

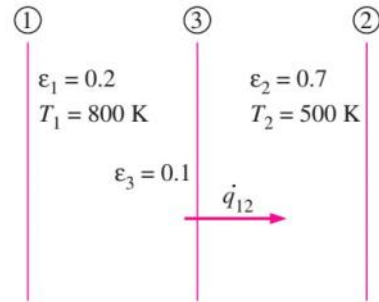
WEEK 6_ZHU CUILING

TASK 1

Considering the same example solved in the previous assignment (radiative heat transfer between two parallel plates), how many shields with $\epsilon = 0.1$ should you add in order to have the new heat transfer rate to be 1% of the case without shields ?

$$q_{net1 \rightarrow 2} = \frac{\dot{Q}_{net2 \rightarrow 1}}{A} = \frac{A\sigma(T_2^4 - T_1^4)}{\frac{1}{\epsilon_1} + \frac{1}{\epsilon_2} - 1} \div A = \frac{\sigma(T_2^4 - T_1^4)}{\frac{1}{\epsilon_1} + \frac{1}{\epsilon_2} - 1}$$

$$= \frac{1.5 \times (5.67 \times 10^{-8}) \times (500^4 - 800^4)}{\frac{1}{0.2} + \frac{1}{0.7} - 1} \approx 3625.41 \text{ W}$$



The new heat transfer rate should be 1% of the $q_{net1 \rightarrow 2}$,

$$q'_{net1 \rightarrow 2} = \frac{1}{100} q_{net1 \rightarrow 2}$$

$$= \frac{\sigma(T_2^4 - T_1^4)}{\left(\frac{1}{\epsilon_1} + \frac{1}{\epsilon_2} - 1\right) + N \cdot \left(\frac{1}{\epsilon_1} + \frac{1}{\epsilon_2} - 1\right)} = \frac{1}{100} \times \frac{\sigma(T_2^4 - T_1^4)}{\frac{1}{\epsilon_1} + \frac{1}{\epsilon_2} - 1}$$

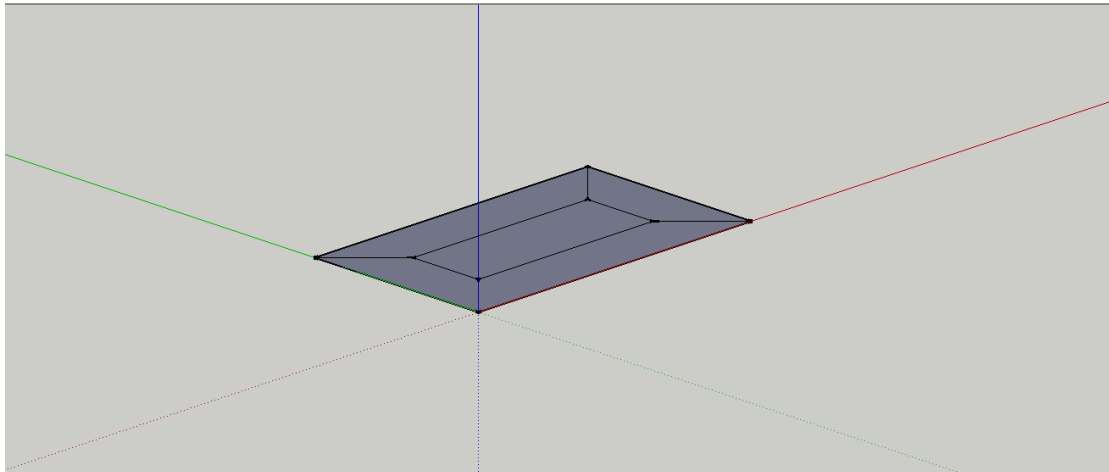
$$\rightarrow 100 \times \left(\frac{1}{\epsilon_1} + \frac{1}{\epsilon_2} - 1\right) = \left(\frac{1}{\epsilon_1} + \frac{1}{\epsilon_2} - 1\right) + N \cdot \left(\frac{1}{\epsilon_1} + \frac{1}{\epsilon_2} - 1\right)$$

$$\rightarrow 99 \times \left(\frac{1}{\epsilon_1} + \frac{1}{\epsilon_2} - 1\right) = N \cdot \left(\frac{1}{\epsilon_1} + \frac{1}{\epsilon_2} - 1\right)$$

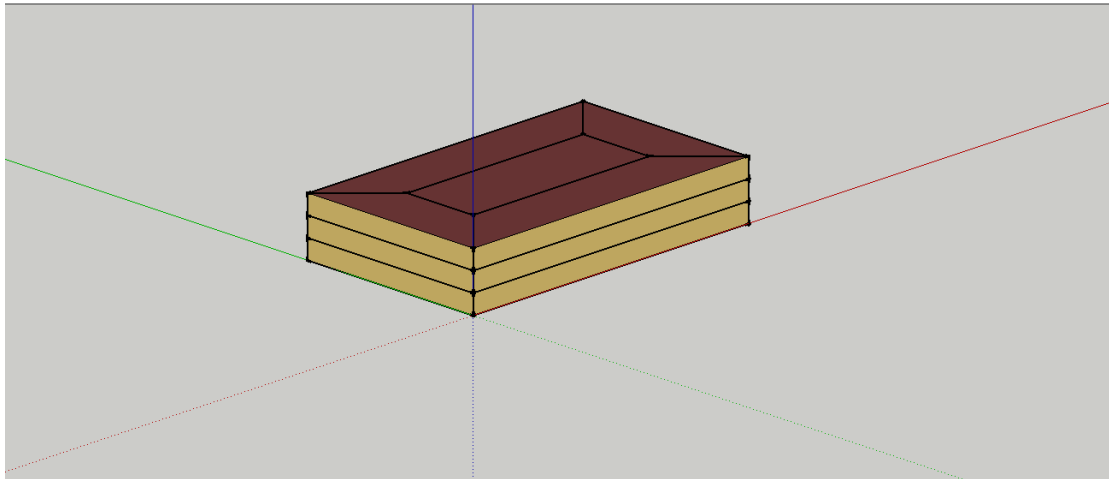
$$\rightarrow N = 28$$

So we need 28 shields which $\epsilon = 0.1$ for the new heat transfer rate be 1% of the previous rate without any shields.

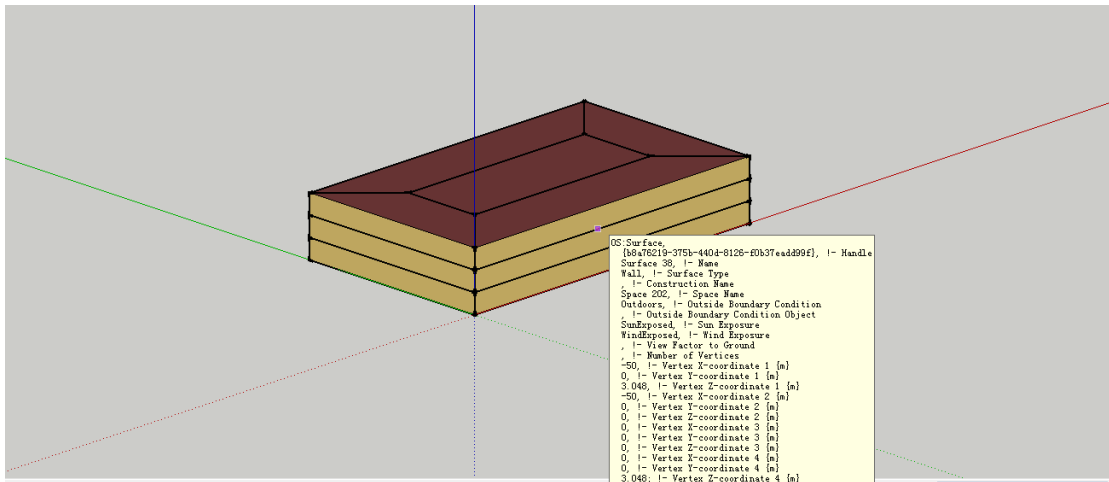
1. Draw the outline and shape of the building in Sketchup.



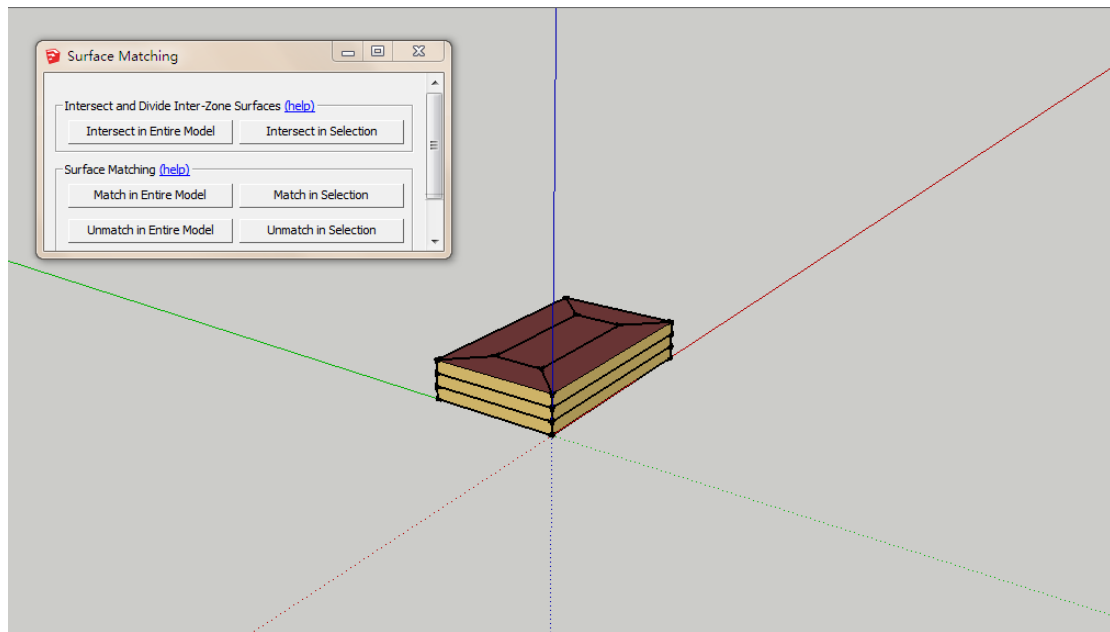
2. Use "Creat spaces from diagram" creat a 3 floor building.



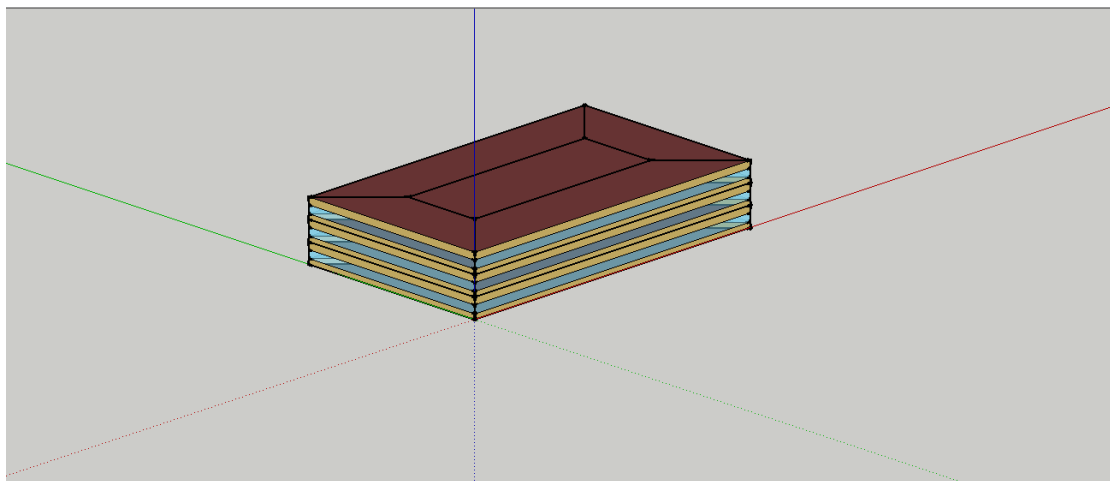
3. We can see the material information using the "Info tool".



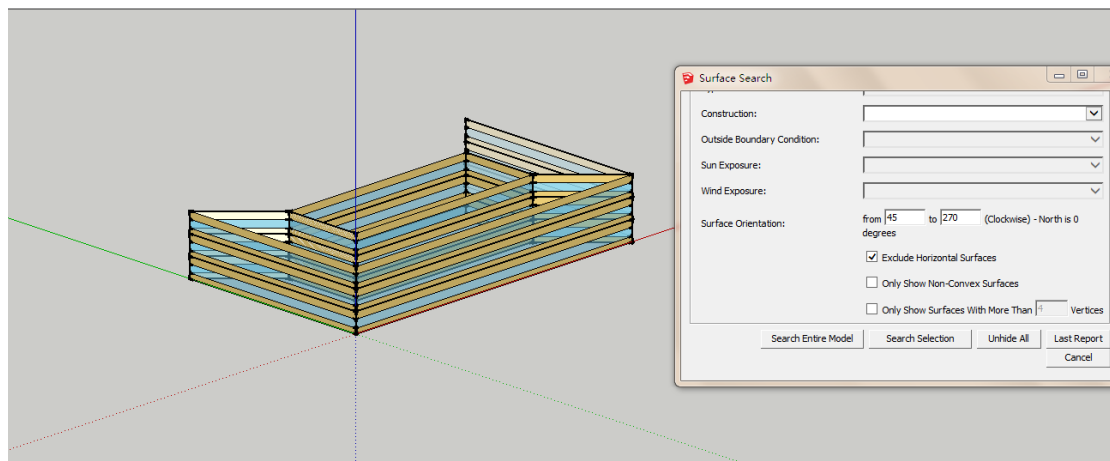
4. Click "Surface matching".



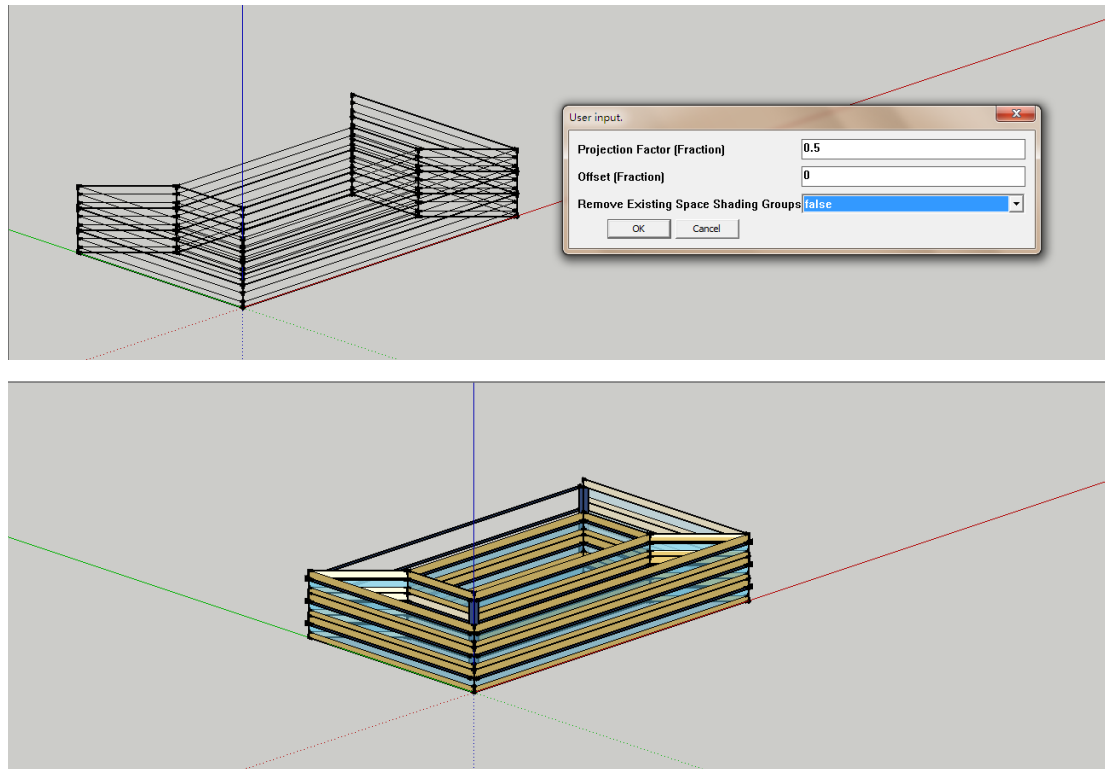
5. Click "Extensions-OpenStudio User Scripts-Alter or Add Model Elements- Set Window to Wall Ratio" to built the windows.



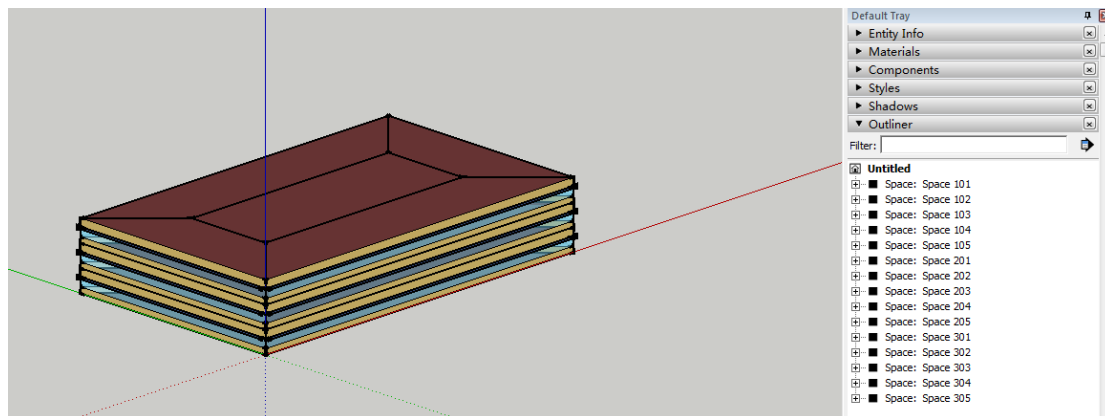
6. Check other directions besides the north.



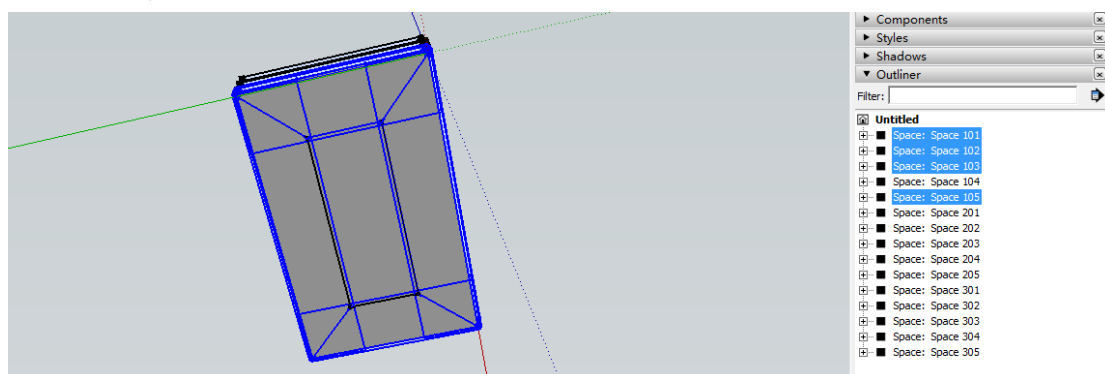
7. Click “Extensions-OpenStudio User Scripts-Alter or Add Model Elements Add Overhangs by Projection Factor” to build overhangs.

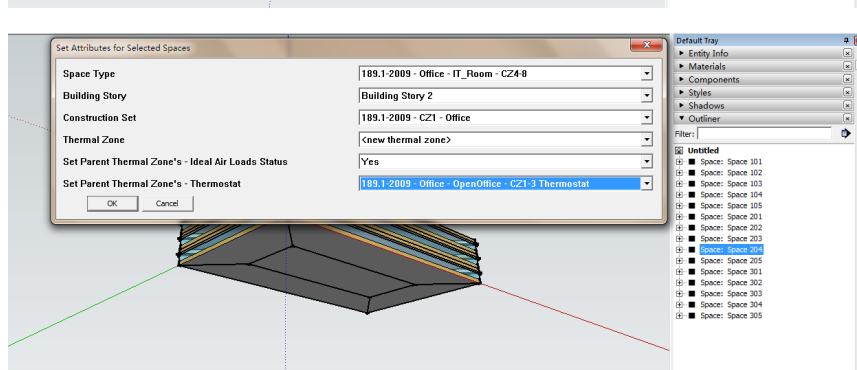
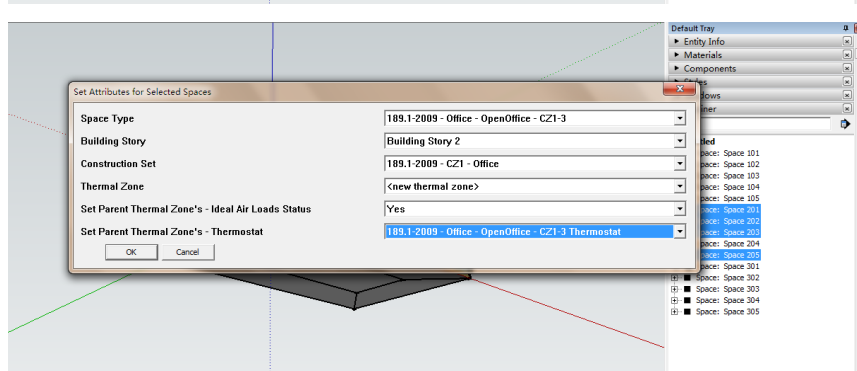
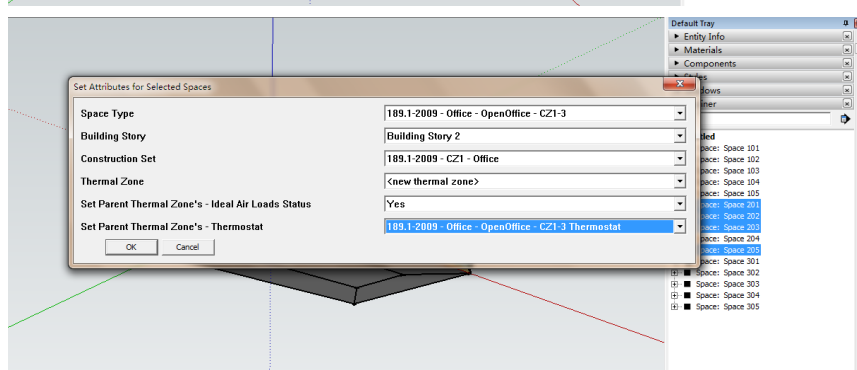
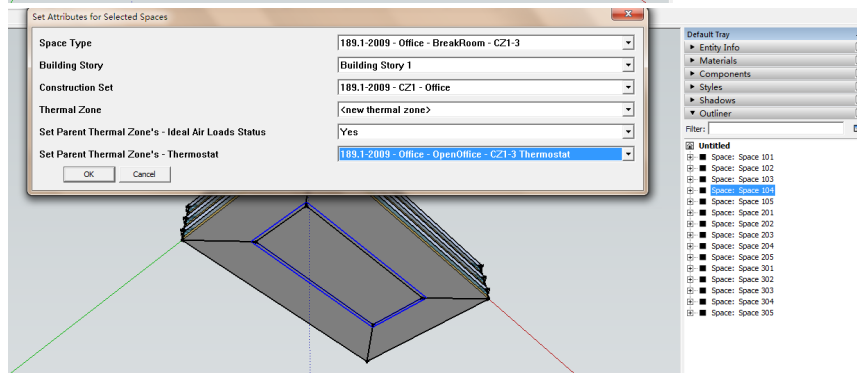
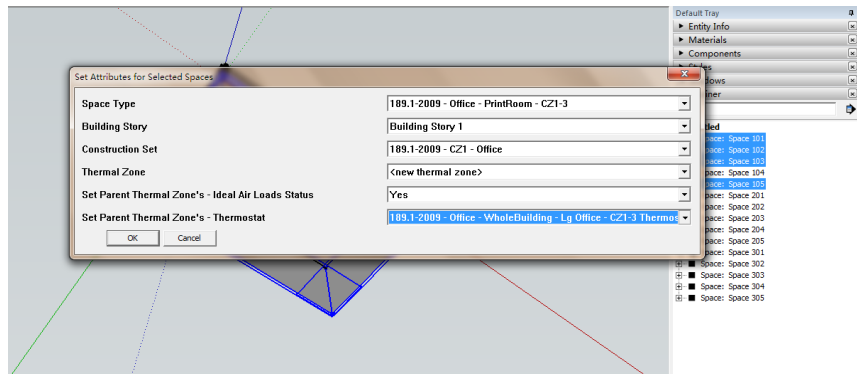


8. Open the “Window-Default Tray-Outliner”

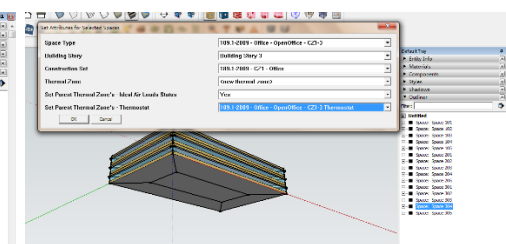
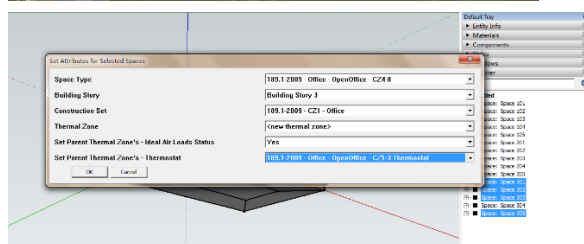
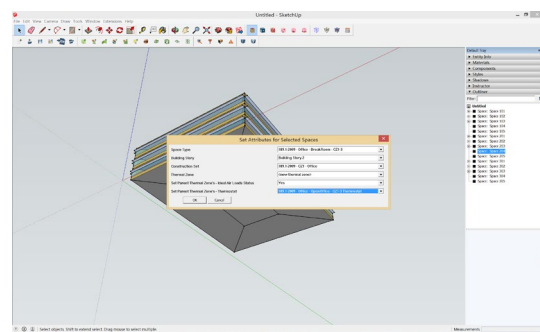
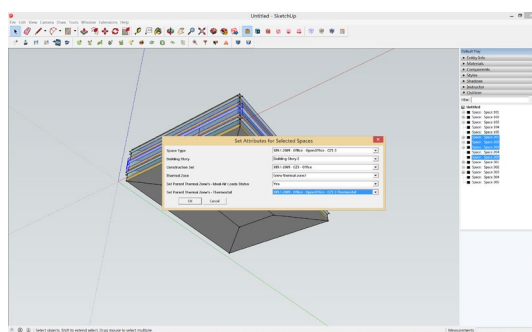
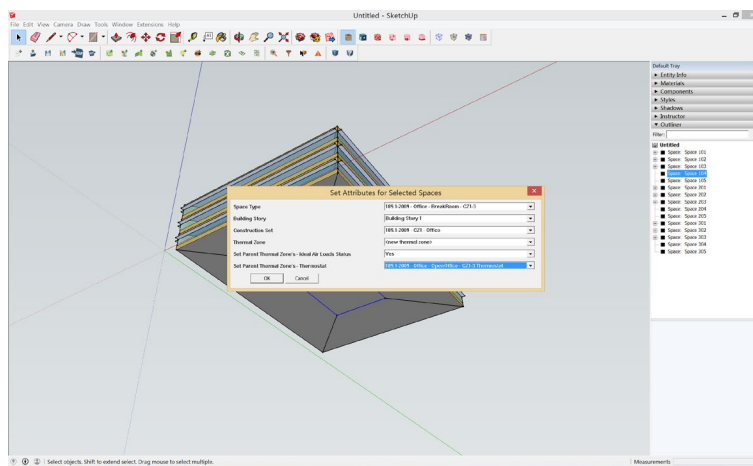
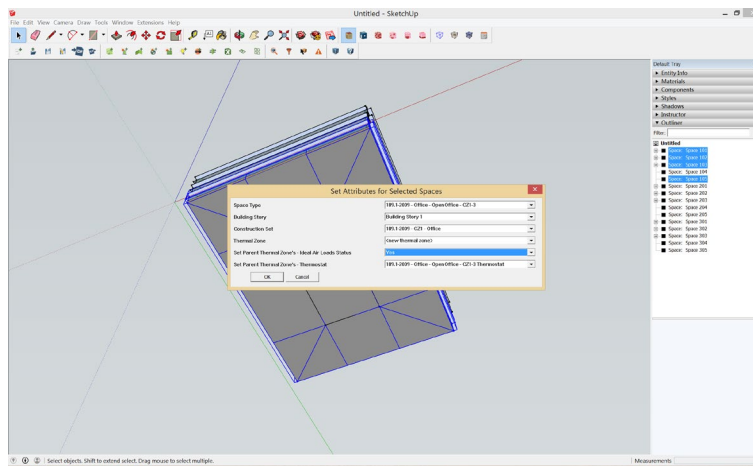


9. Choose the space of each thermal zone.

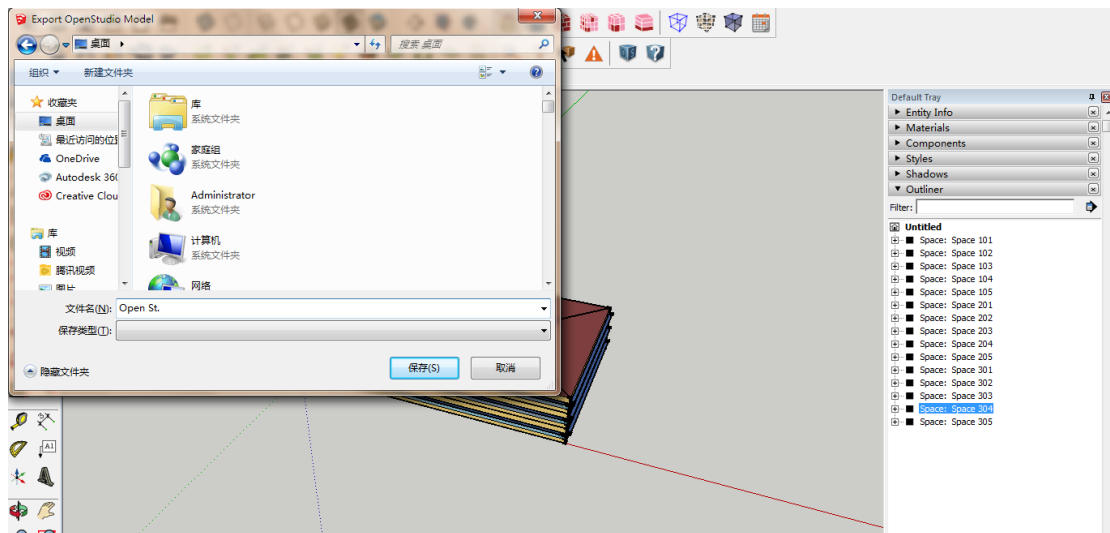




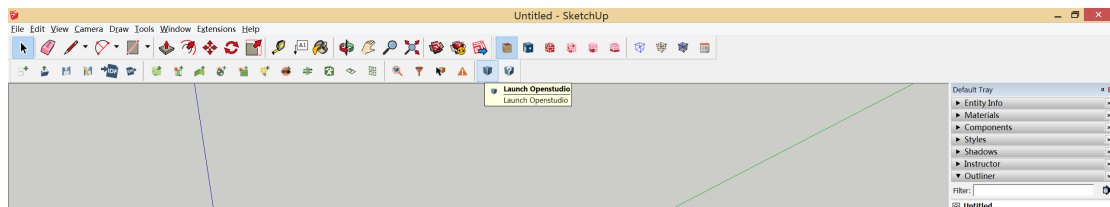
10. Click “Set Attributes for Selected Space” to set parameters.



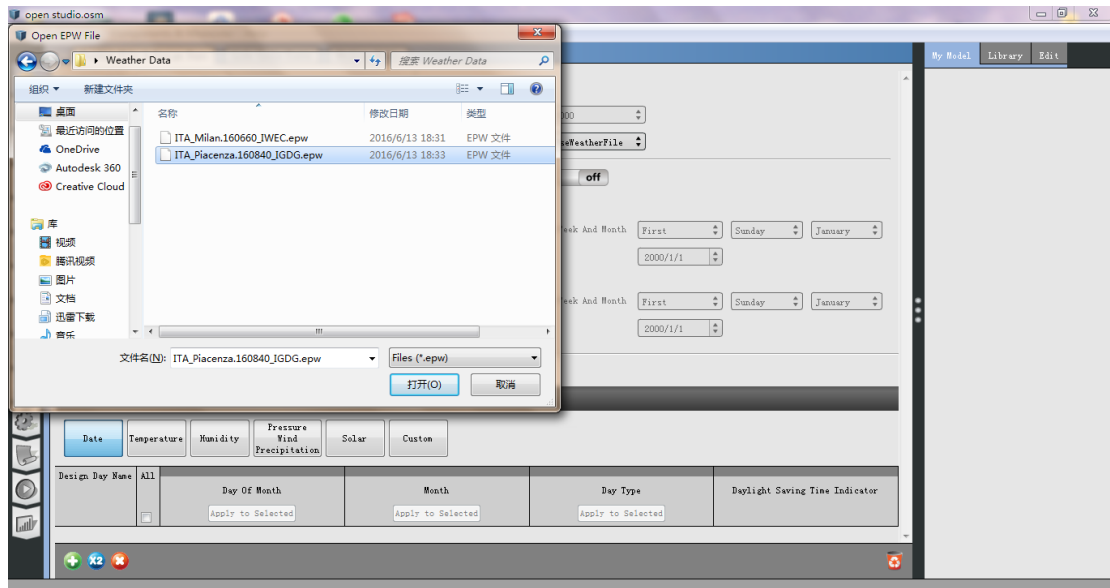
11. Save the model.



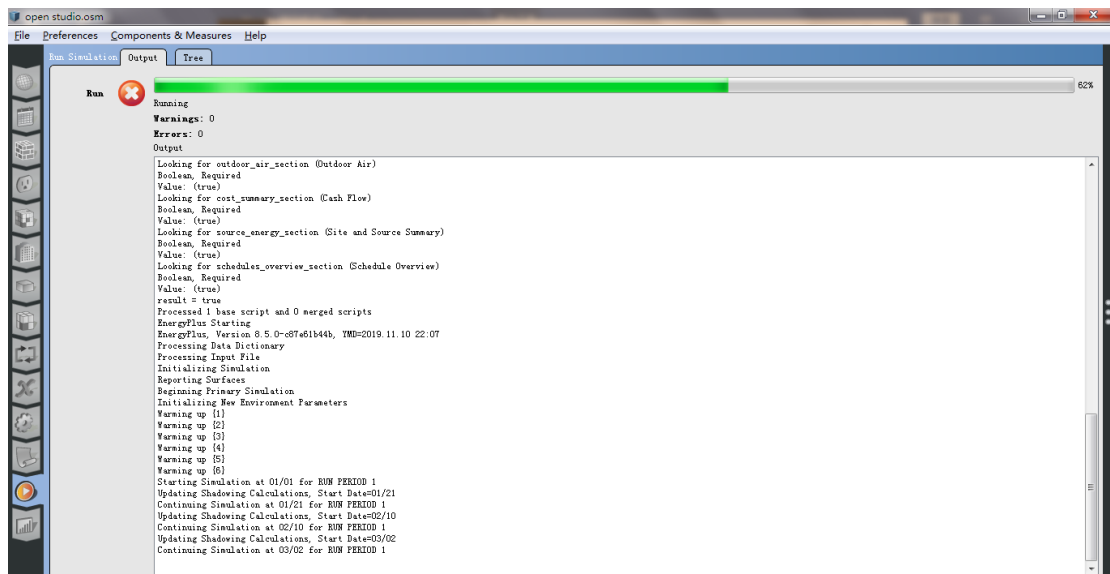
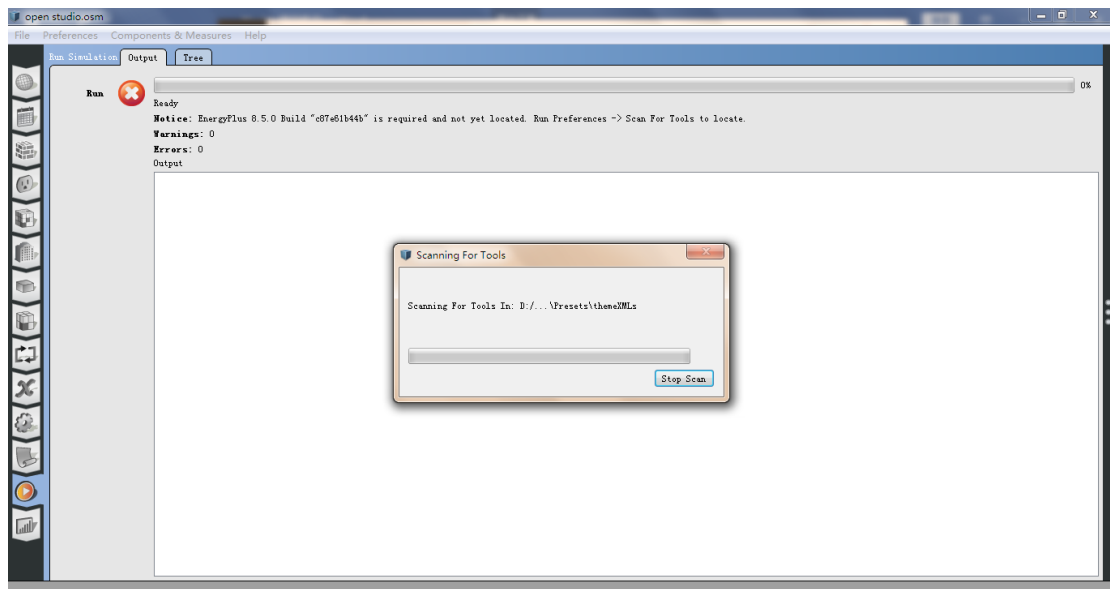
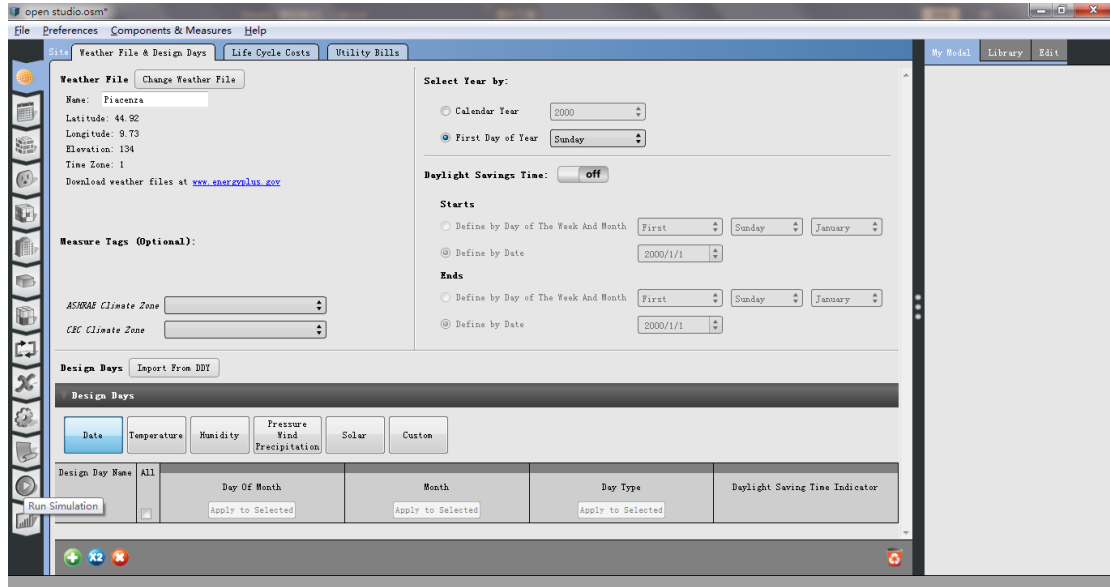
12. Run the “Launch OpenStudio”.

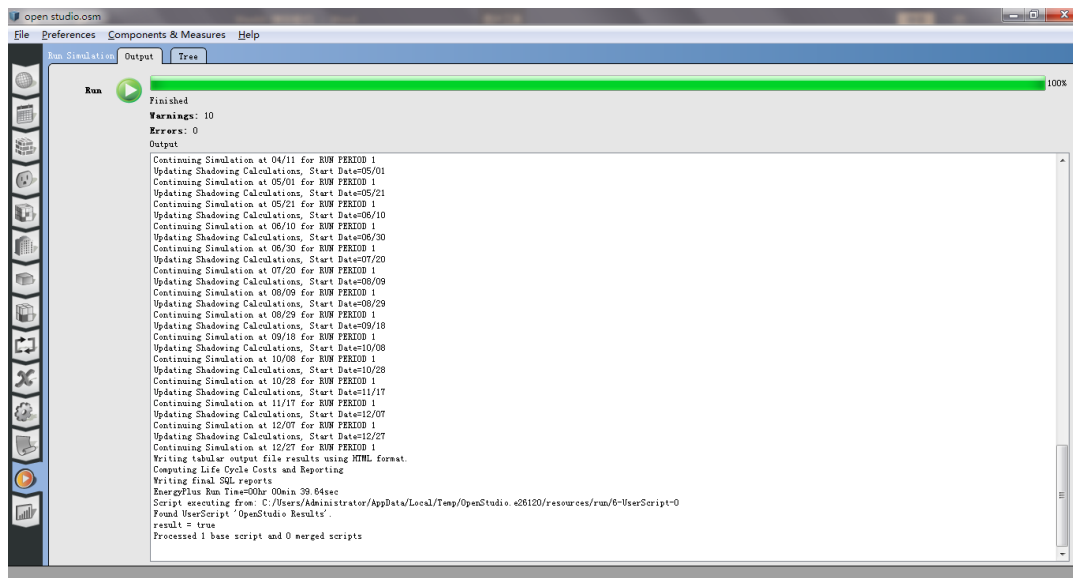


13. Add the weather data.



14. Click the “Run Simulation”.





15. Show the result.

