The colour(s) of the sky - Bridging the theory and practice: Implementation, Benefits and Application Areas

Aicha Diakite, Technische Universität Berlin
DAYLIGHT

Photos: Aicha Diakite
DAYLIGHT

Photos: Aicha Diakite
DAYLIGHT

Temporal Changes
DAYLIGHT
DARGHENIGHT

Spatial Variability
DAILIGHT

Temporal Changes

Spectral Distribution

Spatial Variability

Photos: Aicha Diakite
SKY MODELS

Luminance Distribution

CIE Standard General Sky
ISO 15469:2004(E)/CIE S 011/E:2003

All-Weather Model
Perez et al. 1993

Spectral / CCT Distribution

D65
PRACTICAL APPLICATION
PRACTICAL APPLICATION

6000 K

8200 K
SPATIALLY RESOLVED SPECTRAL DATA

September 12 2016. 08:04 UCT = 09:00 TST, Berlin
SPATIALLY RESOLVED SPECTRAL DATA
SPATIALLY RESOLVED COLORIMETRIC DATA
RECONSTRUCTION OF SPDs

- Judd et al. (1964) | CIE 15:2018
- Rochester (US), Enfield (UK) and Ottawa (CA)
- 622 SPDs for CCTs between 4000 K and 25000 K
PRACTICAL APPLICATION
GOAL: To enhance user well-being and performance in interiors

Measure – Describe – Evaluate – Use
Spectral Daylight Potential Diagrams (SDPDs)
SDPDs

Aicha Diakite, Velux Symposium 2019, Paris | 22
Exemplary SDPDs

CIE 3:12
Summer 2015
Orientation 1° steps
UTC 7:30 a.m. - 8:30 a.m.
DISSEMINATION

Lighting Recommendations
IEA SHC Task 61/ EBC Annex 33 on “Integrated Solutions for Daylighting and Electric Lighting”
SPECTRAL SKY MODELS
SPECTRAL SKY MODELS

CIE Standard General Sky
ISO 15469:2004(E)/CIE S 011/E:2003

All Weather Model
Perez et al. 1993

CCT = f(L, x1, x2, …)
TU Berlin

S(λ) = f(CCT)
Judd et al. 1964
CIE 015:2018
Simulation tools

Implementation in Radiance in collaboration with Jan Wienold - LIPI EPFL

Implementation – examples and comparison


I_{up} = 755 W/m^2

γ = 15.8°, ε = 12, very clear sky

Preetham, t=2
(M. Stock)
Perez (color, Diakite)
Perez (grendayik)
CIE (peunks)
SPECTRAL SENSOR

- Spatial and spectral data (rgb sensors)
- Determination of the incident daylight for integrative lighting solutions
- For areas (for more than one building)
RESEARCH
RANGE OF THE MEASUREMENTS
WORLD WIDE MEASUREMENT CAMPAIGN
WORLD WIDE MEASUREMENTS

Picture: Petr Dlouhý [https://commons.wikimedia.org/wiki/File:A_large_blank_world_map_with_oceans_marked_in_blue.svg)
DAYLIGHTING AND INDOOR LIGHTING TEAM

Daylighting and Indoor Lighting Group Leader
Dr Martine Knoop

Sensor Development
Nils Weber

Directionality of IIL-Effects
Kai Broszio

Spectral Models & Daylight Planning
Aicha Diakite

Virtual Reality Light
Silke Müller

Spectral Data: Simulations & IIL-Effects
Frederic Rudawski

Virtual Reality User Reaction
Marina Leontopoulou
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Lucas K. Liegener | Student Assistant
Sebastian Bremer | MA thesis
Eric Rockstäd | BA thesis

THANK YOU FOR YOUR ATTENTION!