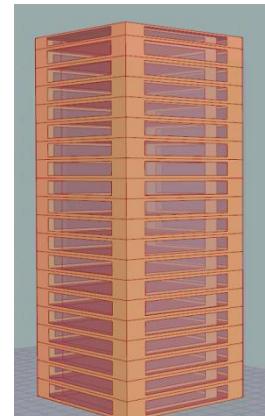
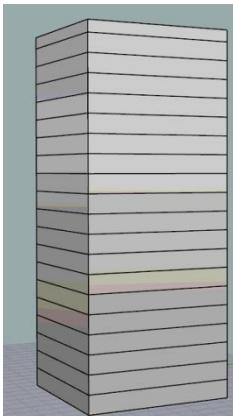
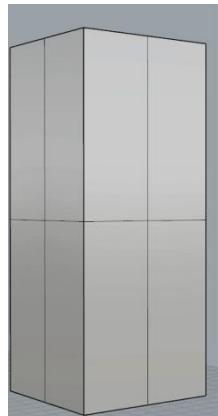
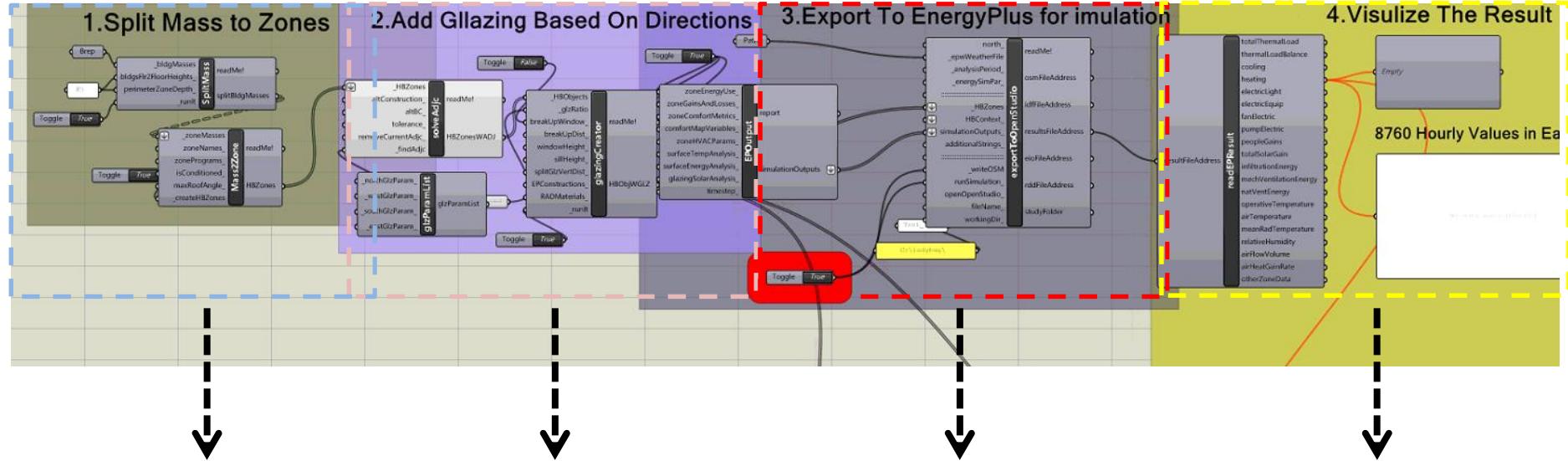
With Shading Panel 有遮阳板



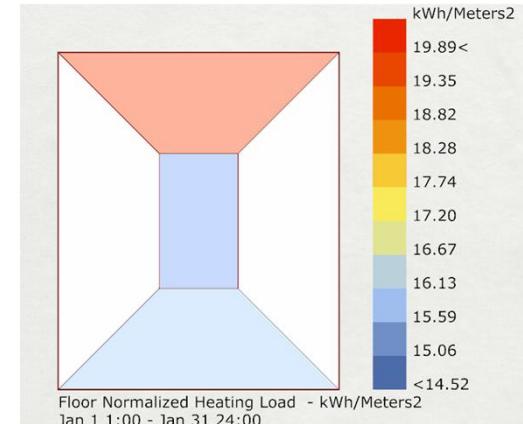
Annual Average Solar Radiation: 284.65kWh/m²

案例实践

Honeybee模拟分析



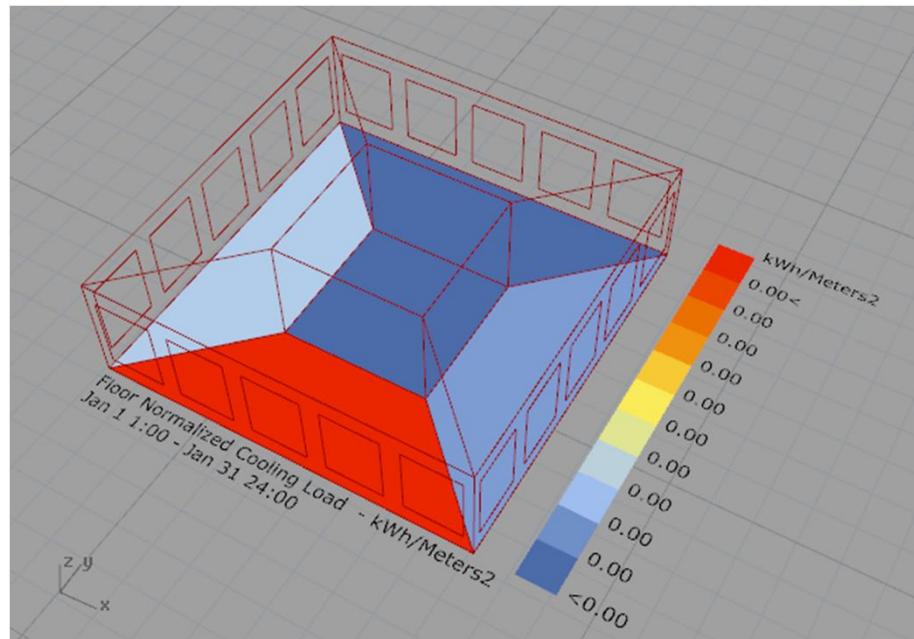
```
Updating Beam-to-Beam Exterior Solar Reflection Factors
Continuing Simulation at 03/02 for RUN PERIOD 1
Updating Shadowing Calculations, Start Date=04/01
Updating Beam-to-Diffuse Exterior Solar Reflection Factors
Updating Beam-to-Beam Exterior Solar Reflection Factors
Continuing Simulation at 04/01 for RUN PERIOD 1
Updating Shadowing Calculations, Start Date=05/01
Updating Beam-to-Diffuse Exterior Solar Reflection Factors
Updating Beam-to-Beam Exterior Solar Reflection Factors
Continuing Simulation at 05/01 for RUN PERIOD 1
Updating Shadowing Calculations, Start Date=05/31
Updating Beam-to-Diffuse Exterior Solar Reflection Factors
Updating Beam-to-Beam Exterior Solar Reflection Factors
Continuing Simulation at 06/30 for RUN PERIOD 1
Updating Shadowing Calculations, Start Date=07/30
Updating Beam-to-Diffuse Exterior Solar Reflection Factors
Updating Beam-to-Beam Exterior Solar Reflection Factors
Continuing Simulation at 07/30 for RUN PERIOD 1
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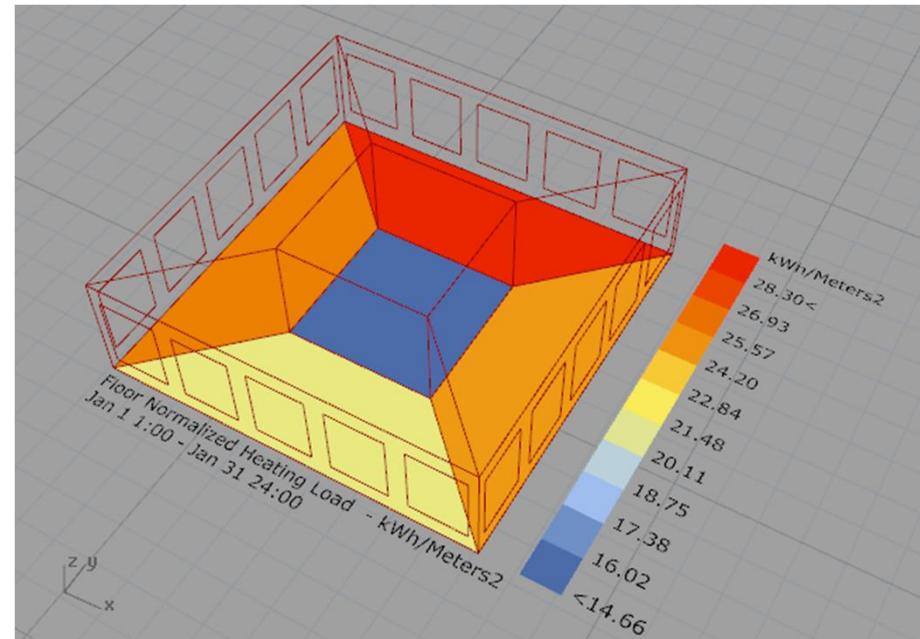


案例实践

Honeybee模拟分析



逐月冷负荷

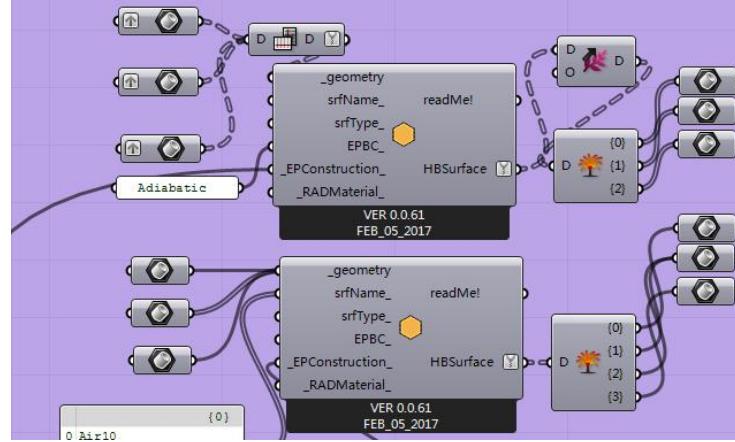


逐月热负荷

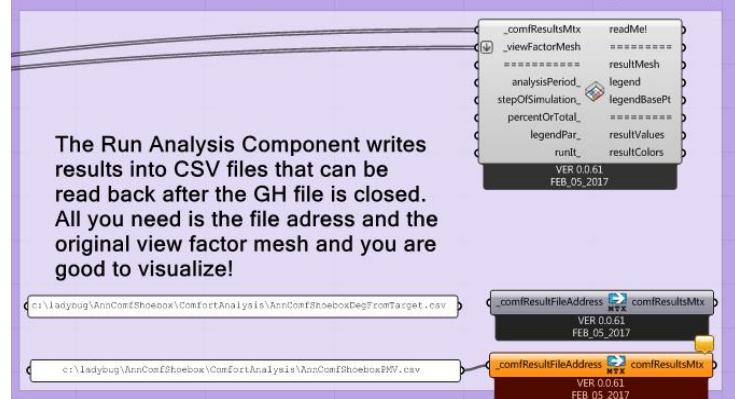
案例实践

Ladybug计算室内热舒适

Set Up The Geometry



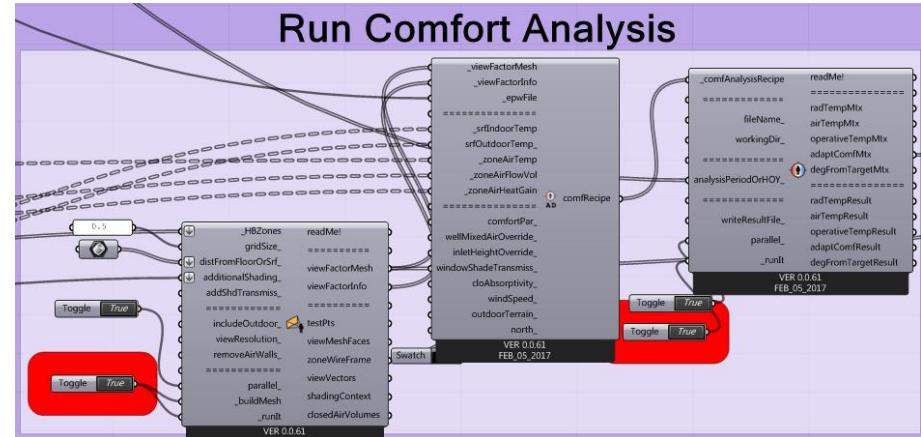
Visualize Indoor Comfort Sapitally



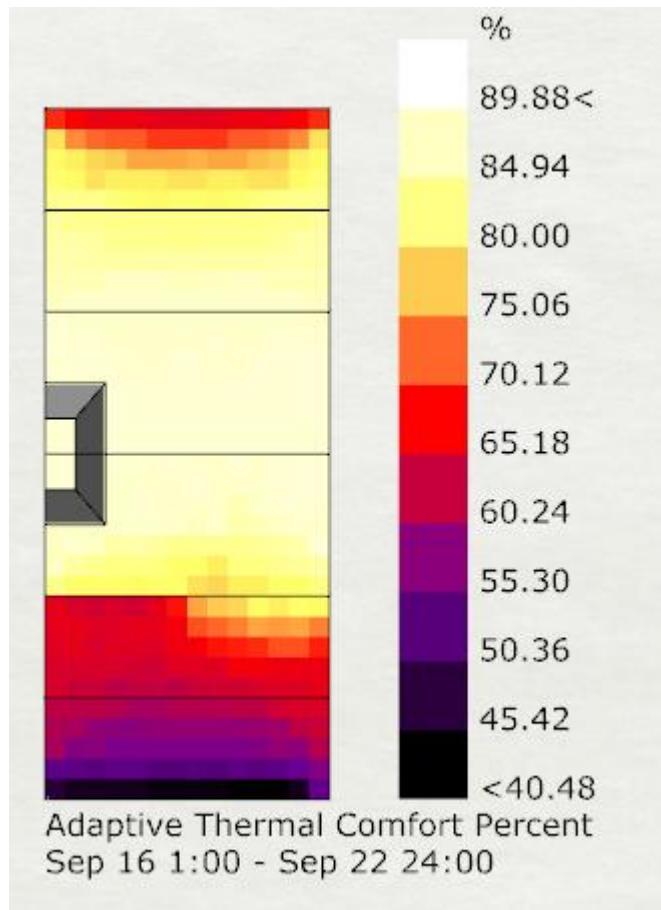
Run the Energy Simulation + Get Results



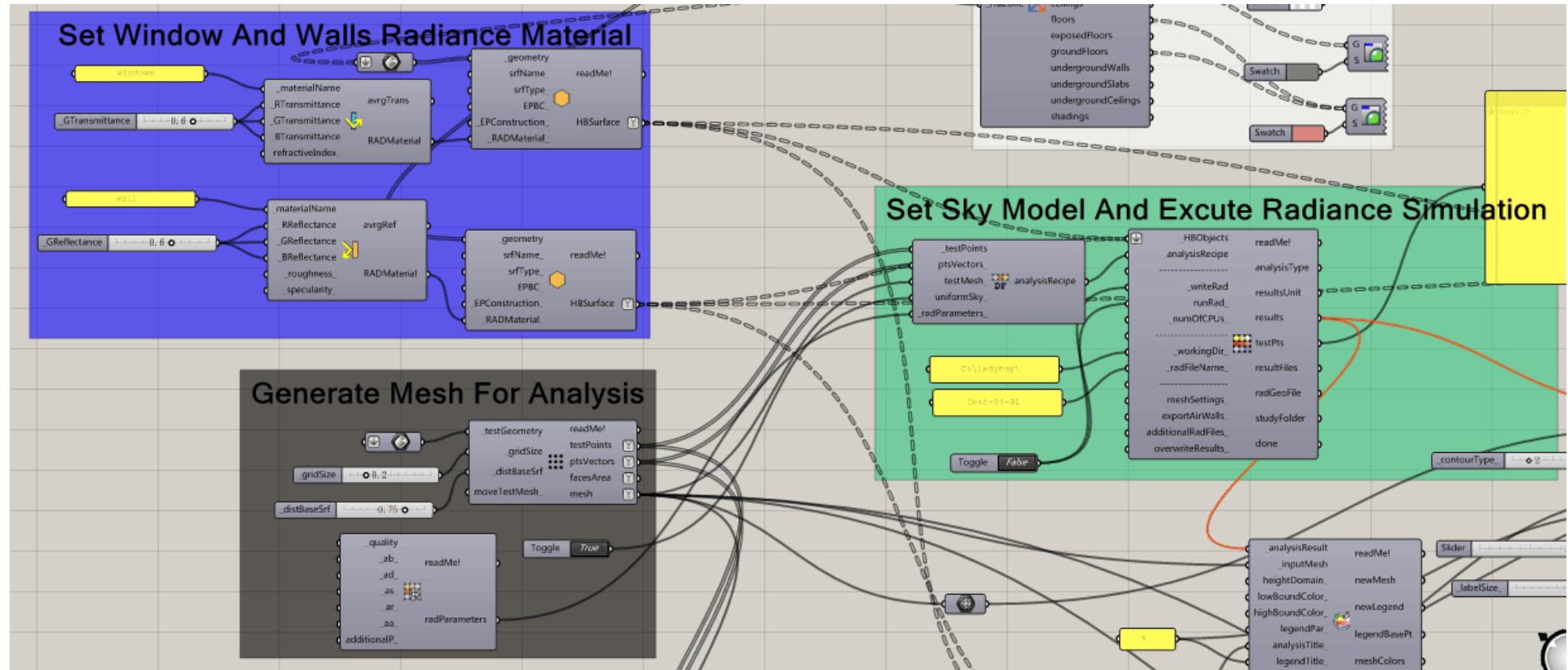
Run Comfort Analysis



室内热舒适



Honeybee模拟分析

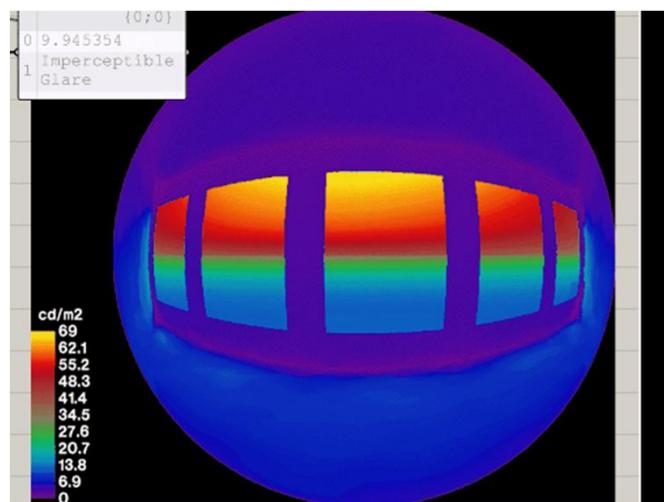


自然采光系数计算

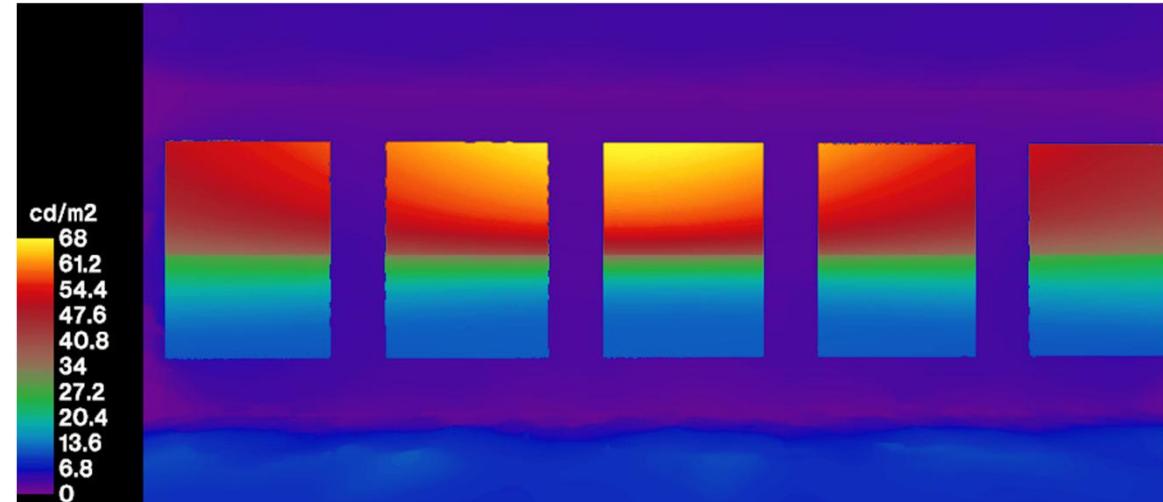
自然采光计算

评价指标Daylight Glare Index

- Daylight Glare Index表示某一时刻从室内看到窗户平均亮度与室外亮度的比值。
- 计算时需要调用Radiance



夏至日6-18点 室内眩光变化 (鱼眼视图)

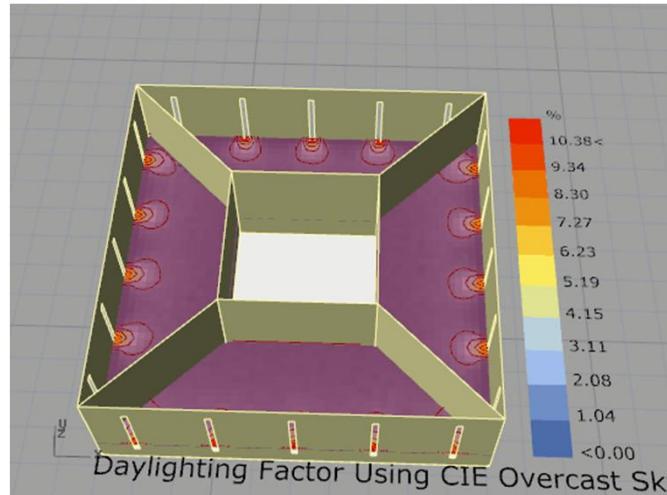


夏至日6-18点 室内亮度变化 (透视视图)

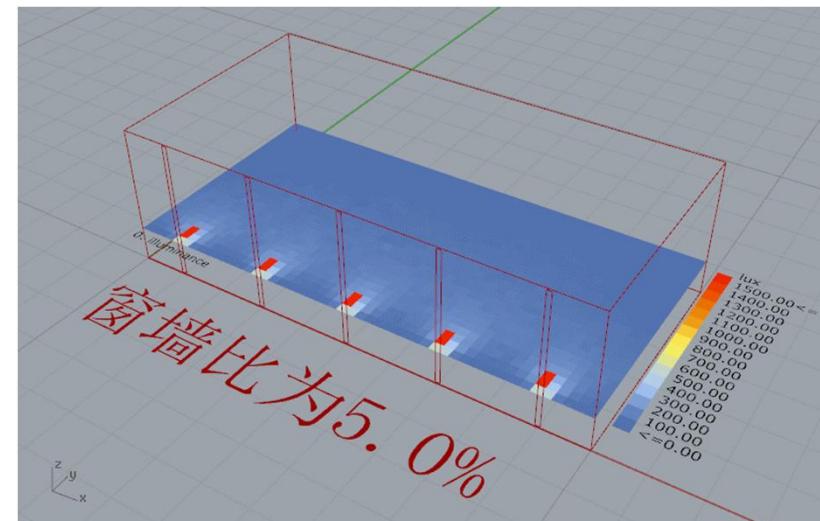
自然采光计算

评价指标Daylight Factor

- Daylight Factor 表示全阴天天空模型下，建筑内某一点的照度值与室外天空照度的比值
- 计算时需要调用Radiance



不同窗墙比下 室内采光系数的变化



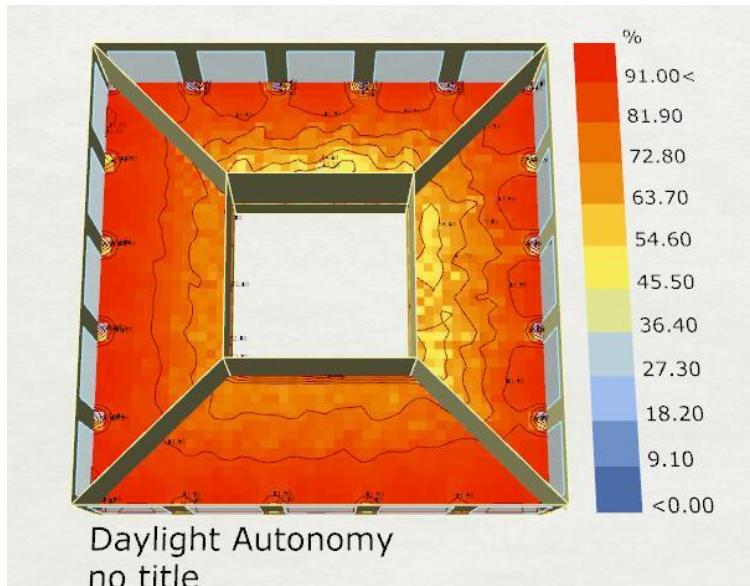
单个房间

案例实践

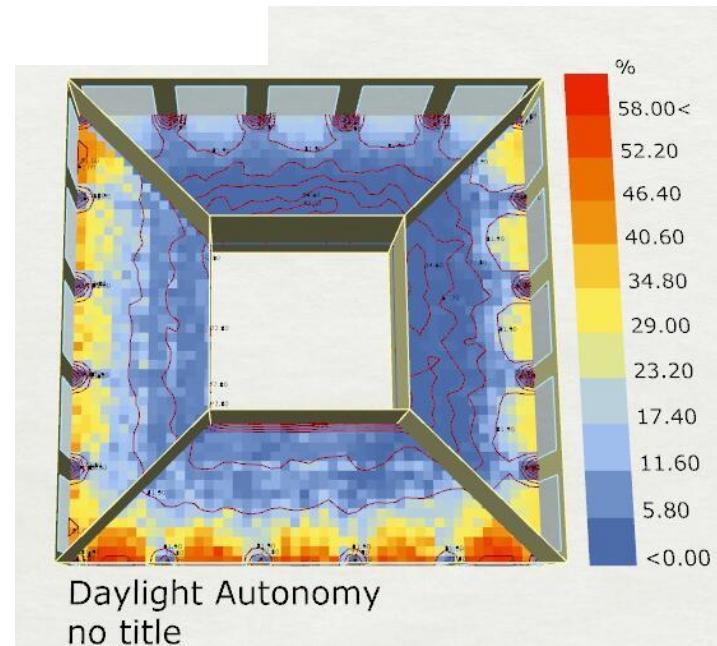
全年动态自然采光计算

评价指标Daylight Autonomy

- Daylight Autonomy 表示全年工作时间内，建筑内某一点单独依靠自然采光就能达到最小照度要求的时间百分比
- 计算时需要调用Daysim



Daylight Autonomy 300lux



Daylight Autonomy 超过2000lux

```
C:\Windows\system32\cmd.exe
C:\Program Files\Rhinoceros 5 <64-bit>\System>SET RAYPATH=.;C:\Radiance\lib;C:\DAYSIM\bin;C:\DAYSIM\lib;
C:\Program Files\Rhinoceros 5 <64-bit>\System>PATH=C:\Radiance\bin;C:\DAYSIM\bin;C:\DAYSIM\lib;$PATH

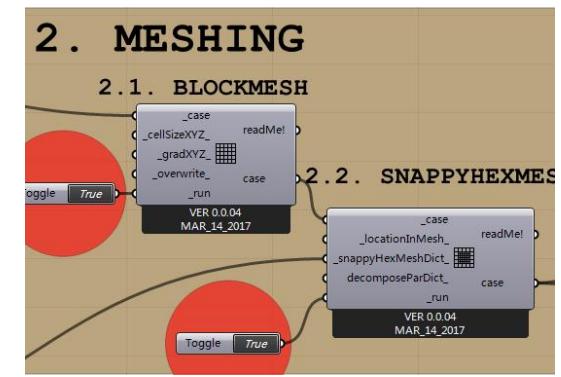
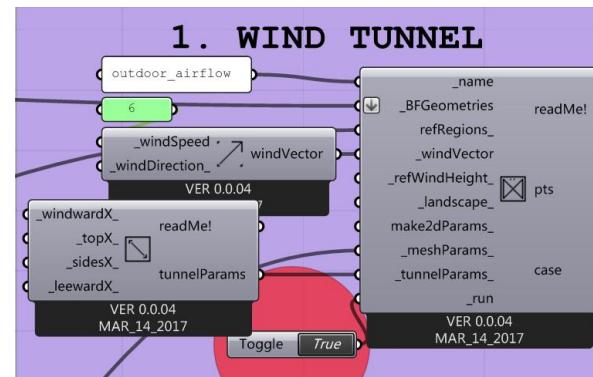
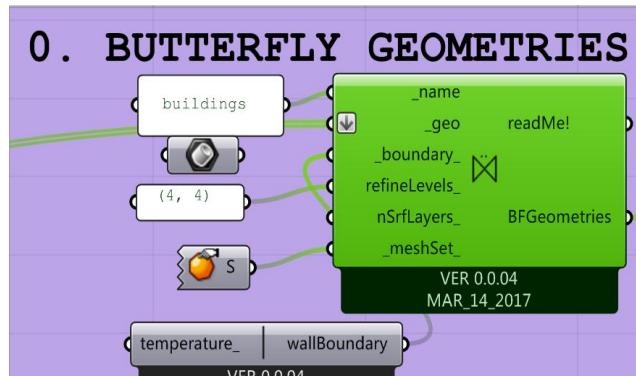
C:\Program Files\Rhinoceros 5 <64-bit>\System>gen_dc C:\ladybug\Test0401\annuals\simulation\Test0401_0.hea -dif
=====
= gen_dc: calculate diffuse daylight coefficients =
= <ignore WARNING: no light sources found>
= <this simulation may take several minutes to hours>
=====
calculate diffuse daylight coefficients for variant no_blind...
rtrace_dc: warning - no light sources found

C:\Program Files\Rhinoceros 5 <64-bit>\System>gen_dc C:\ladybug\Test0401\annuals\simulation\Test0401_0.hea -dir
=====
= gen_dc: calculate direct daylight coefficients =
= <this simulation may take several minutes to hours>
=====
calculate 61 direct daylight coefficients for variant no_blind...
```

调用Daysim

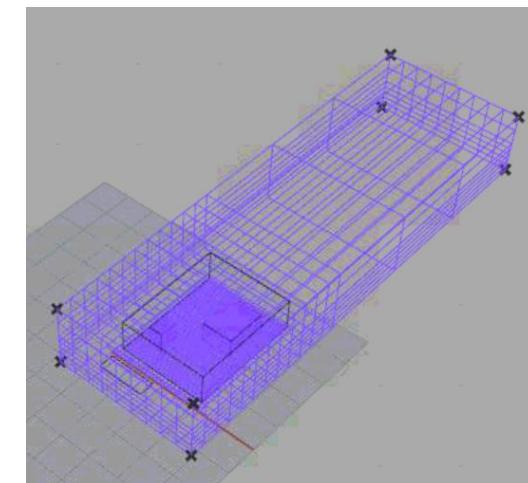
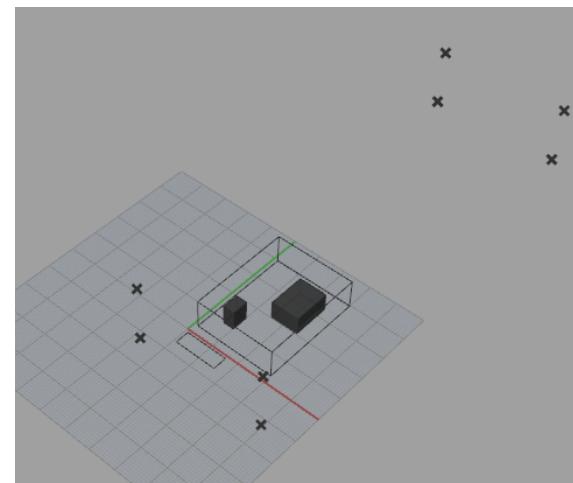
案例实践

Butterfly进行CFD模拟分析



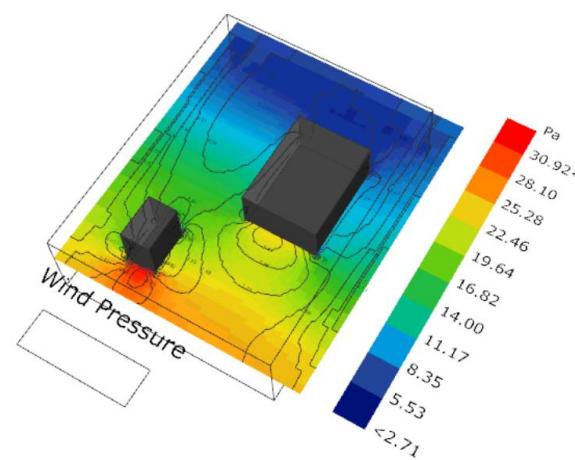
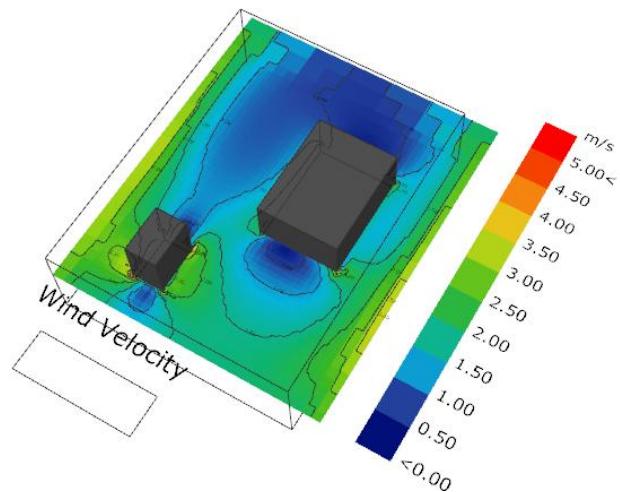
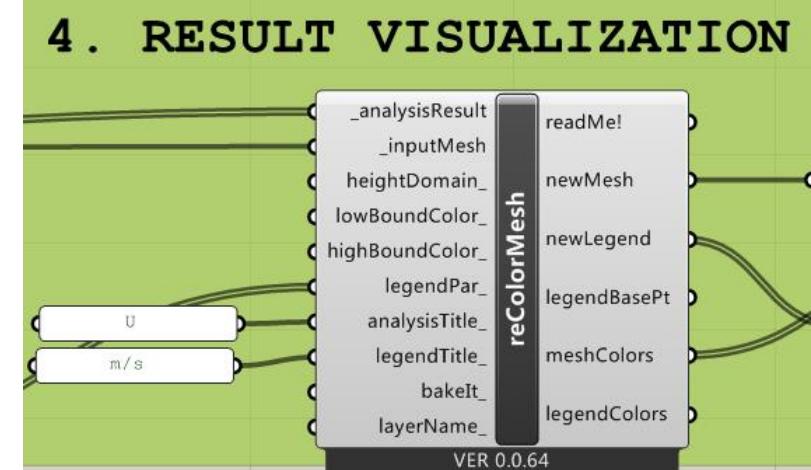
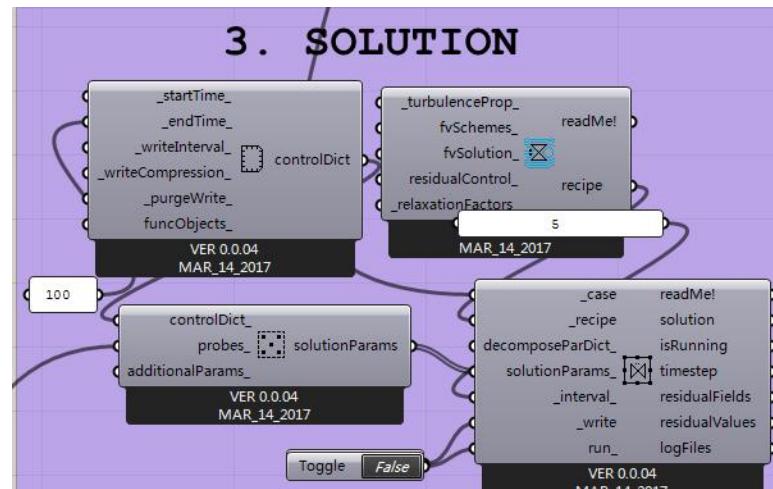
管理员: OpenFOAM_Start

```
C:\Program Files (x86)\ESI\OpenFOAM\1606>"C:\Program Files (x86)\ESI\OpenFOAM\1606\Windows\Scripts\of_start_container.exe" -Arguments "C:\Program Files\ Docker Toolbox\c:\Program Files\Git\bin"
Starting "default"...
(default) Check network to re-create if needed...
(default) Waiting for an IP...
Machine "default" was started.
Waiting for SSH to be available...
Detecting the provisioner...
Started machines may have new IP addresses. You may need to re-run the 'docker-machine env' command.
of_plus_1606
[ofuser@default ~]$
```



案例实践

Butterfly进行CFD模拟分析



THE
FUTURE
BY
DESIGN



The End
THANKS

