UV-radiation in Norway:

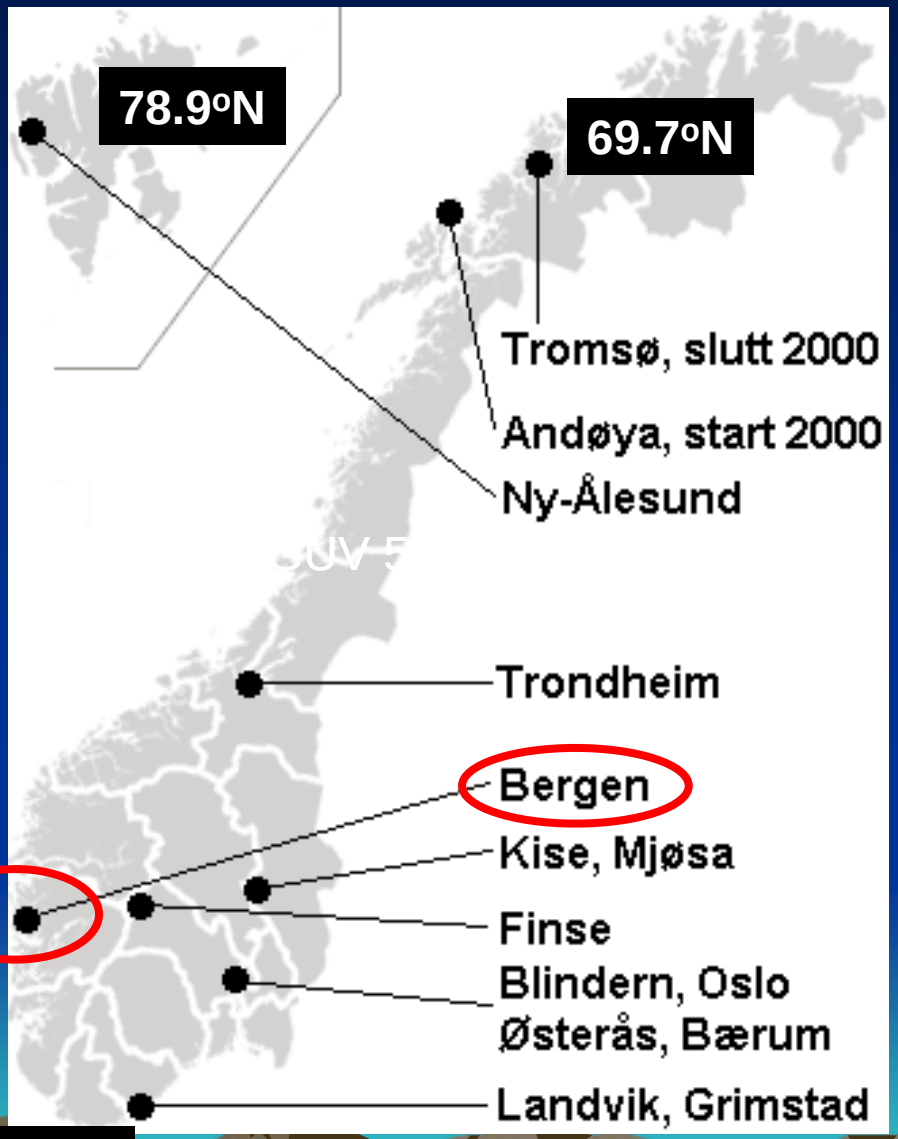
Measurements, Reconstructions and Applications

Jan Asle Olseth, Iselin Medhaug, Joachim Reuder,
Brynhild Berge Sjølingstad, Ottar Sætre

Geophysical Institute
University of Bergen

One century of UV Radiation Research
PMOD/WRC, Davos 18 - 20 September 2007

Norwegian UV network



COST726
Test site

Norwegian Radiation Protection Agency (NRPA)

GUV 541

Geophysical Institute (60.4ºN, 45 m.a.s.l.)
University of Bergen

Radiation Observatory

Geophysical Institute (45 m.a.s.l.)

Shortwave (solar) radiation

1. Sunshine duration
2. Global (total) solar radiation
3. Diffuse solar radiation
4. Direct normal radiation

Geophysical Institute (45 m.a.s.l.)

Shortwave (solar) radiation

5. UV radiation

Part of the
Norwegian UV network

Recent master theses on UV-radiation at Geophysical Institute

Ottar Sætre:

Observed and modelled UV-radiation in Bergen

(finished spring 2006)

Iselin Medhaug:

Reconstruction of UV-radiation and its potential implications on development of skin cancer

(finished summer 2007; Norwegian Cancer Registry)

Brynhild Berge Sjølingstad:

Reconstruction of UV radiation: UV exposure of the Arcto-Norwegian cod egg population, 1957-2005

(finished summer 2007; Institute for Marine Research)

Part of EU-project:
COST726 Long term changes and climatology of UV radiation over Europe

- **Estimation of erythemal UV in Bergen**
- **Comparison between modelled and observed values**

Model:

STAR – two versions:

- STARsci for clear sky
- STARneuro under actual cloud cover
  - ”Trained” on data from Garmisch-Partenkirchen

Variable input for STAR:

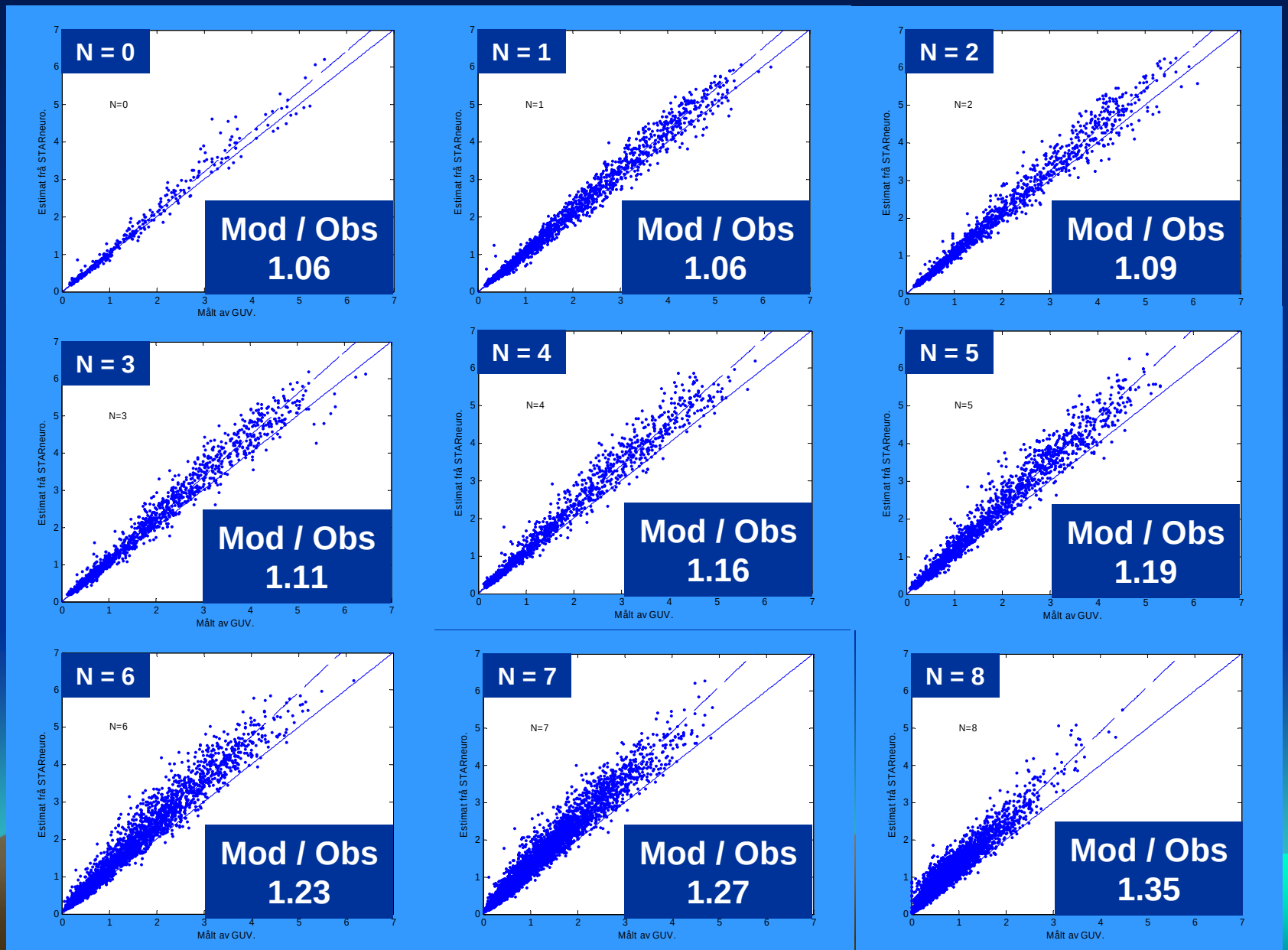
- Solar elevation
- Cloud amount
- Global irradiance
- Ozone
- Air pressure

Non-variable input for STAR:

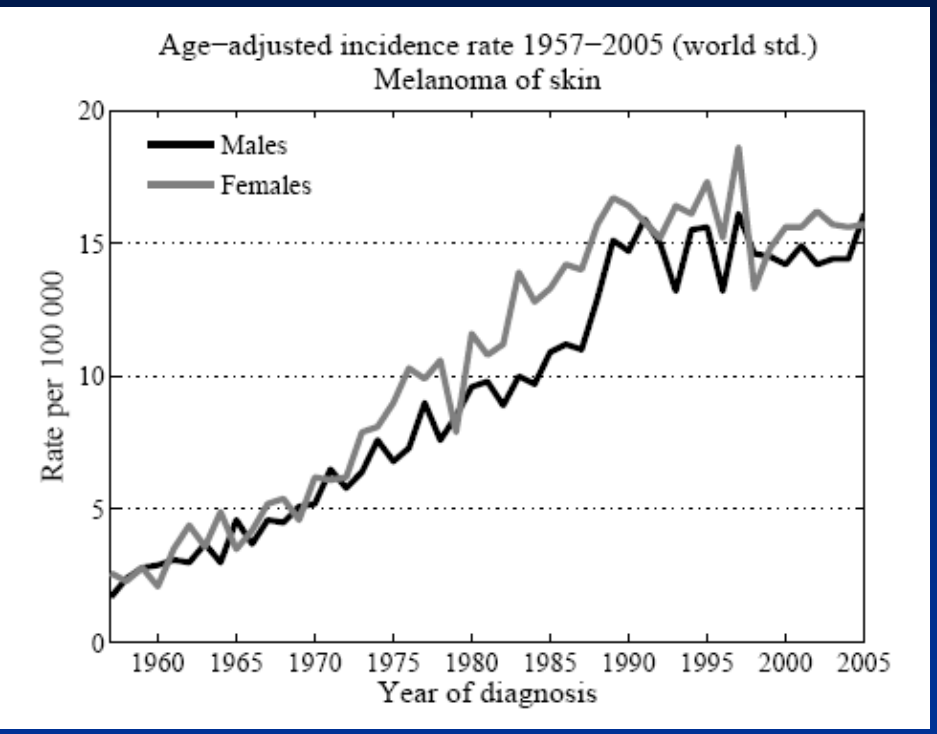
- Average continental atmosphere
- Aerosol optical depth (AOD) 0.20
- Albedo 0.03

O. Sætre: Observed and modelled UV-radiation in Bergen

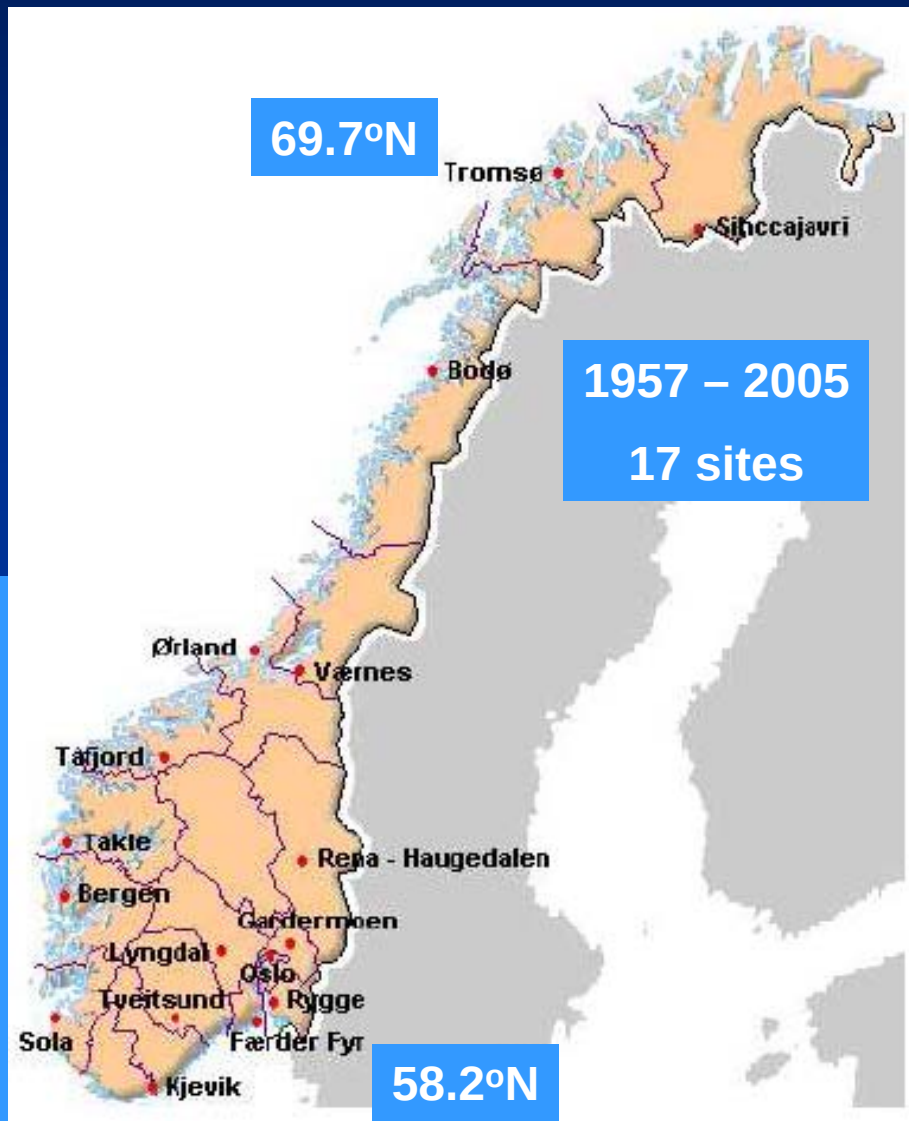
Comparison model results vs ground measurement for different cloud amounts N



I. Medhaug: ”UV-radiation and its effect on skin cancer in Norway”



Reconstruction of UV-radiation
One station in each county

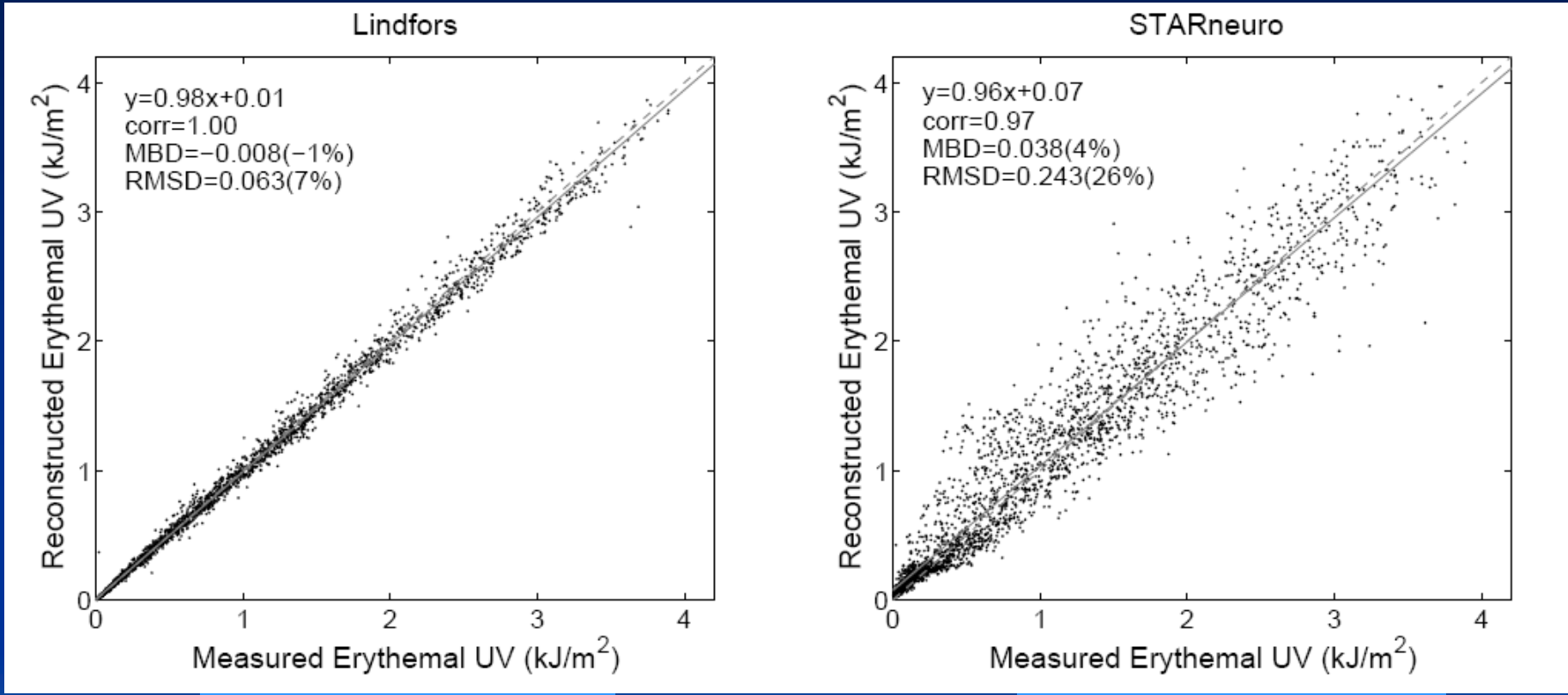


Model:
STARneuro

Input:
- Solar elevation
- Ozone
- Cloud information
- Turbidity
- Ground albedo

Daily values

Bergen



Global radiation as additional input

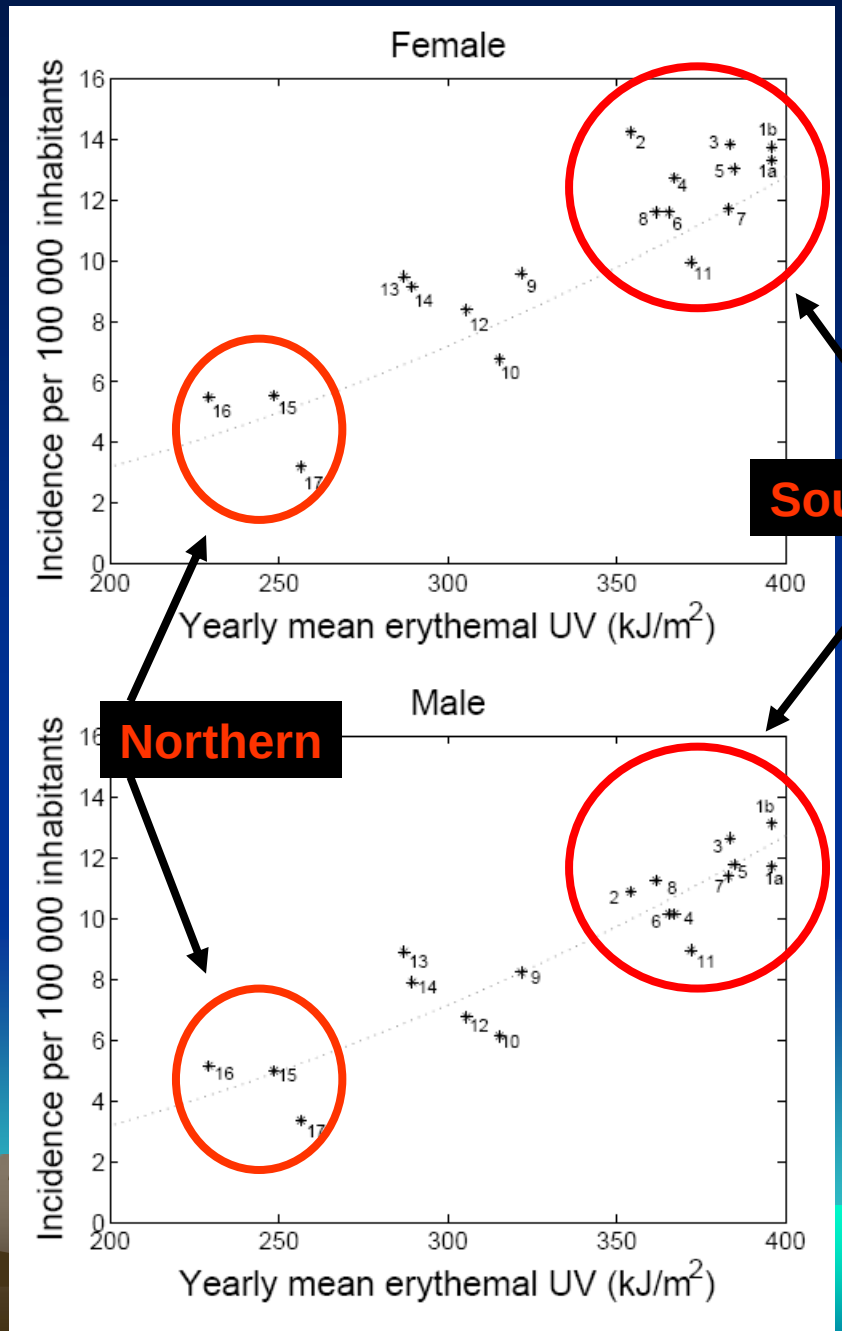
Only regular cloud info as input

Incidence rate of malignant melanoma

vs

Erythemal UV

(averages for 1957-2005)

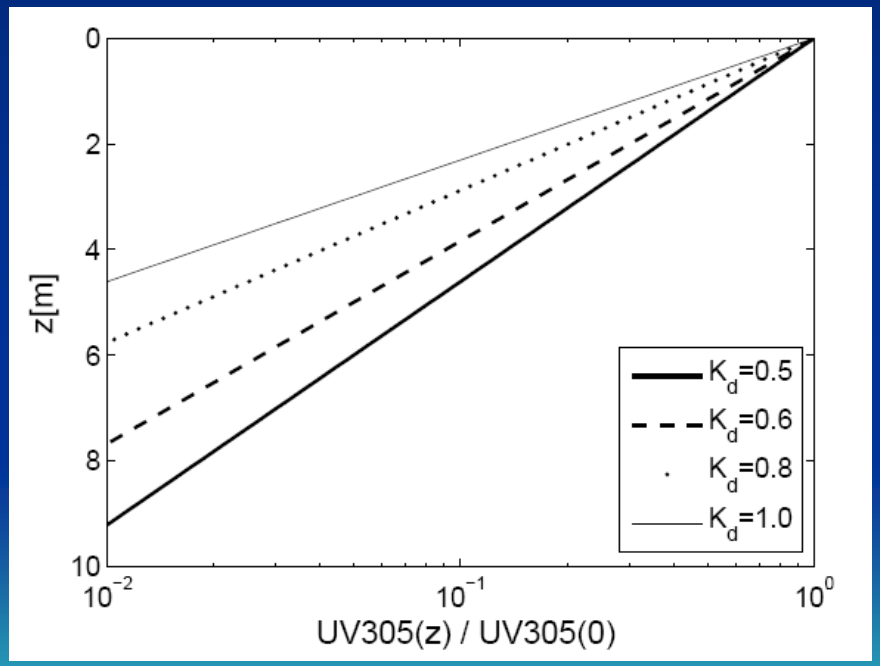


Cod-eggs are passively drifting in the ocean

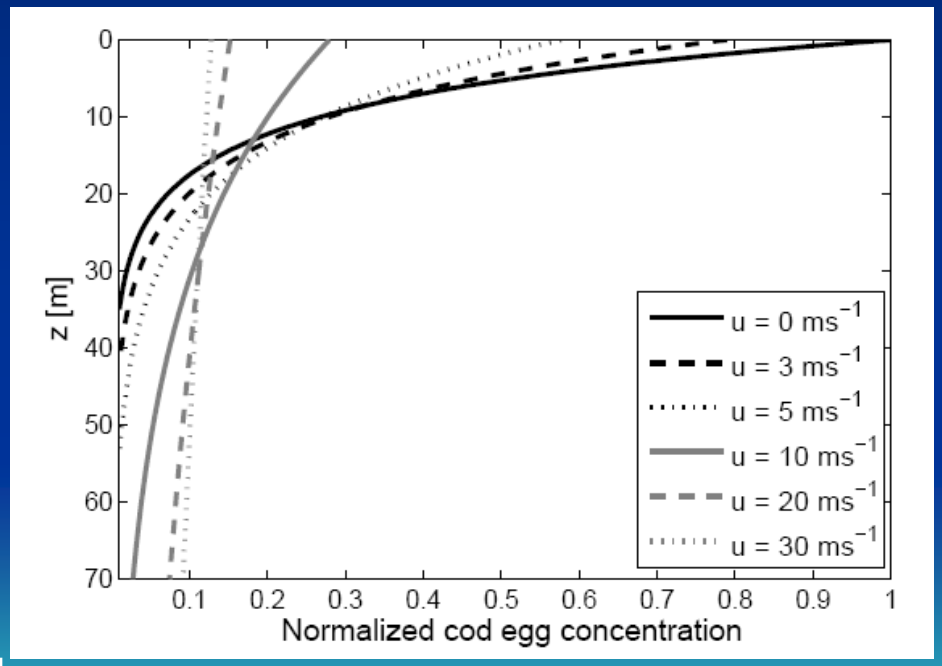
Spectrally weighted UV-radiation at sea surface

+

UV-transmission in ocean



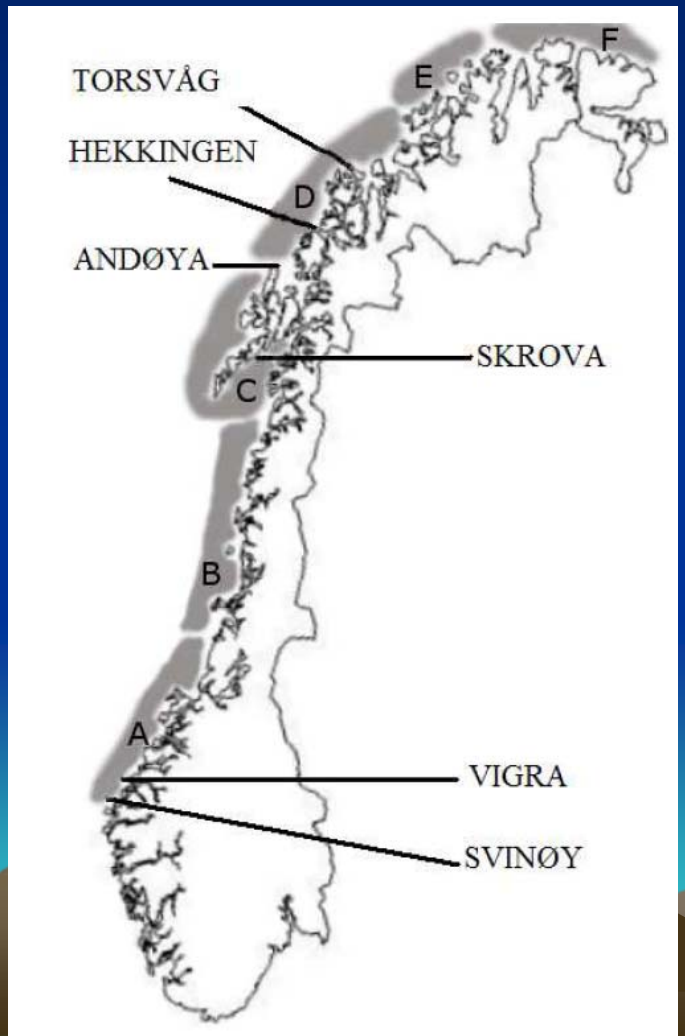
Vertical distribution of cod-eggs as a function of wind speed



Cod UV-index

quantify potential UV effect on cod eggs

Spawning areas
(March – May)
Synoptic stations



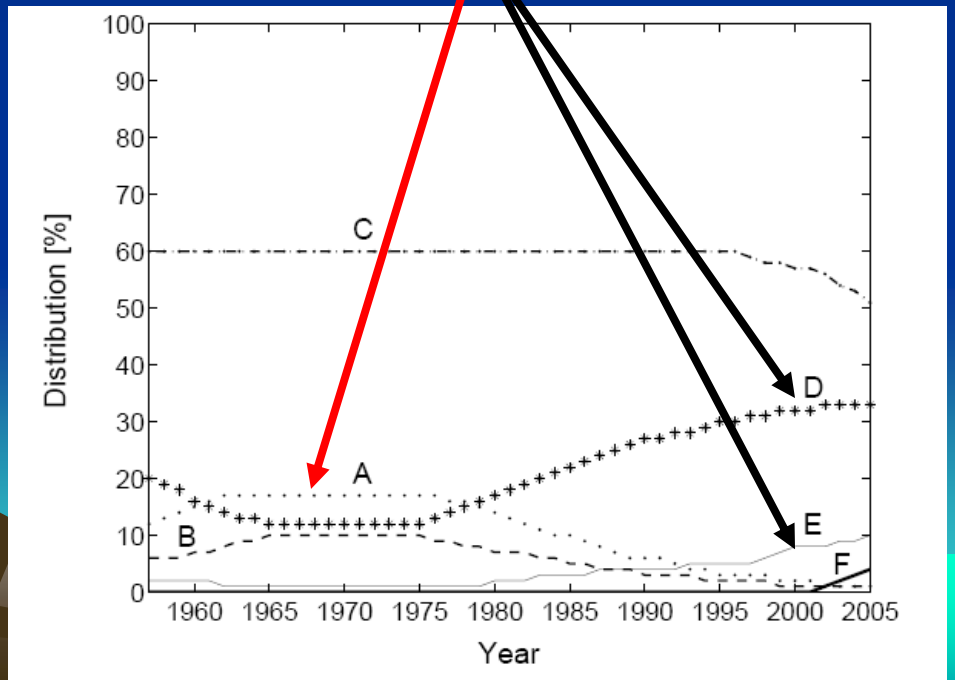
Relative weight of the spawning areas

Shift towards north with time

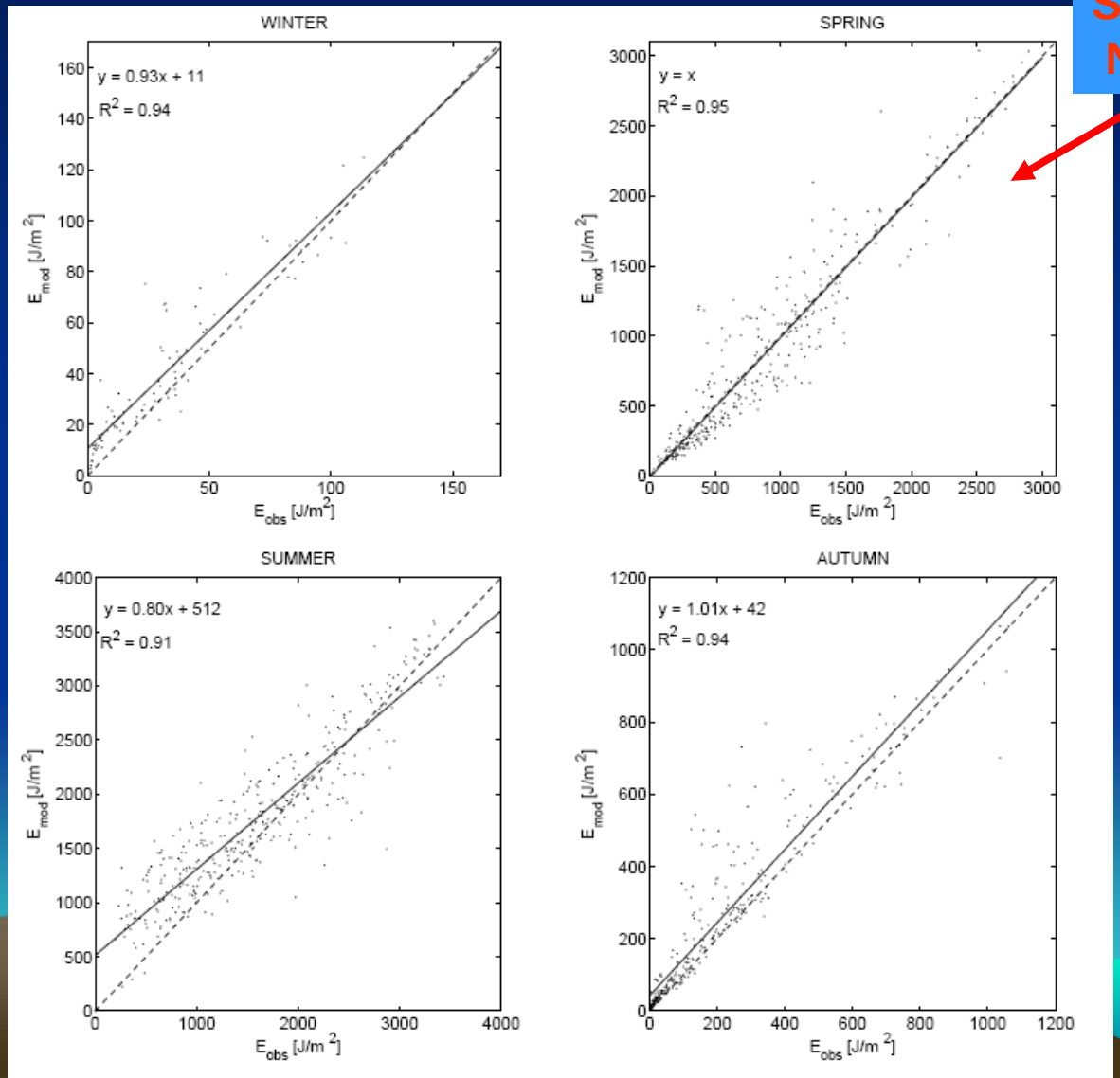
(caused by increasing sea temperature)

Southern area

Northern area



Daily Erythemal UV
Andøya 2000-2003
Mod vs Obs



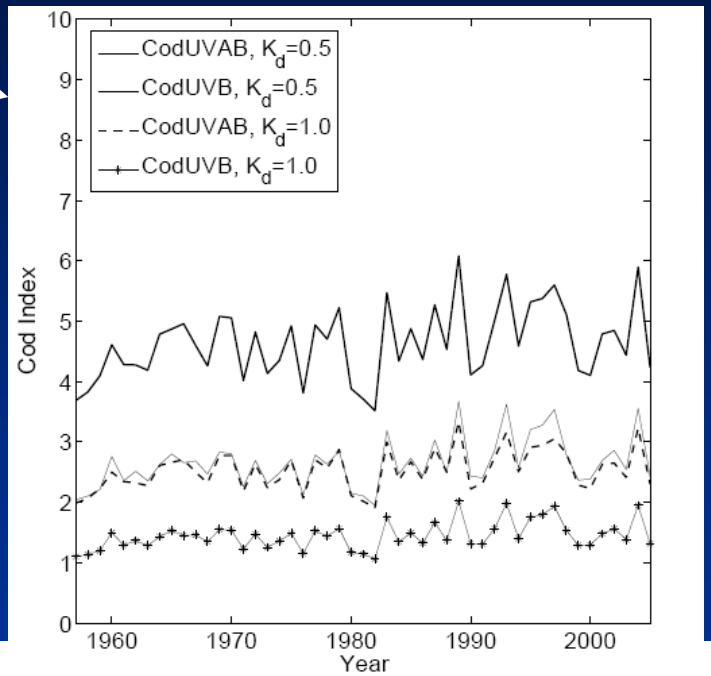
Spawning period
Nice agreement

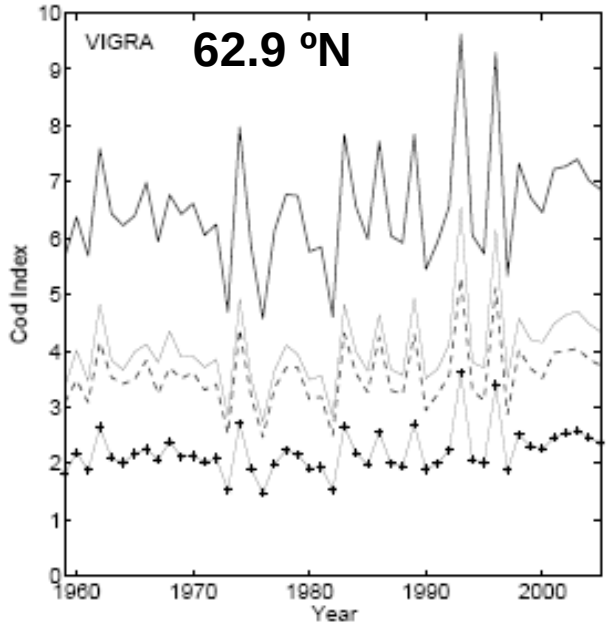
Annual Cod UV-index

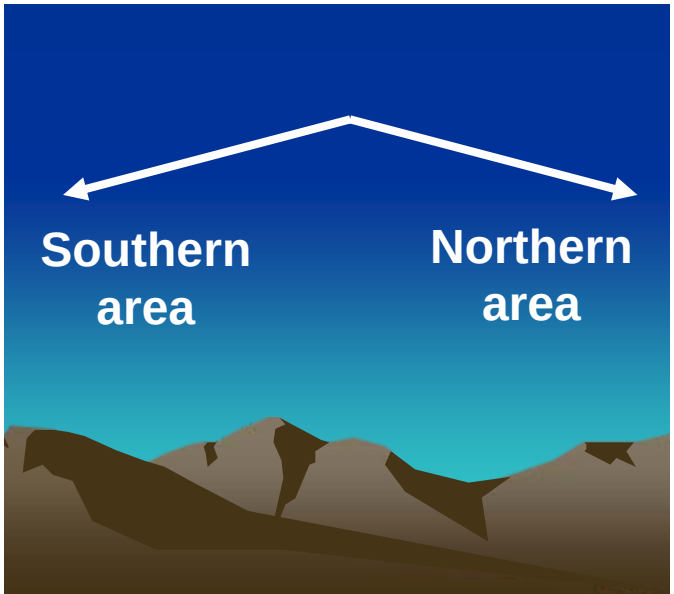
Overall

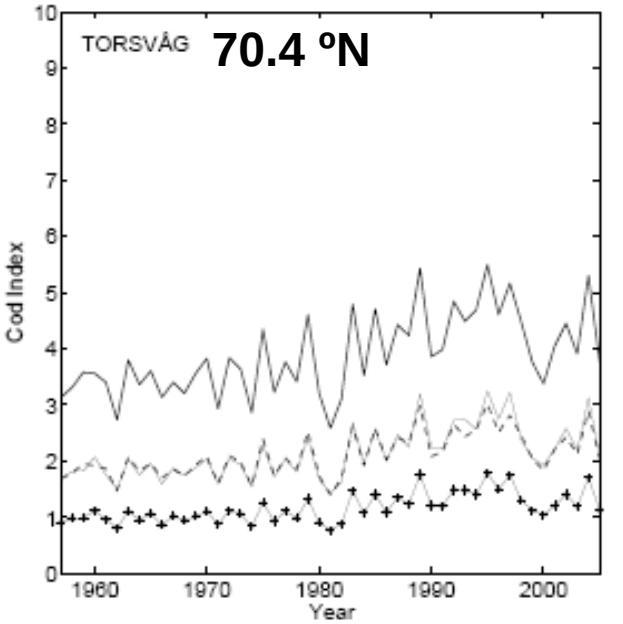
For the entire cod-egg population

Weighted according to the relative weight of the spawning areas









Conclusions

What have the students done?

- Reconstructed Erythemal UV for different regions in Norway (58 - 70ºN) for a period of 50 years
- Compared reconstructed and measured UV
- Developed a new method for estimation of potential UV-effect on cod-eggs
- Investigated the effect of UV on human beings and fish

What to do in the future?

- Use the reconstructed UV data for further investigations on more complex relationships between UV and biology

Thank you

Take care of your students !!!