

Aristotle University of Thessaloniki

Laboratory of Atmospheric Physics

Calculations of the human Vitamin D
exposure from UV spectral
measurements at three European
stations

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- Climatology of Vitamin D dose
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Short Introduction

- Solar UVB radiation:

Dangers

Cataracts and corneal injuries

Non cancerous skin diseases / Skin cancer

Burden on the health care system

DNA damage

etc.



Short Introduction

- Solar UVB radiation:

Benefits

Production of Vitamin D₃ against

Multiple sclerosis / rheumatoid arthritis

Type 1 diabetes

Prostate, colon and breast cancer

etc.

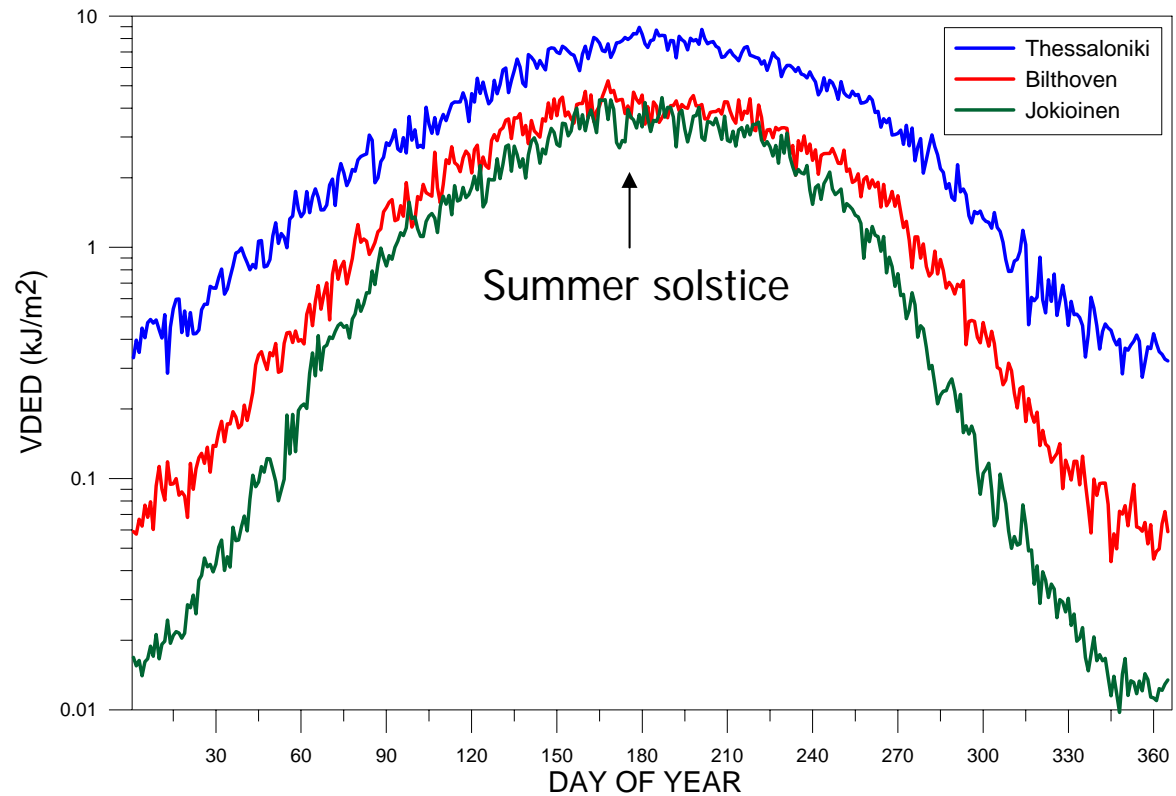
Climatology of Vitamin D dose

Stations' Latitudes

Thessaloniki: 40,39N

Bilthoven: 52,13N

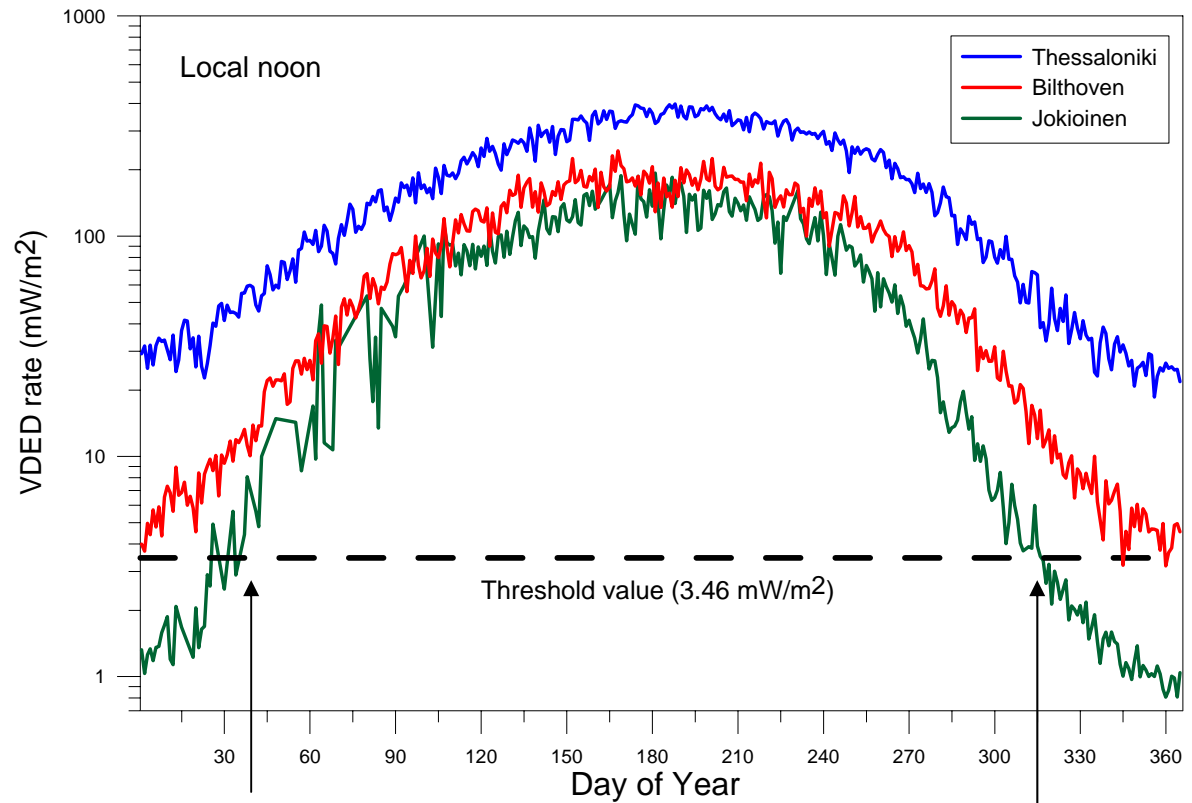
Jokioinen: 60,82N



Vitamin D effective dose (VDED)
as a function of the day of year

Vitamin D dose rates during the day

LOCAL NOON



Biological Effective
Dose_{threshold*} = 3.46 mW/m²

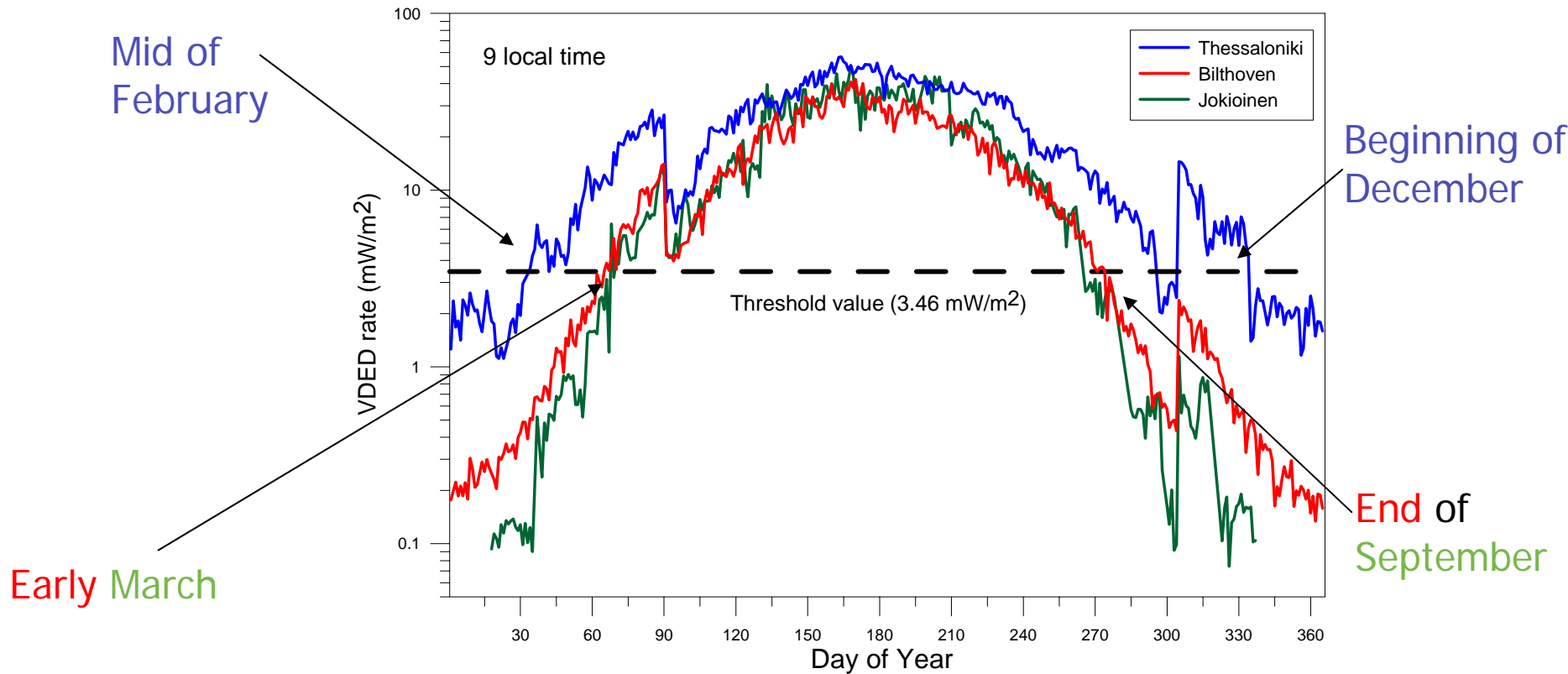
*Engelsen et al. 2005

End of January

Mid November

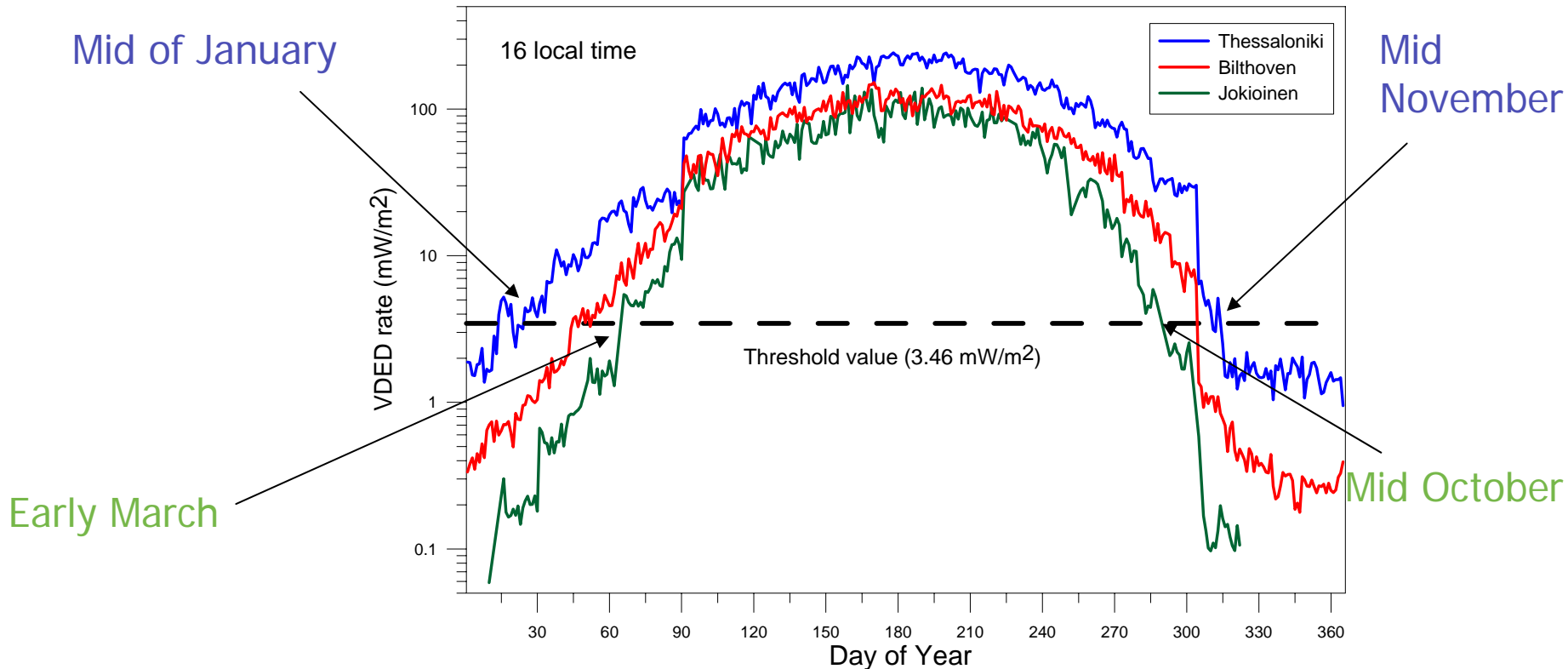
Vitamin D dose rates during the day

9 LOCAL TIME



Vitamin D dose rates during the day

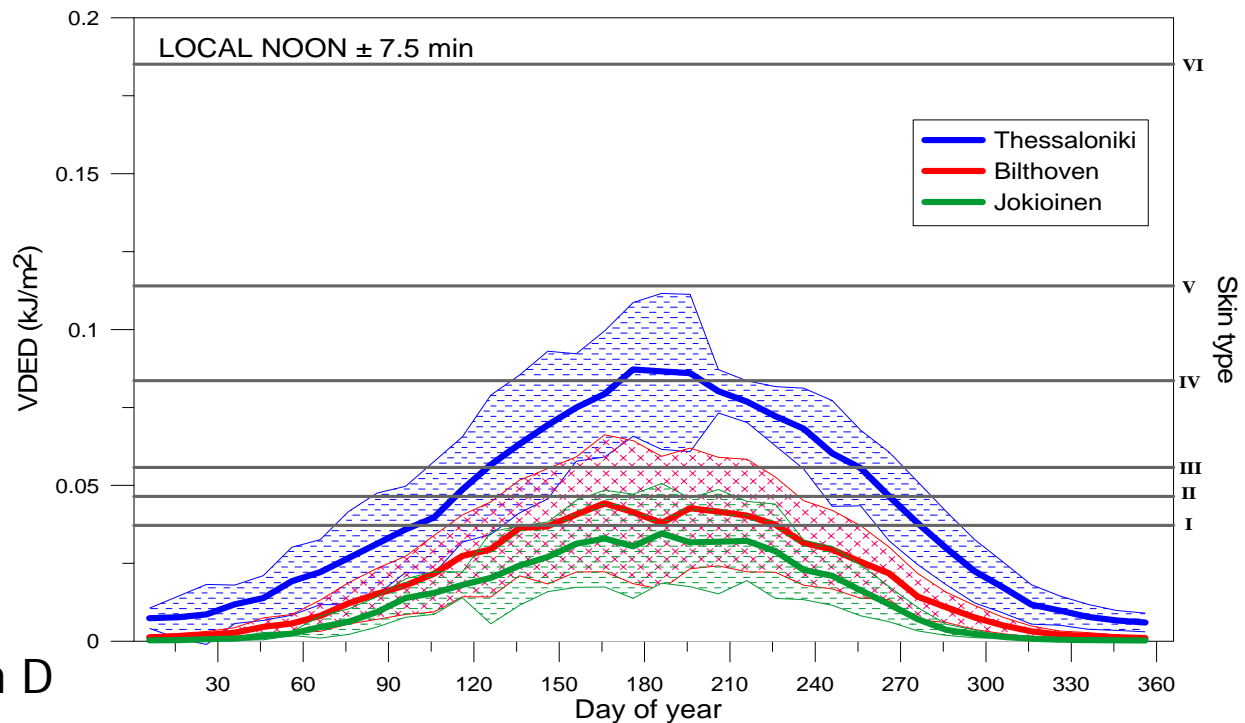
16 LOCAL TIME



Minimum recommended exposure for Vitamin D production

LOCAL NOON \pm 7.5 min

Skin type	Color
I	Caucasian; blonde or red hair, freckles, fair skin, blue eyes
II	Caucasian; blonde or red hair, freckles, fair skin, blue eyes or green eyes
III	Darker Caucasian, light Asian
IV	Mediterranean, Asian, Hispanic
V	Middle Eastern, Latin, light-skinned black, Indian
VI	Dark-skinned black

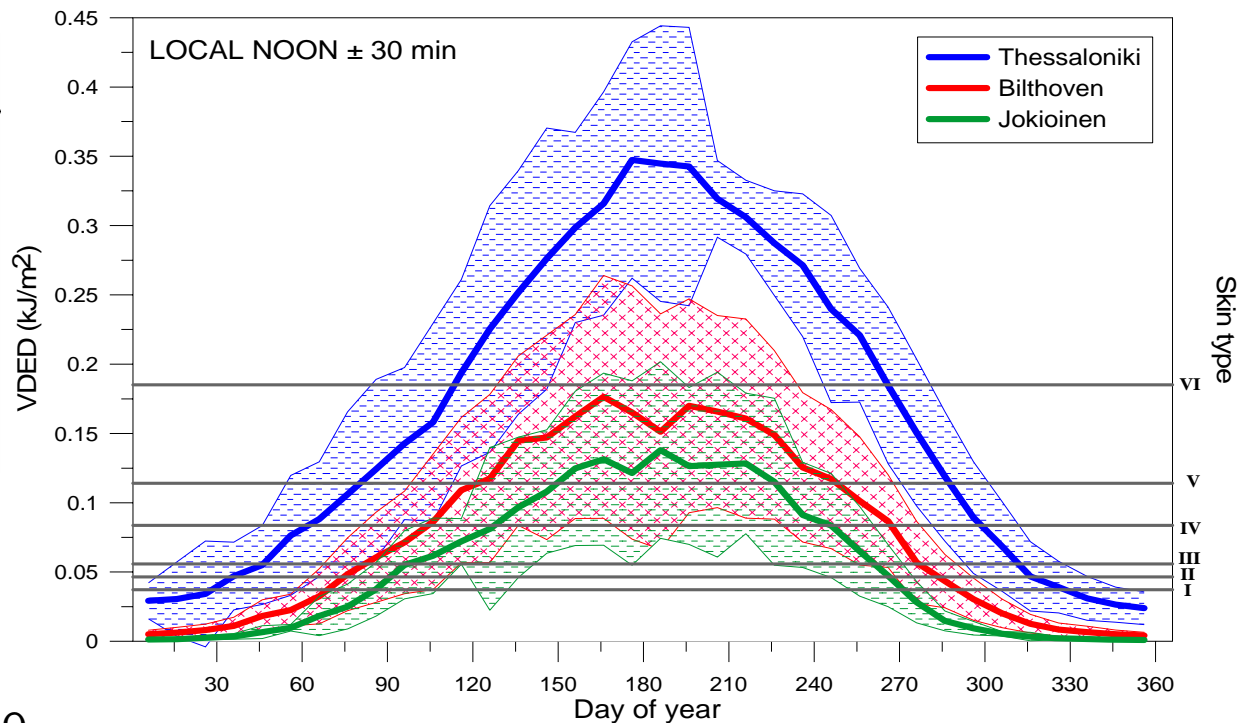


Standard Vitamin D Dose
 1 SDD: recommended UV
 Dose for adequate vitamin D
 synthesis in human skin

Minimum recommended exposure for Vitamin D production

LOCAL NOON \pm 30 min

Skin type	Color
I	Caucasian; blonde or red hair, freckles, fair skin, blue eyes
II	Caucasian; blonde or red hair, freckles, fair skin, blue eyes or green eyes
III	Darker Caucasian, light Asian
IV	Mediterranean, Asian, Hispanic
V	Middle Eastern, Latin, light-skinned black, Indian
VI	Dark-skinned black

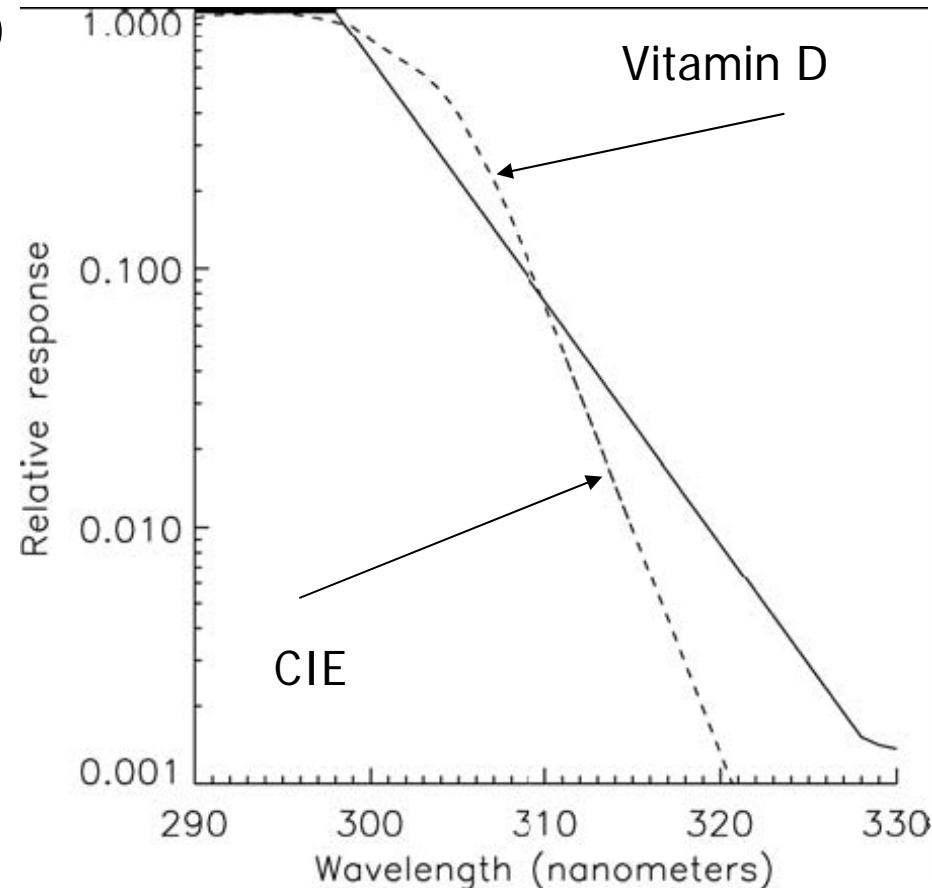


The sunburn is defined by the Minimal Erythemal Dose (MED)

Relationship between Vitamin D and Erythemal dose rates

- Can we estimate VDED rates from erythemal dose rates?
- Why isn't it a linear relationship?

A linear fit can introduce uncertainties from -50% up to +30%





Conclusions

- Usage of measurements under real atmospheric conditions for 10 to 16 years!
- The winter averaged values of VDED are from 20 (Thessaloniki) to 250 times (Jokioinen) lower than those of summer.



Conclusions

- Cutaneous Vitamin D cannot be produced for latitudes above 50° during winter, “Vitamin D winter”.
- When using MacLaughlin et al. action spectrum, the daily values decrease from 2.5% up to 8% during winter regarding to CIE’s and less than 2% in summer.



Thank you for your

- Attention and

- Patience

