Laboratory of Atmospheric Physics

Aristotle University of Thessaloniki

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

Melina Zempila
mzempila@auth.gr

* A. Kazantzidis et al. (2008), Journal of Photochemical and Photobiological Sciences

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Short Introduction (1/2)

- 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 (2/2)

- Solar UVB radiation:

  Benefits

  Production of Vitamin D_3 against:

  Multiple sclerosis/rheumatoid arthritis

  Autoimmune diseases

  Type 1 diabetes

  Prostate, colon and breast cancer

  etc.

Climatology of Vitamin D dose

Stations' Latitudes

Thessaloniki:40,39N

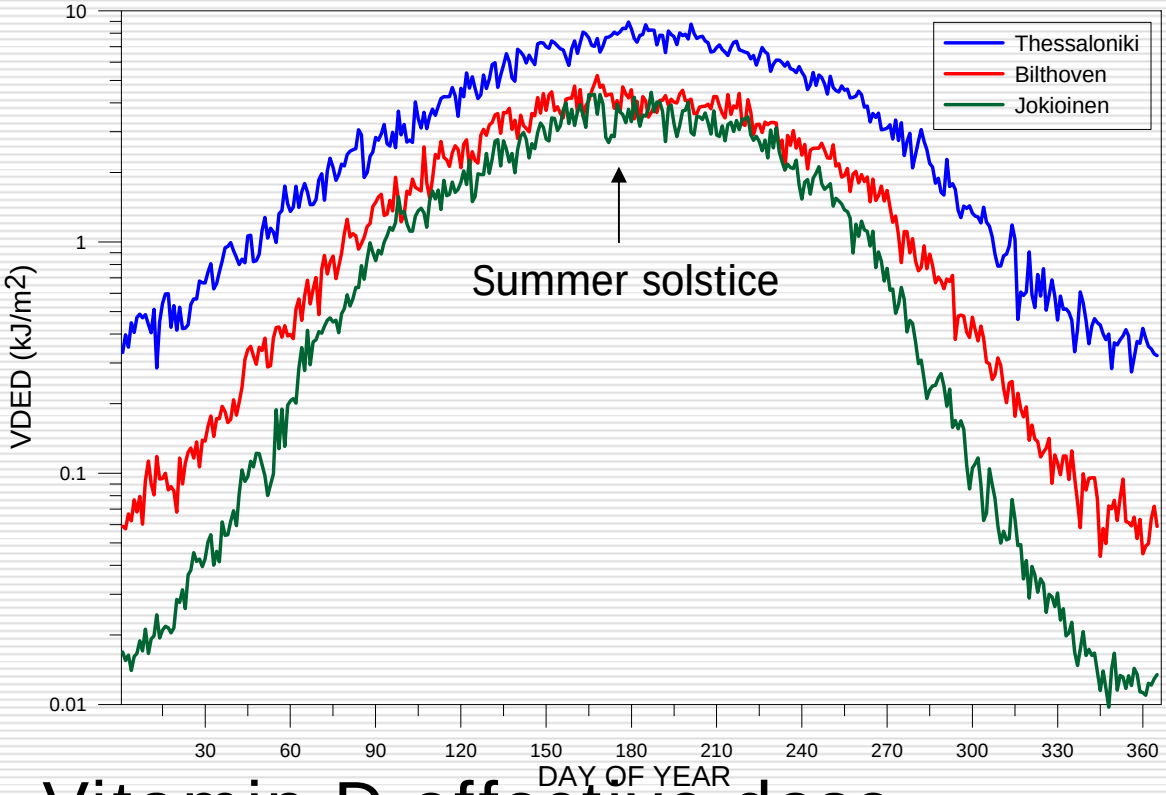
1990-2005

Bilthoven: 52,13N

1996-2005

Jokioinen: 60,82N

1996-2005



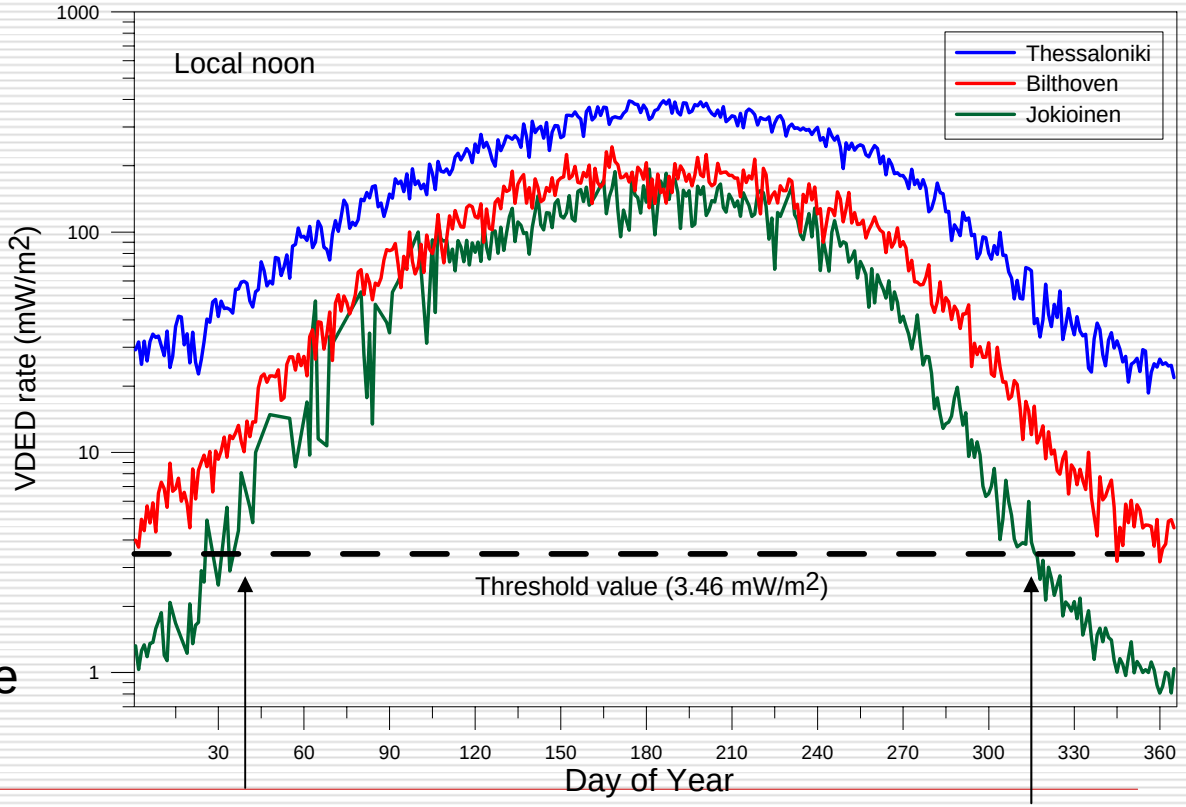
Vitamin D effective dose as a function of the day of year

Vitamin D dose rates during the day (1/3)

LOCAL NOON

The Biological Effective Dose threshold (BED), as defined by Engelsen et al. (2005), is 3.46 mW/m^2

McKenzie et al. (2008)
Even for more limited exposures the vitamin D produced would be non-zero. So the threshold/detection value is under discussion.

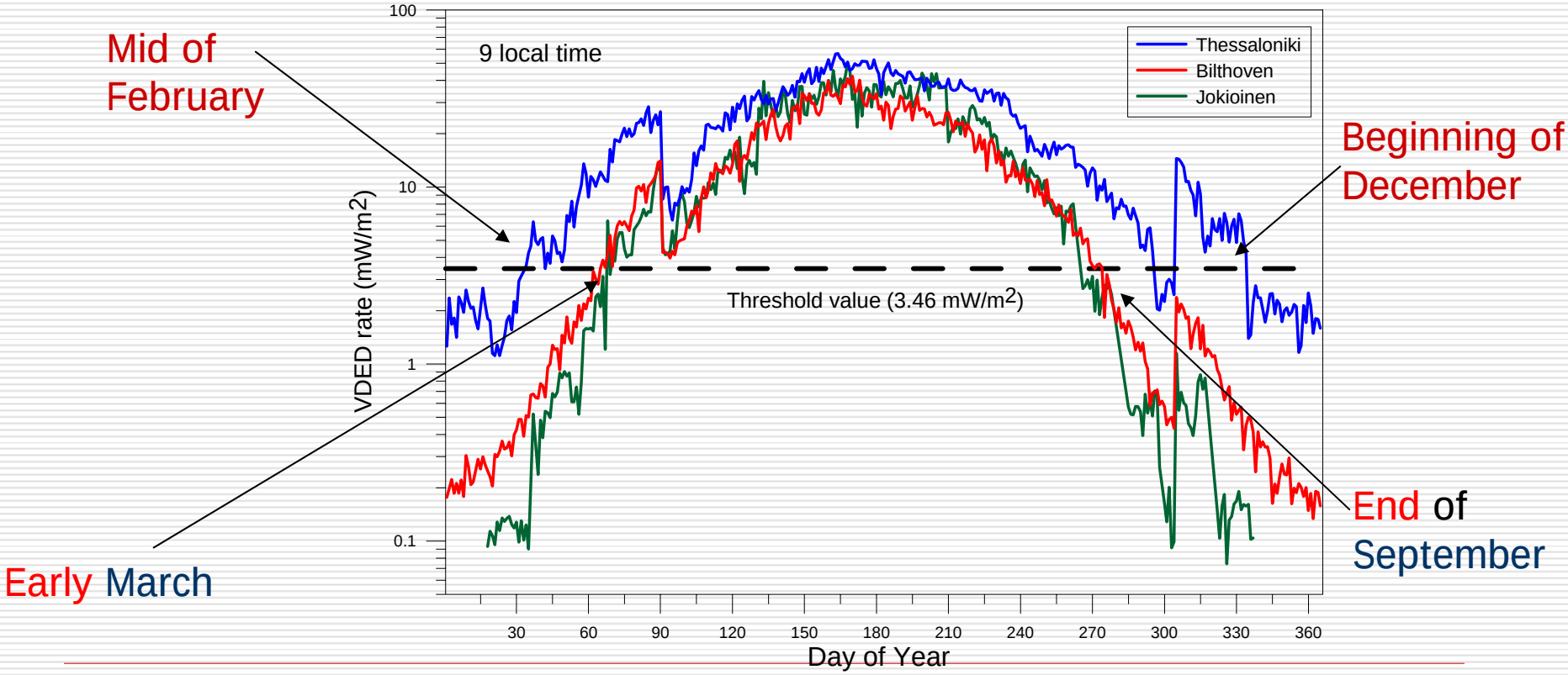


End of January

Mid November

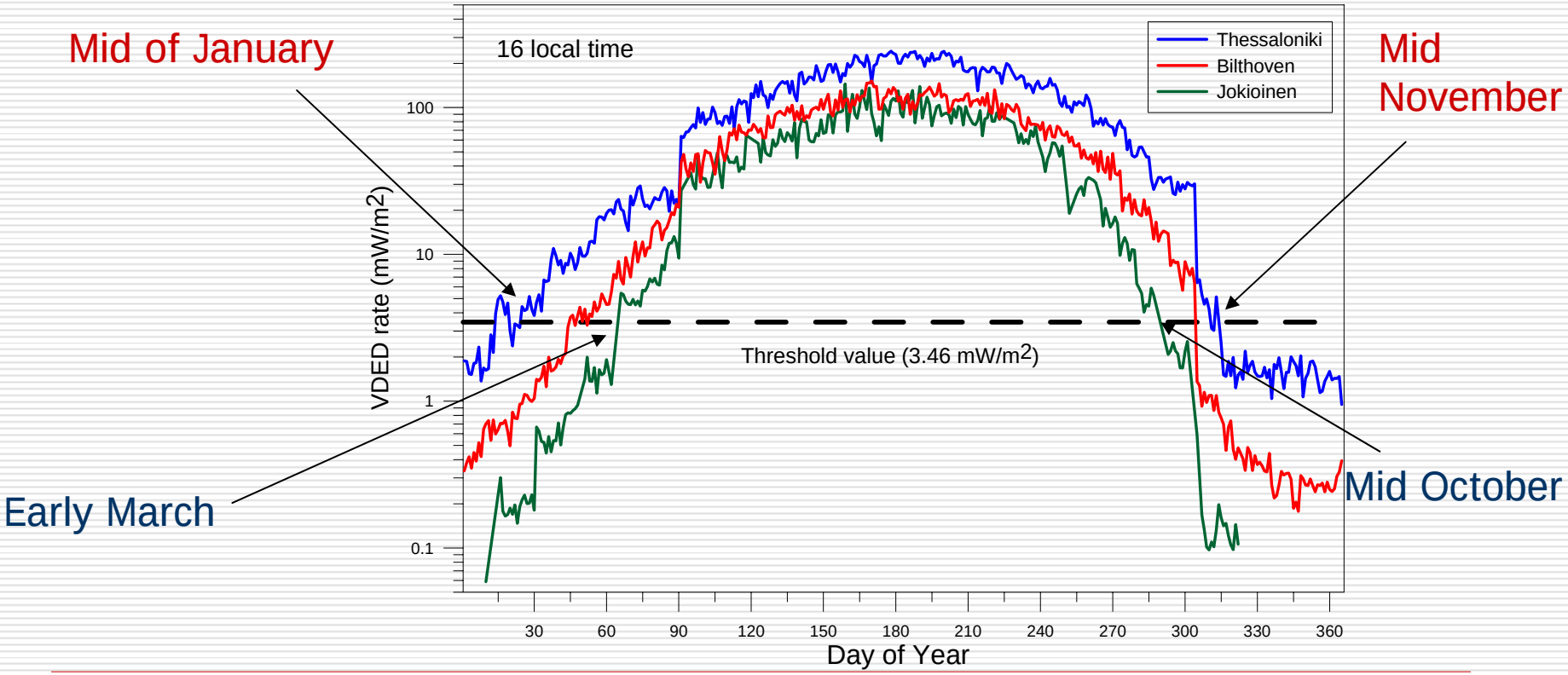
Vitamin D dose rates during the day (2/3)

9 LOCAL TIME



Vitamin D dose rates during the day (3/3)

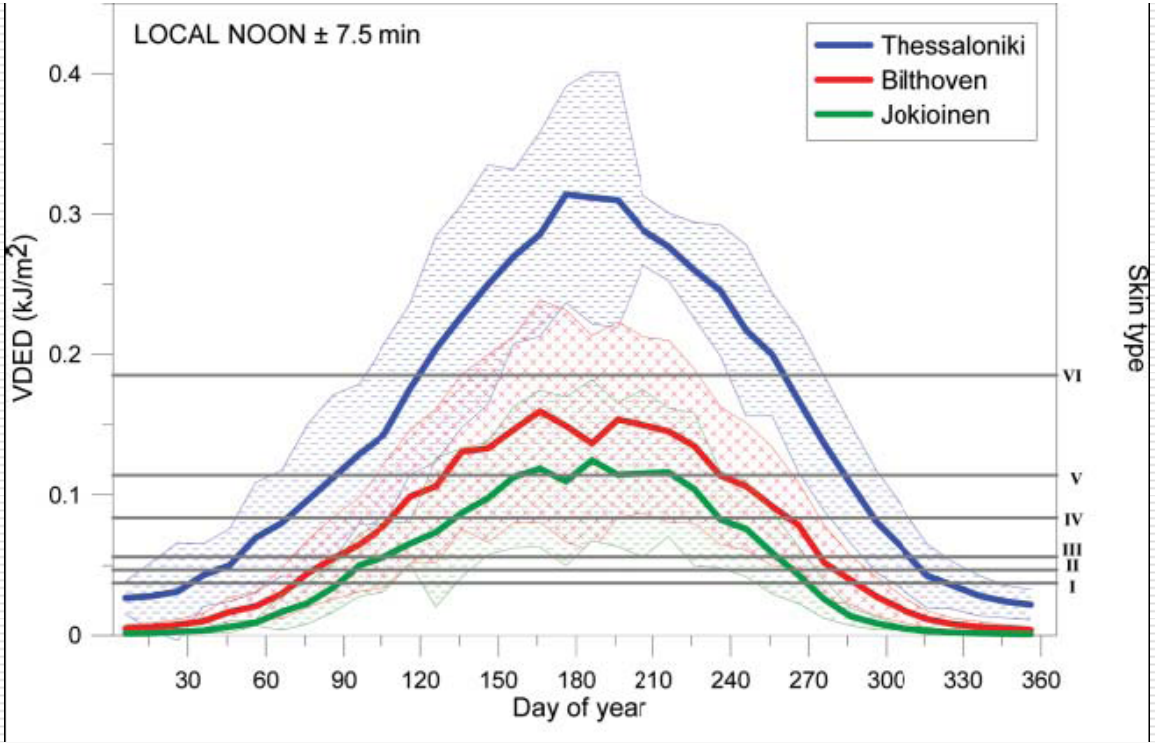
16 LOCAL TIME



Minimum recommended exposure for Vitamin D production(1/2)

LOCAL NOON ± 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

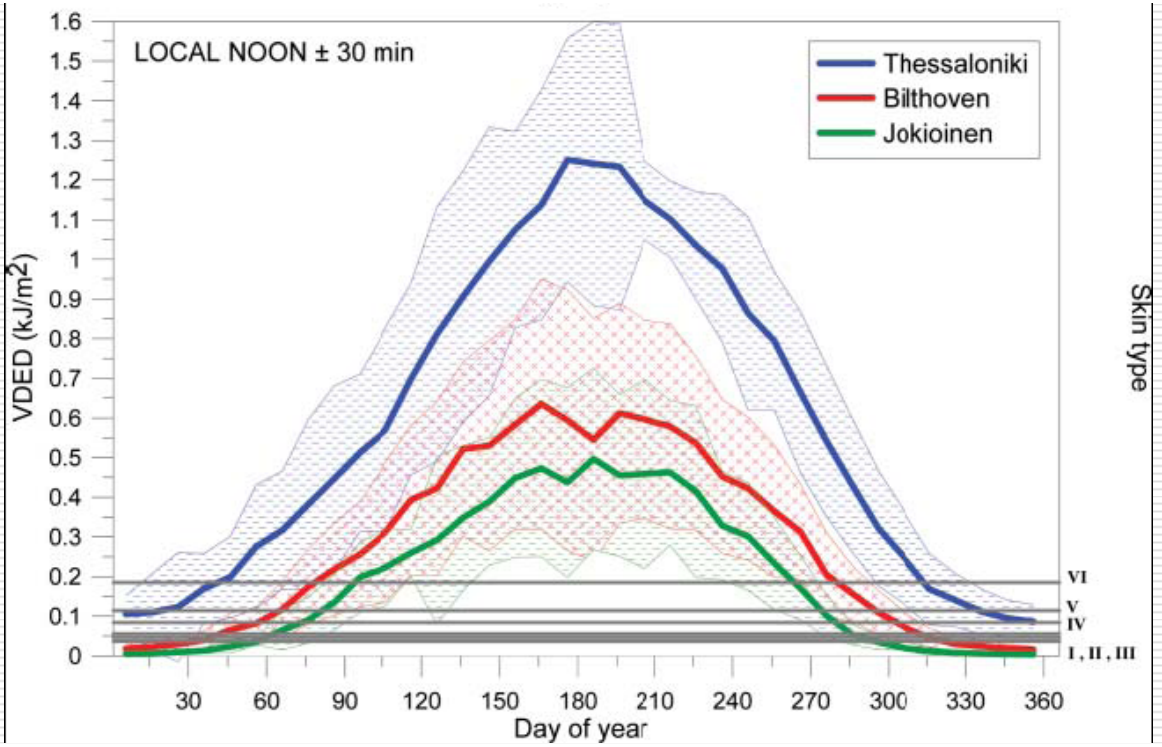
1 SDD: recommended UV Dose for adequate vitamin D synthesis in human skin defined by Webb and Engelsen. (2006).

Minimum recommended exposure for Vitamin D production (2/2)

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).

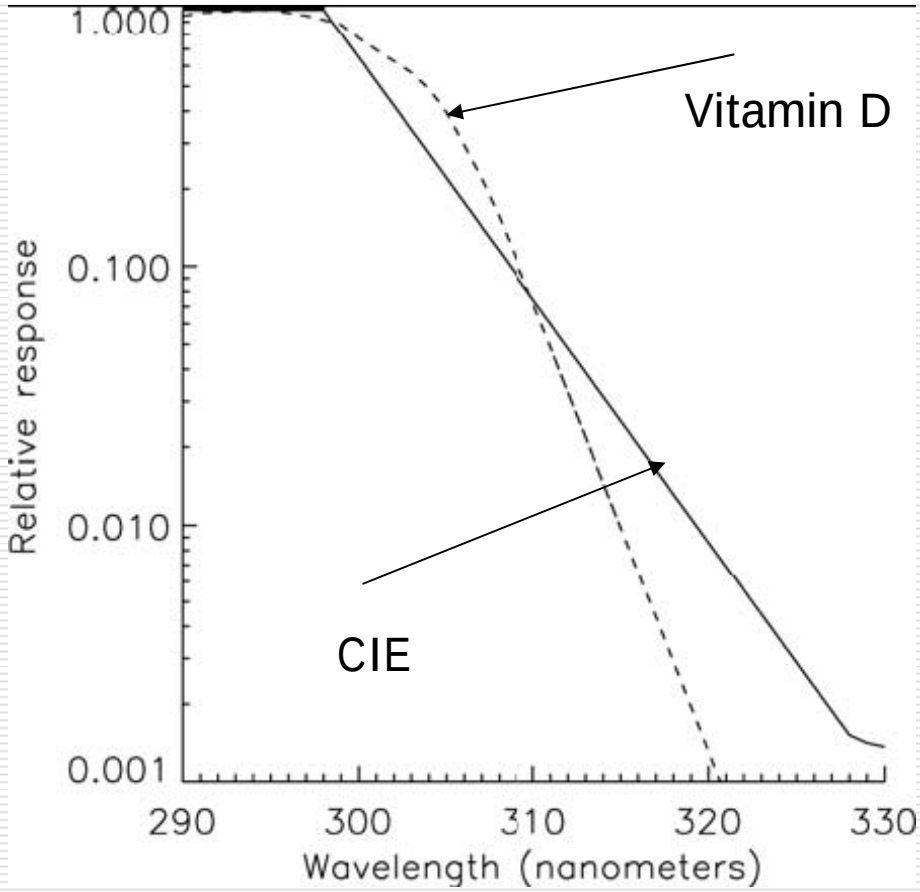
LOCAL NOON ± 30 min



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 (1/3)

- The maximum average daily VDED (from 3.5 at Jokioinen up to 8 kJ/m^2 at Thessaloniki) are observed during the second half of June.
- The winter averaged values of VDED are from 20 (Thessaloniki, Southern site) to 250 times (Jokioinen, Northern site) lower than those of summer.

Conclusions (2/3)

- The average values of VDED rates around local noon reveal the sustainability of the cutaneous production of Vitamin D at Thessaloniki & Bilthoven.
- At 9 & 16 local time this time period lies between 6.5 and 9.5 months at Jokioinen and Thessaloniki respectively.

Conclusions (3/3)

- Even for an exposure of one hour around local noon, no production of Vitamin D can be detected for skin types I-III in Bilthoven and Jokioinen throughout the year.
- When using MacLaughin et al. action spectrum, the daily values decrease from 2.5% up to 8% during winter and less than 2% in summer.

Thank you for your

- Attention and patience!
- Any questions/comments please…?

- Working team:

A. Kazantzidis, A. Bais, S. Kazadzis

P.N. den Outer, T. Koskela, H. Slaper. & me.