

# ECOTEECT – DAYSIM – RADIANCE “package”

ECOTEECT

Daylight autonomy



Daylight Factor  
Illuminance



RCP

Daylight factor



DAYSIM

Lighting energy

ECOTEECT

Visualization

RADIANCE

Screenshots removed due to copyright restrictions.

# ECOTECH – Program features

- ▶ Shadows and Shading design
- ▶ Lighting
  - Daylight Factor or Illuminance (overcast sky)
  - Annual Daylight Sufficiency
  - Electric lighting

# ECOTECH – Program features

- ▶ Shadows and Shading design
- ▶ Lighting
- ▶ Solar
  - diffuse and direct solar radiation
  - solar stresses

# ECOTEECT – Program features

- ▶ Shadows and Shading design
- ▶ Lighting
- ▶ Solar
- ▶ and...
  - Thermal
  - Energy & building regulations
  - Acoustics
  - Air flow
  - Cost & resources

# ECOTECH - accuracy for lighting calculations

## ▶ Limited capabilities

- based on simple evaluation methods
- no consideration of climate (only for solar/thermal analyses)
- internal reflections are averaged

# ECOTECH – Export to RADIANCE

## ► Sky description in Radiance: gensky

- Sunny sky without sun (CIE clear)
- Sunny sky with sun (CIE clear + source description of sun)
- Cloudy sky (CIE overcast)
- Intermediate sky without sun (CIE intermediate)
- Intermediate sky with sun (+ somewhat subdued sun)
- Uniform cloudy sky

# ECOTECH – Export to RADIANCE

## ▶ Rendering parameters

- internal vs. external (with 0 indirect reflections)

# ECOTECH – Export to RADIANCE

## ▶ Rendering parameters

- internal vs. External
- indirect reflections

-ab parameter

i.e.

nb bounces



# ECOTECH – Export to RADIANCE

## ▶ Rendering parameters

- internal vs. External
- indirect reflections
- image parameters

ab 5

Detail: low

Variability: low

Quality: low



Images removed due to  
copyright restrictions.

ab 5

Detail: **high**

Variability: **high**

Quality: **high**



# RADIANCE - output

- Illuminance
- Luminance
- Glare sources & indexes
- Daylight factor values
- Sun patch position →
- Solar gains



# RADIANCE - Accuracy

## ► Accuracy

- depends on Radiance parameters' choice
- help with the "RAD" program (also in ECOTECT)

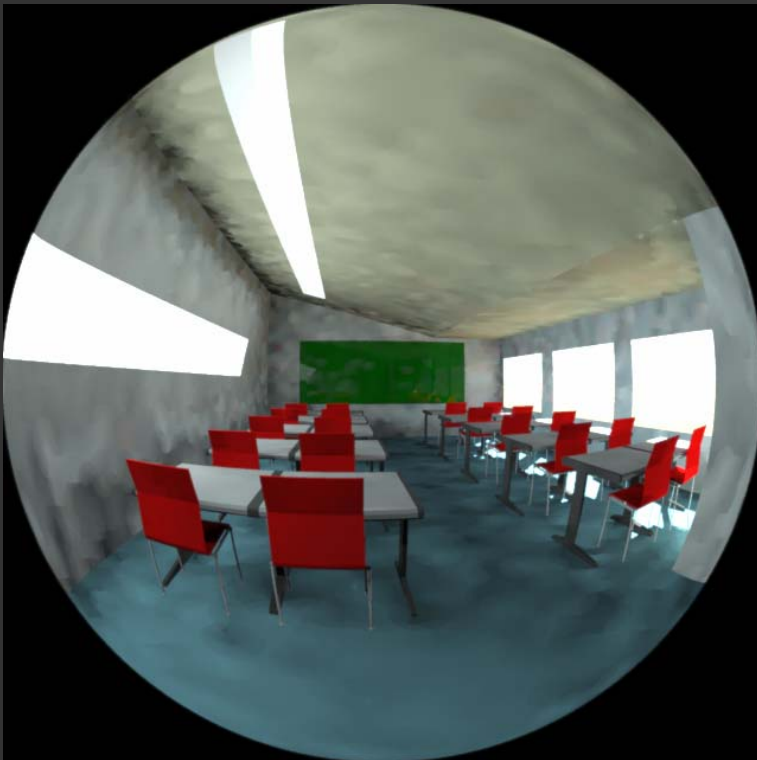


Image looking better but still inaccurate

# RADIANCE - Limitations

## ► Limitations

- Learning time (very long)
- Calculation time
- Complex daylighting systems (curved specular surfaces)

<http://radsite.lbl.gov/radiance/HOME.html>

Book "Rendering with Radiance". G. Ward

# DAYSIM - Input

## ► Input

- geometry file
- weather data file
- electric Lighting system data
- grid points + sensor positions
- user behavior

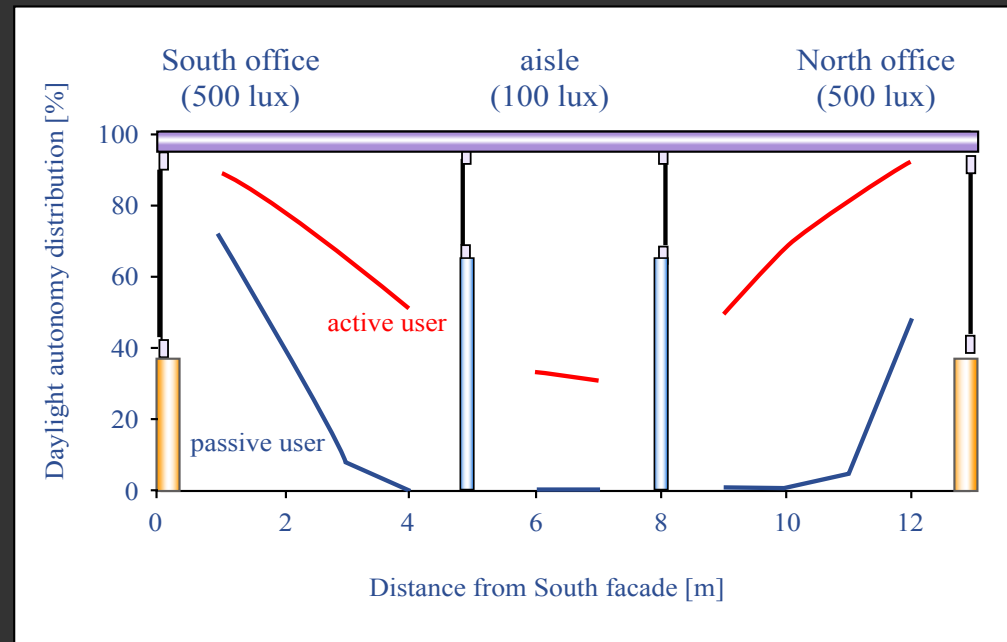


Figure by MIT OCW.

# DAYSIM - Input

## ► Calculation methods

- stochastic model to get shorter time-steps

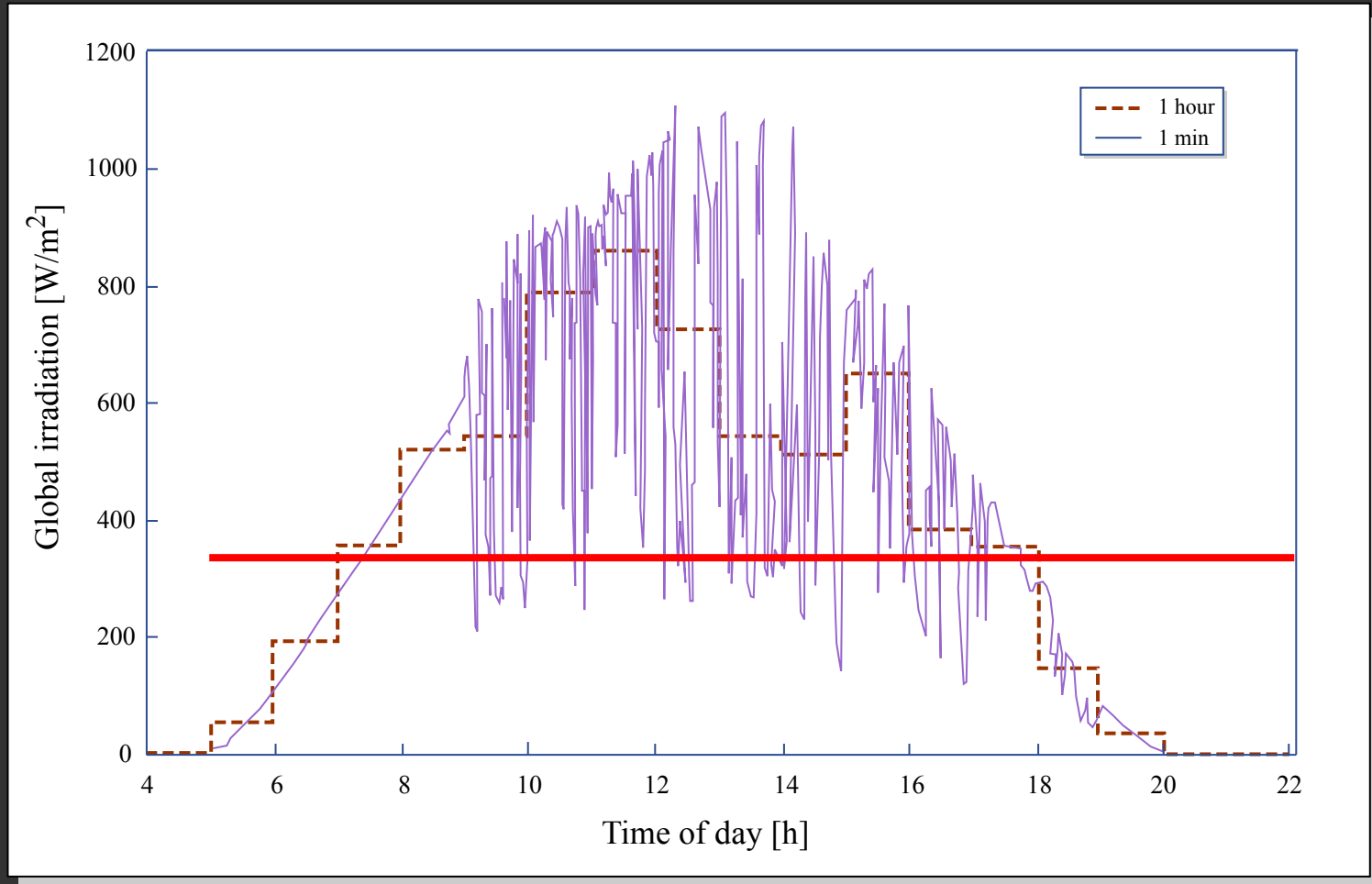


Figure by MIT OCW.

# DAYSIM - Input

## ► Calculation methods

- daylight coefficients → fast & accurate dynamic method

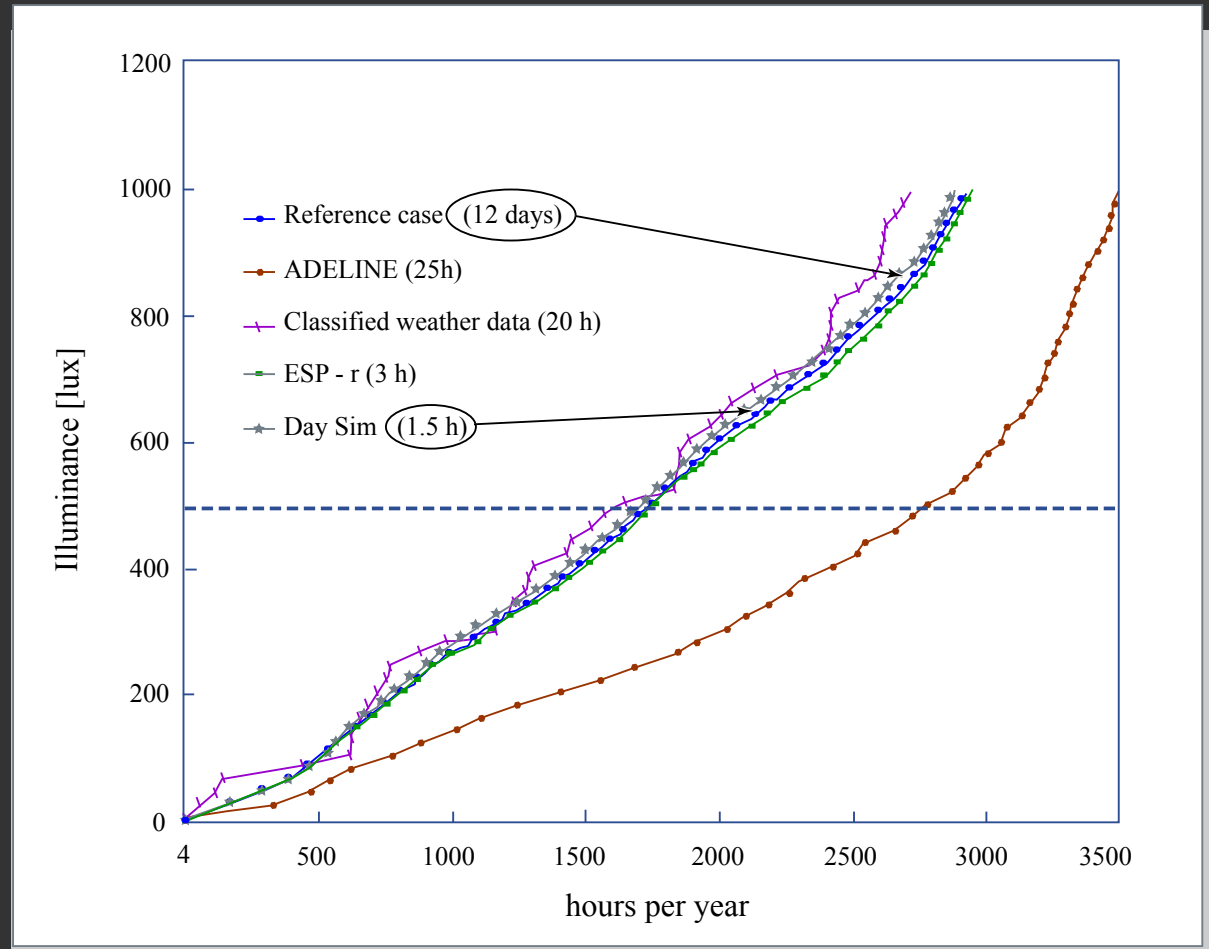


Figure by MIT OCW.

# DAYSIM - Output

## ► Output

- Dynamic daylight autonomy (re-exported to Ecotect)
- Electric lighting consumption (time steps – annual)
- Daylight illuminance (time steps)
- html report



# DAYSIM - [www.daysim.com](http://www.daysim.com)

## ▶ Accuracy

- comparable to Radiance, climate-based
  - combined with daylight coefficients and Perez sky model
  - approach validated by several independent studies (~20% rel. error i.e. comparable to static analyses)

## ▶ Calculation time

- shortened thanks to Daylight Coefficients

## ▶ Learning time

- short (a few hours) - Useful tutorial
- accurate results need Radiance parameters to be understood.