

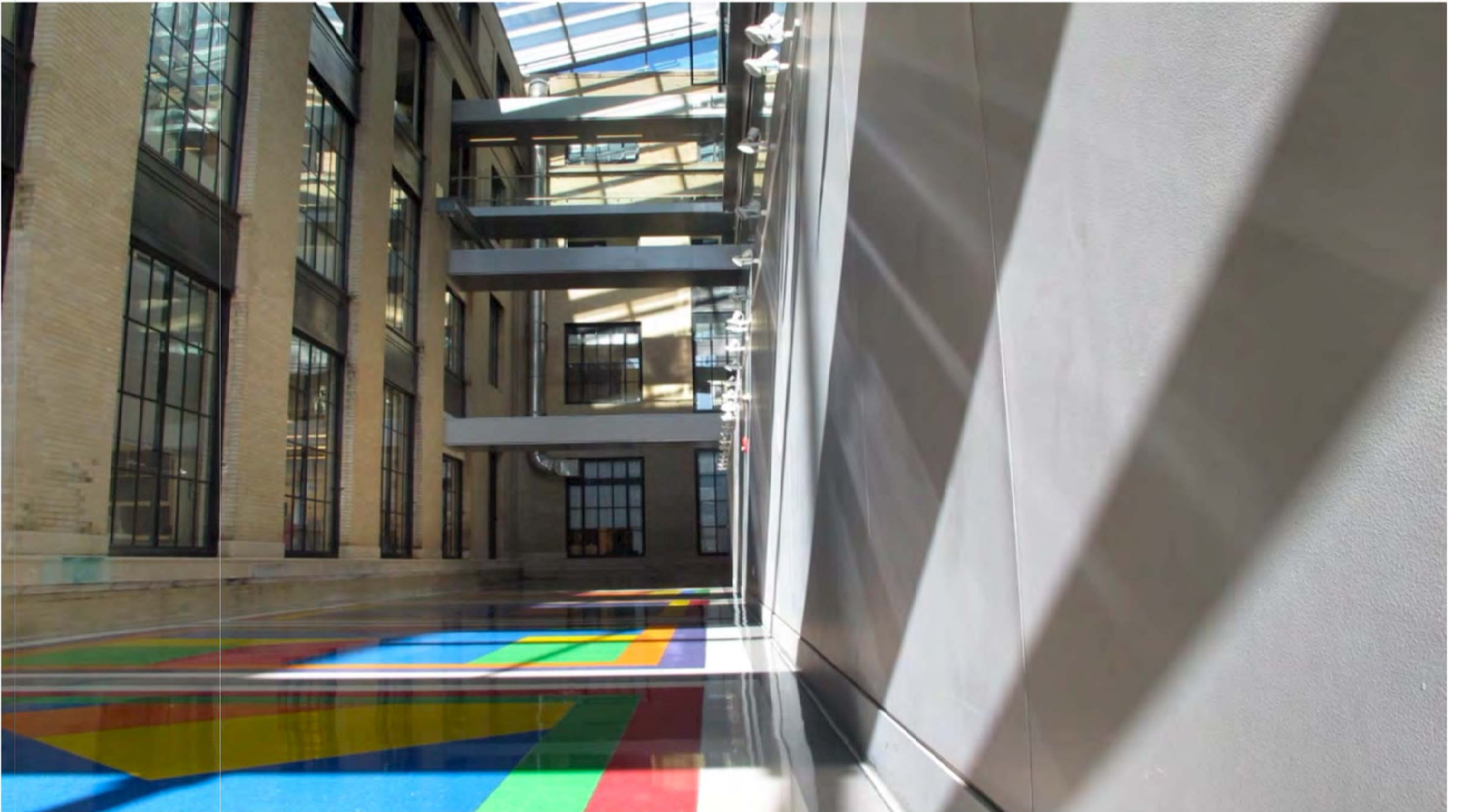
Eclairage par le soleil et le ciel:
dynamique temporelle et
perception par les occupants

Le Temps de la Lumière

UEE - PENS-313

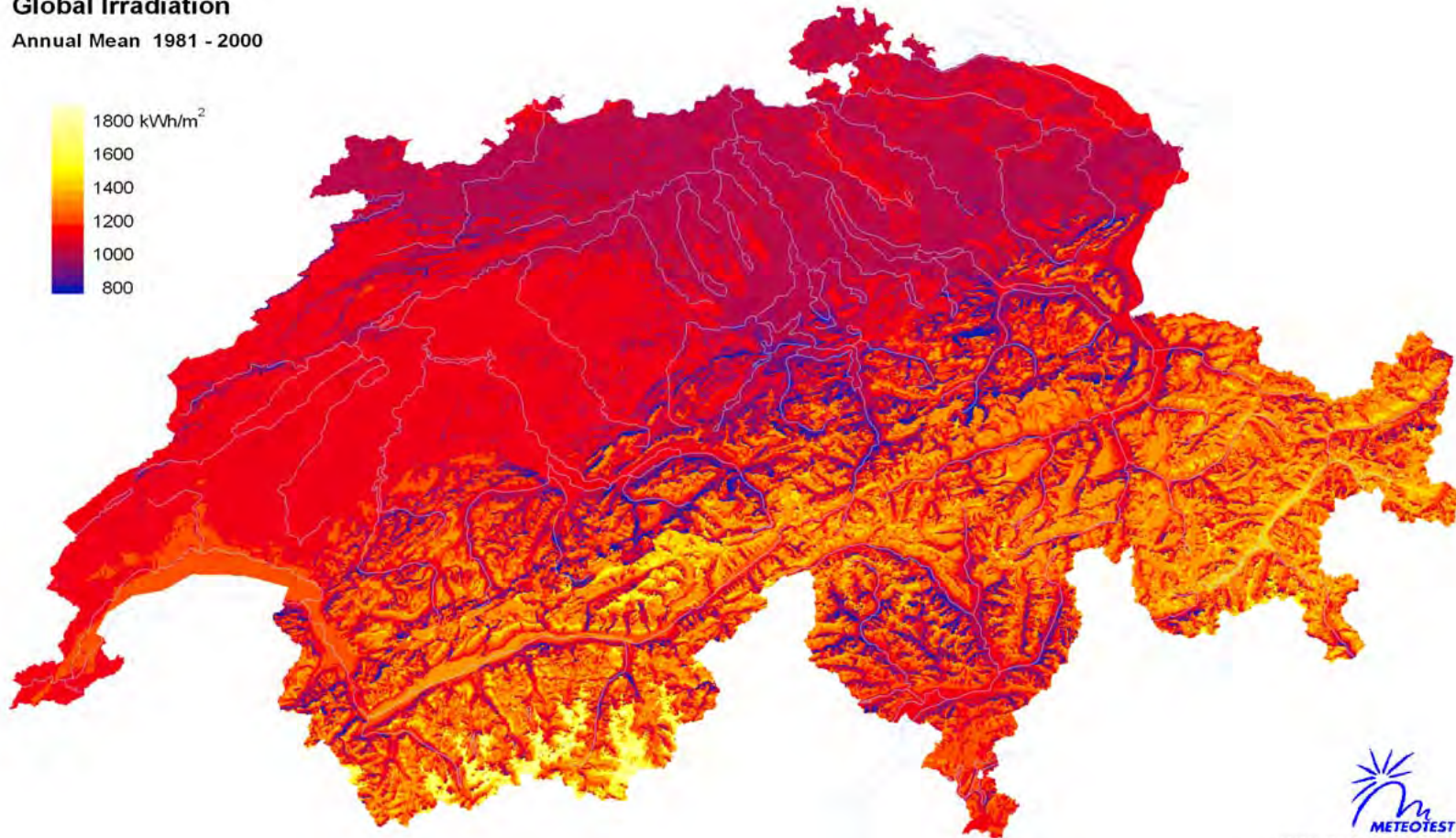
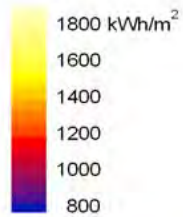
Prof. Marilyne Andersen | Dr. Bernard Paule

DAYLIGHT IS FAMILIAR, BUT NOT ALWAYS INTUITIVE



Solar Resource in Switzerland

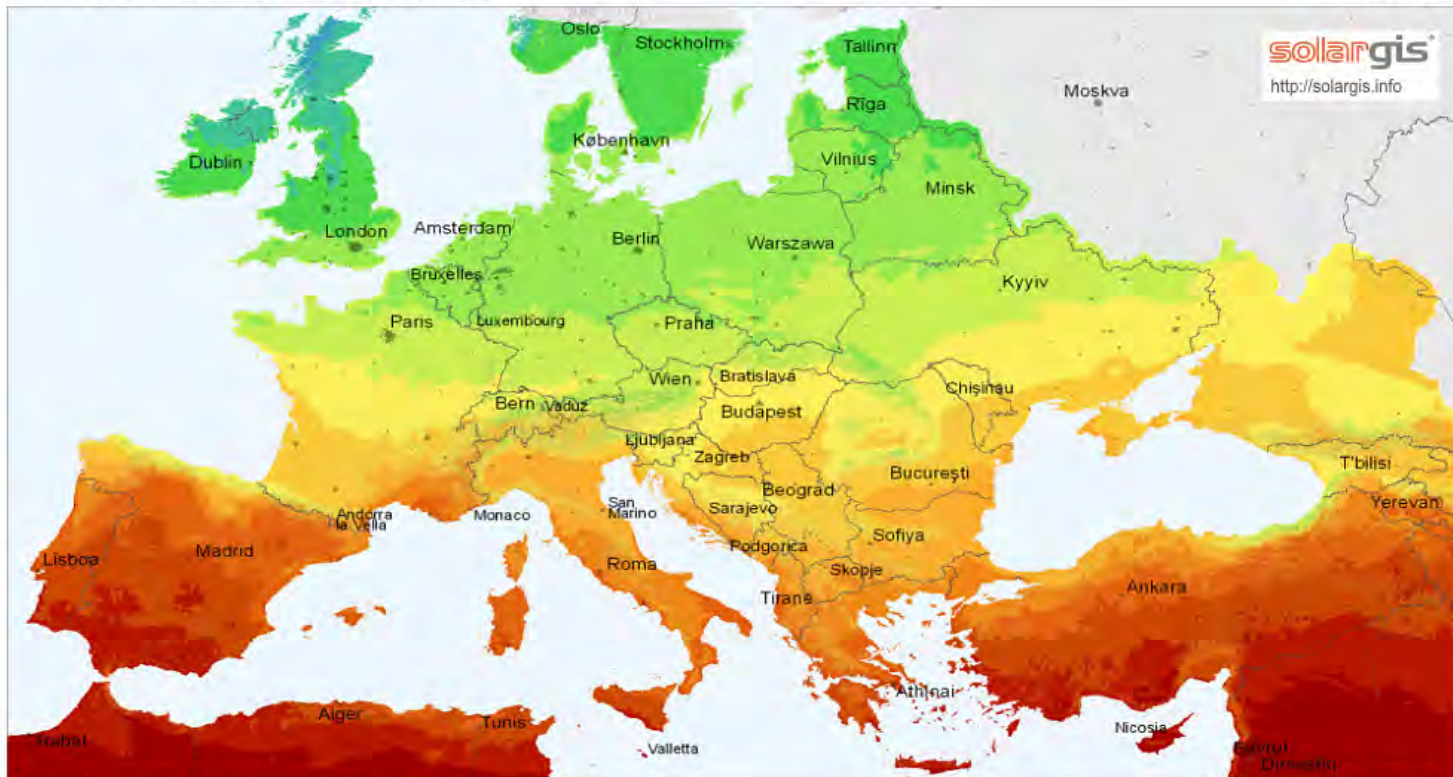
Global Irradiation
Annual Mean 1981 - 2000



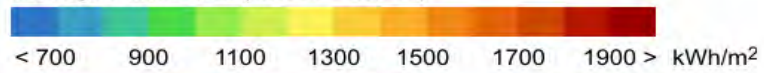
Solar Resource in Europe

Global horizontal irradiation

Europe



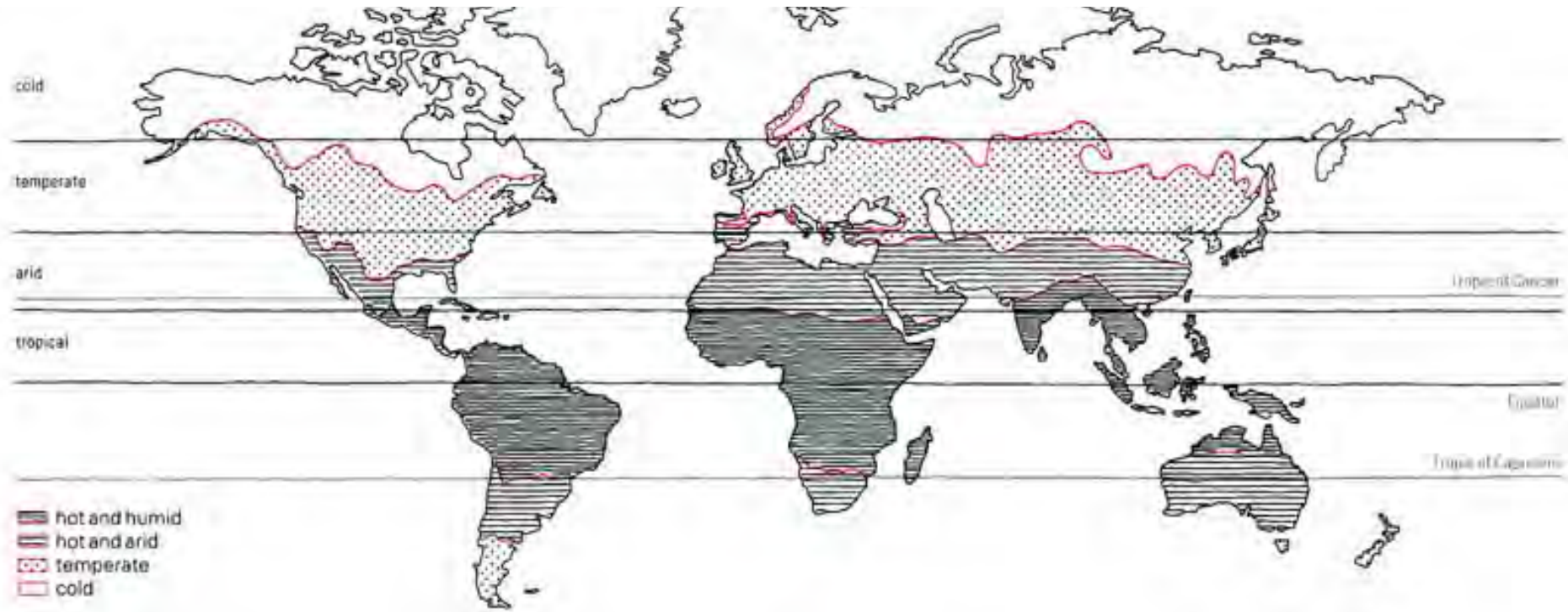
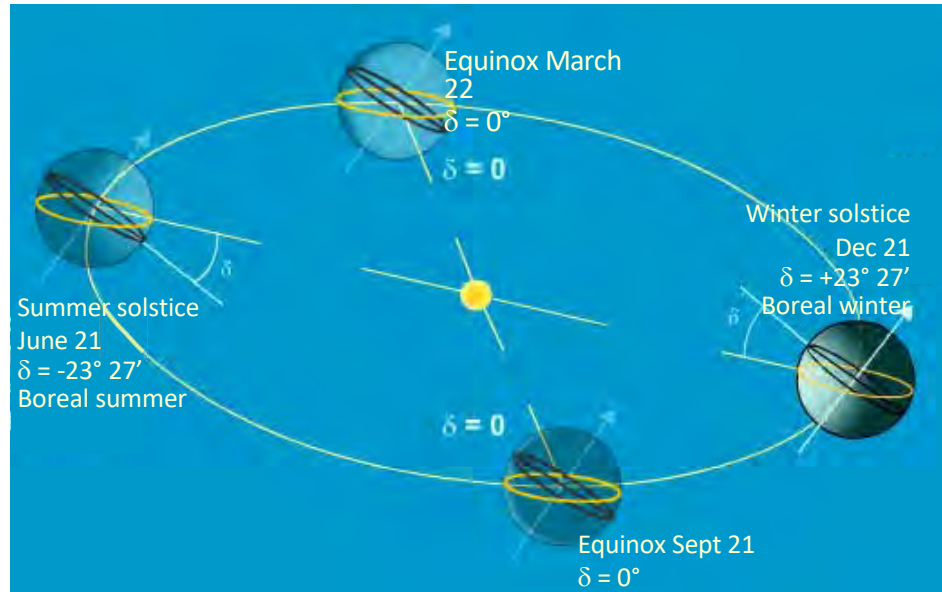
Average annual sum (4/2004 - 3/2010)



0 250 500 km

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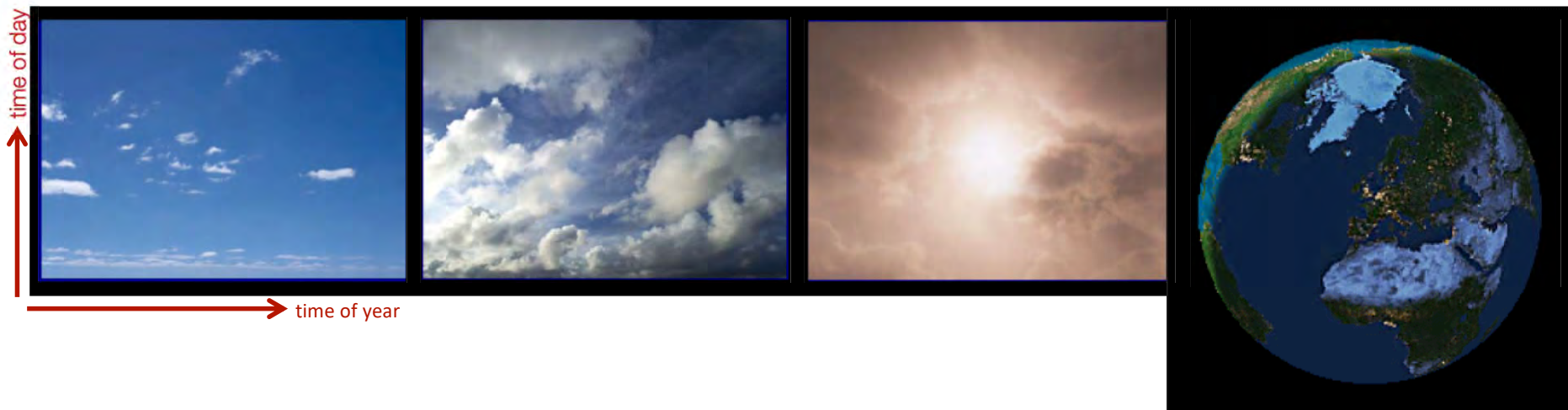
Climate «is» latitude



Daily dynamics



Image credit: StevenRutledge



Weather dynamics

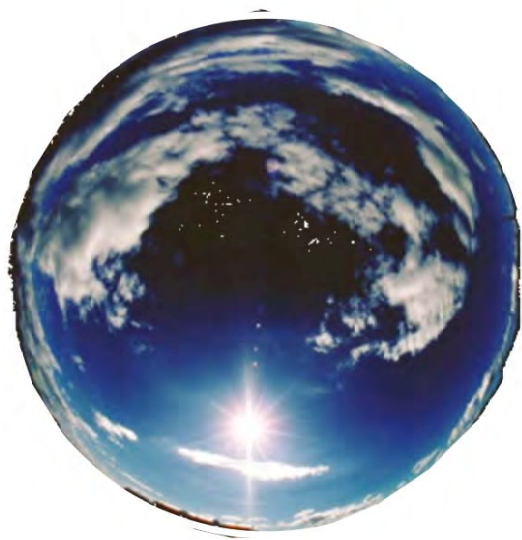
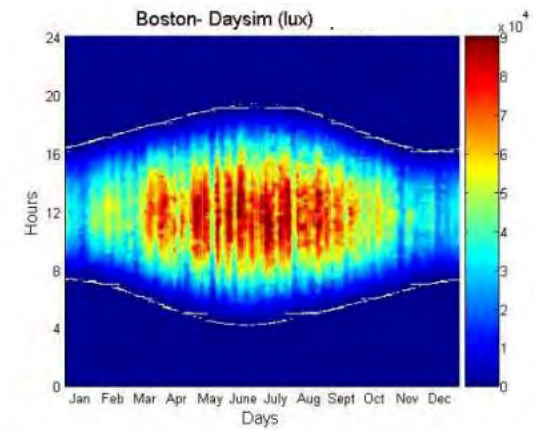
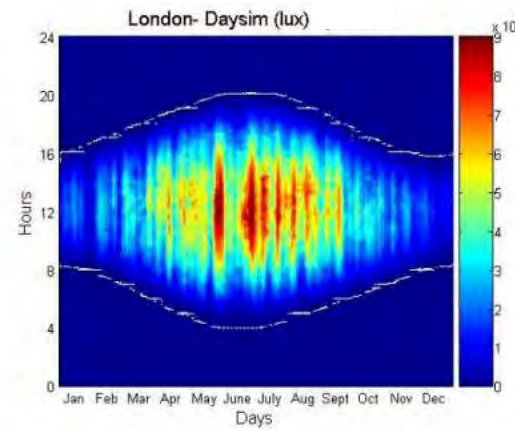
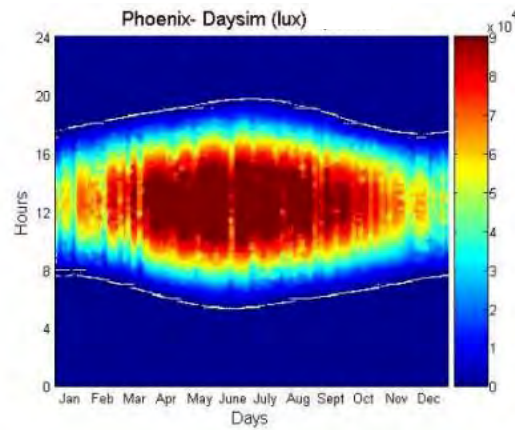
influence of cloud cover (and time of day) on visual perception of environment



Image courtesy from B. Paule - West view from EPFL campus

Weather dynamics

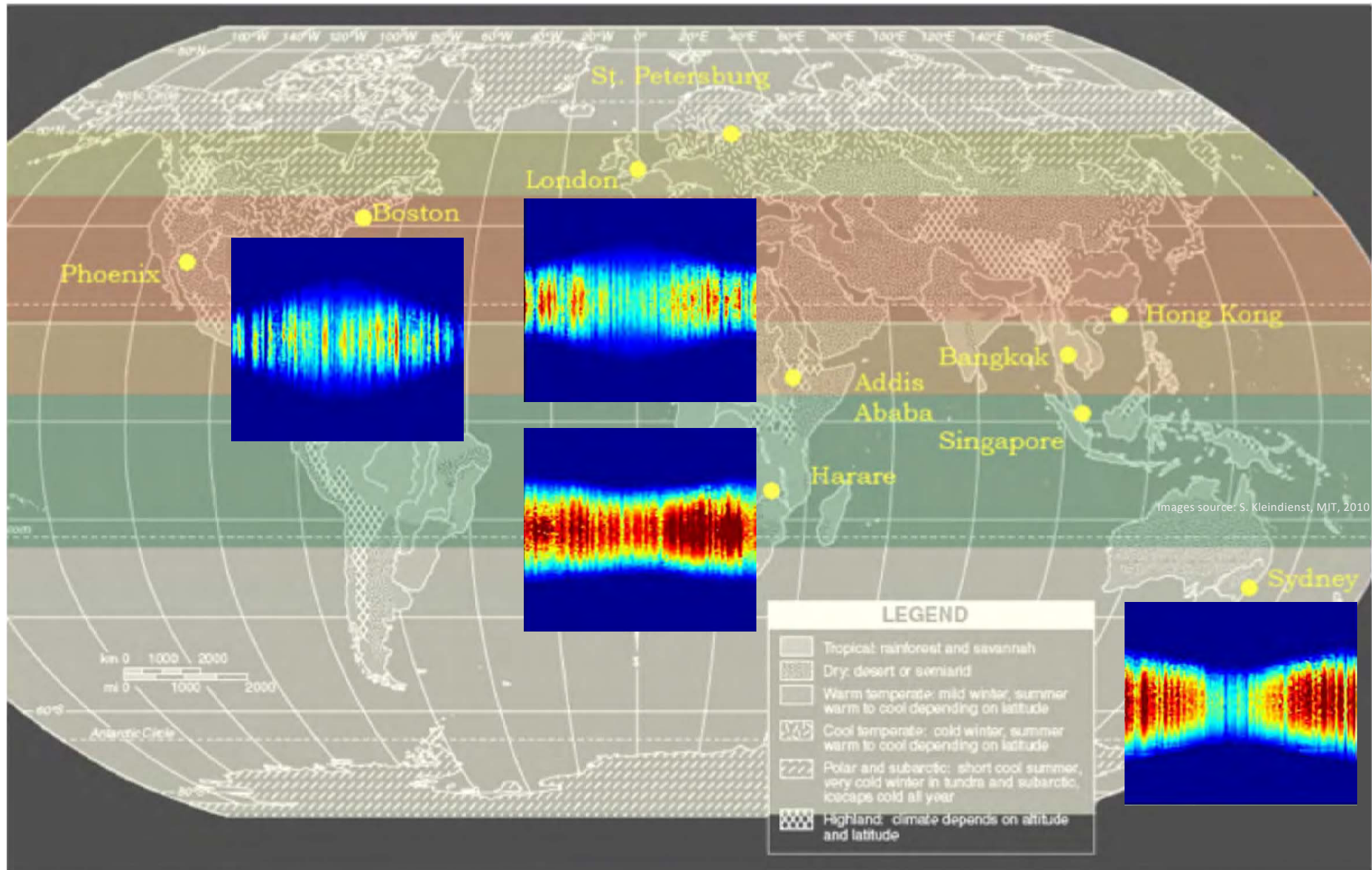
annual horizontal illuminance for different local climates at similar latitudes



Photographs by: B. Paule

Annual dynamics over the globe

annual vertical irradiance in different regions



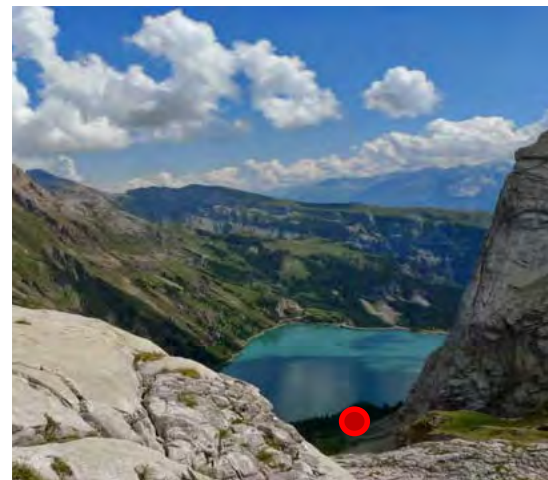
Contribution of sky components

← **direct** vs. diffuse →

Sky type	Clear	Milky-white	Partly cloudy	Whitish	Light grey	Dark grey	Dark
Sun	Shiny	Clear	Partly veiled	Veiled	Still visible	Barely visible	Invisible
Global radiation [W/m²]	800 to 900	600 to 800	300 to 700	250 to 400	200 to 300	100 to 200	20 to 100
Diffuse component	10 to 20%	20 to 40%	20 to 50%	40 to 80%	50 to 100%	75 to 100%	100%

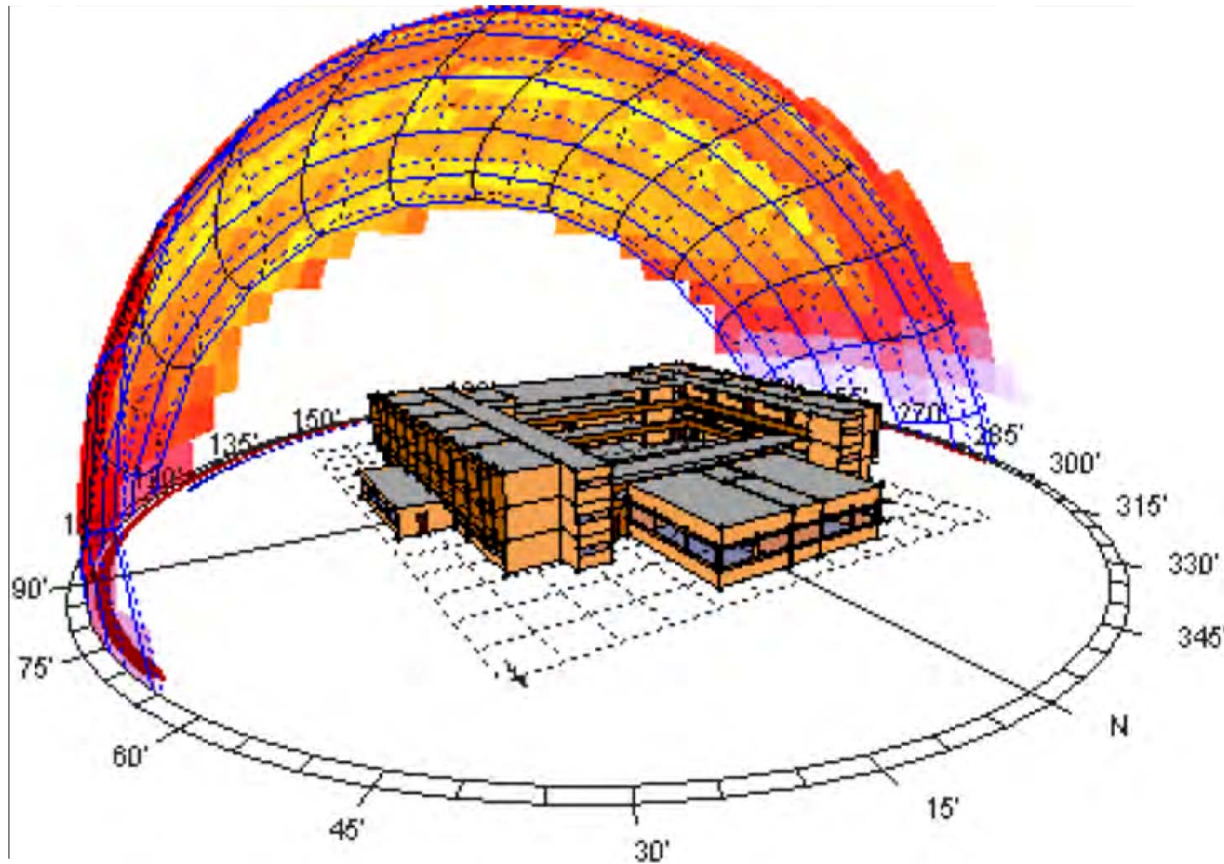
Contribution of urban and natural surroundings

obstruction from buildings and from topography

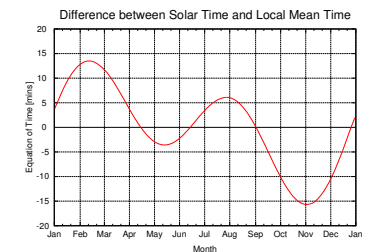


Sun course

stereographic projection to evaluate direct sunlight potential

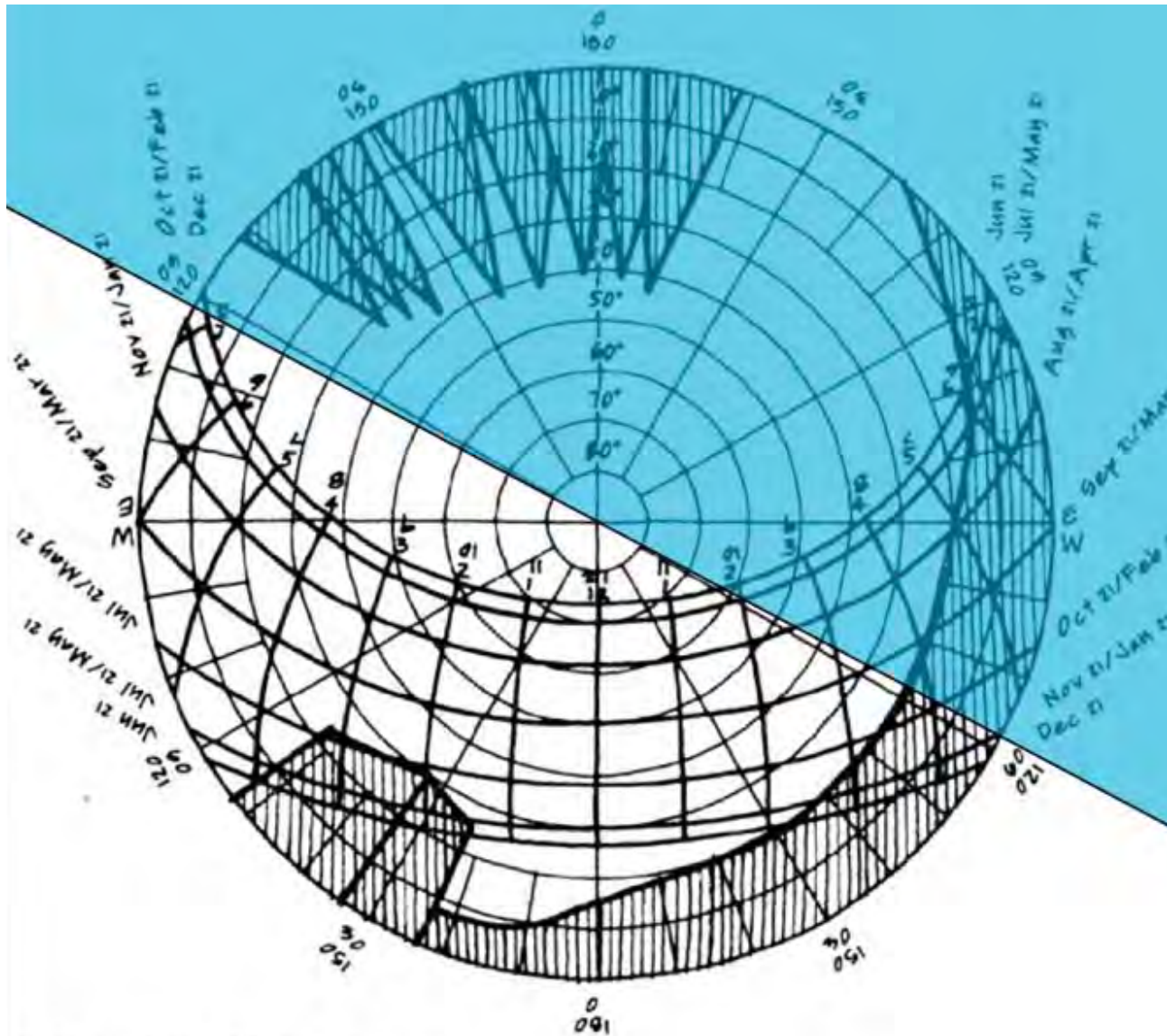


! difference between solar time and legal time !

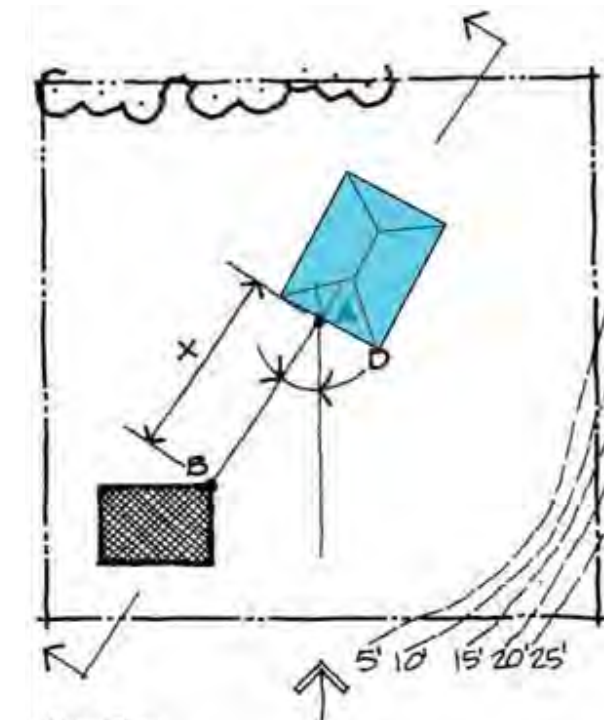
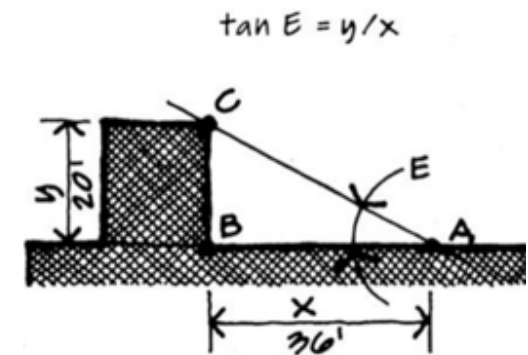


Using a stereographic projection

impact of urban/natural obstructions – ONE façade orientation at a time !



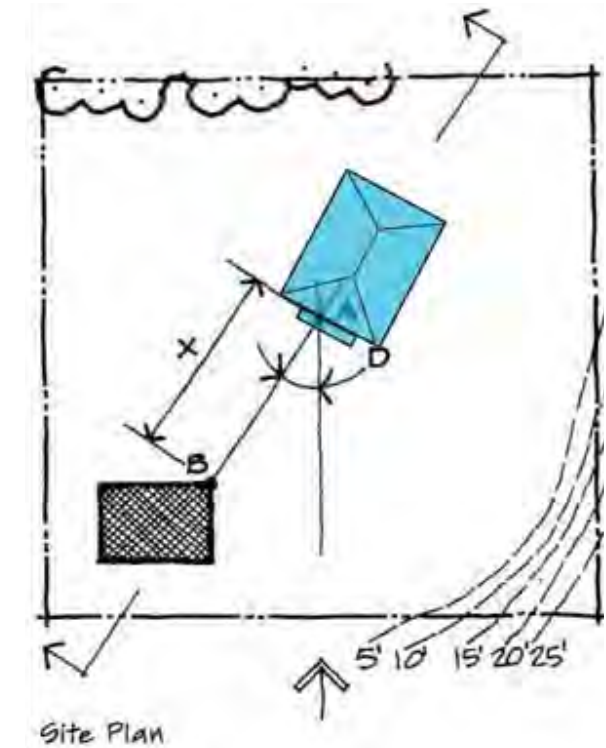
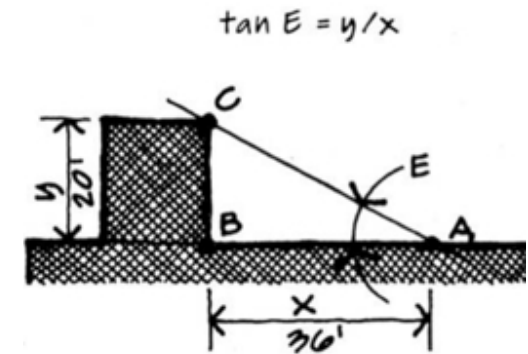
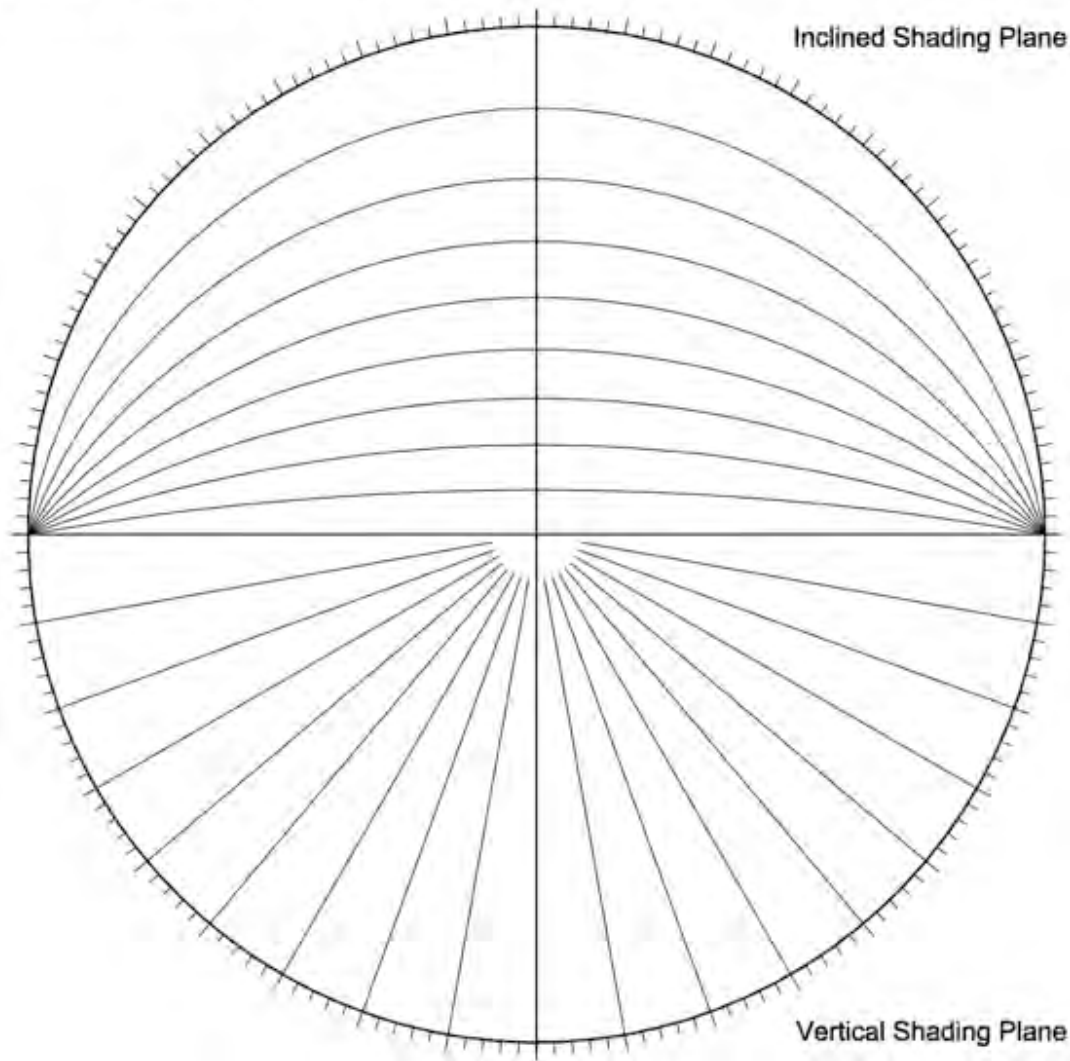
Plot of Site Obstructions



Site Plan

Using a stereographic projection

impact of solar protections (shading mask) – angular referential (dimensionless)



Using an artificial sun

shadow analysis with heliodons

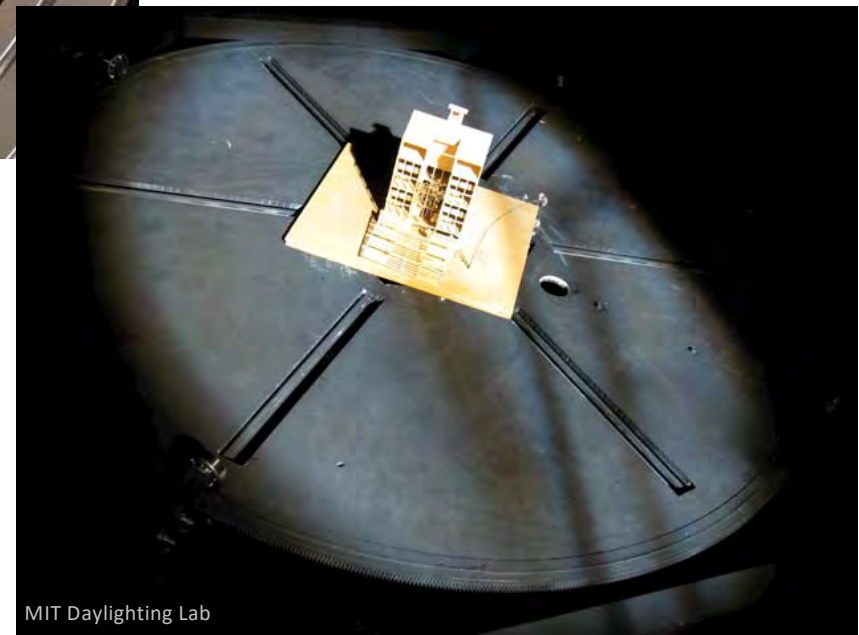


manual heliodon (intuitive)



EPFL-LIPID Lab

motorized heliodon



MIT Daylighting Lab