

UV irradiance maps to support skin cancer research and prevention

Introduction

Problem... Switzerland has the highest skin cancer rate in Europe:
lack of public awareness about dangers of UV

Need... **simple and clear** representations of risk to support
public health decision making

Need... Accurate data for individual & population risk for **research**

Solution: We developed **UV-TAMER** (Toolkit for Analysis and Maps of Exposure Risk), a software suite to address these needs.

Goals

- Improve **ease of access** and **portability** of massive UV dataset
- Develop tools providing:
 - ✓ Straightforward analysis capabilities and outputs for non-experts
 - ✓ Flexibility with a range of different user input
 - ✓ Further applicability to different datasets (e.g. pollutants)

Chronic exposure

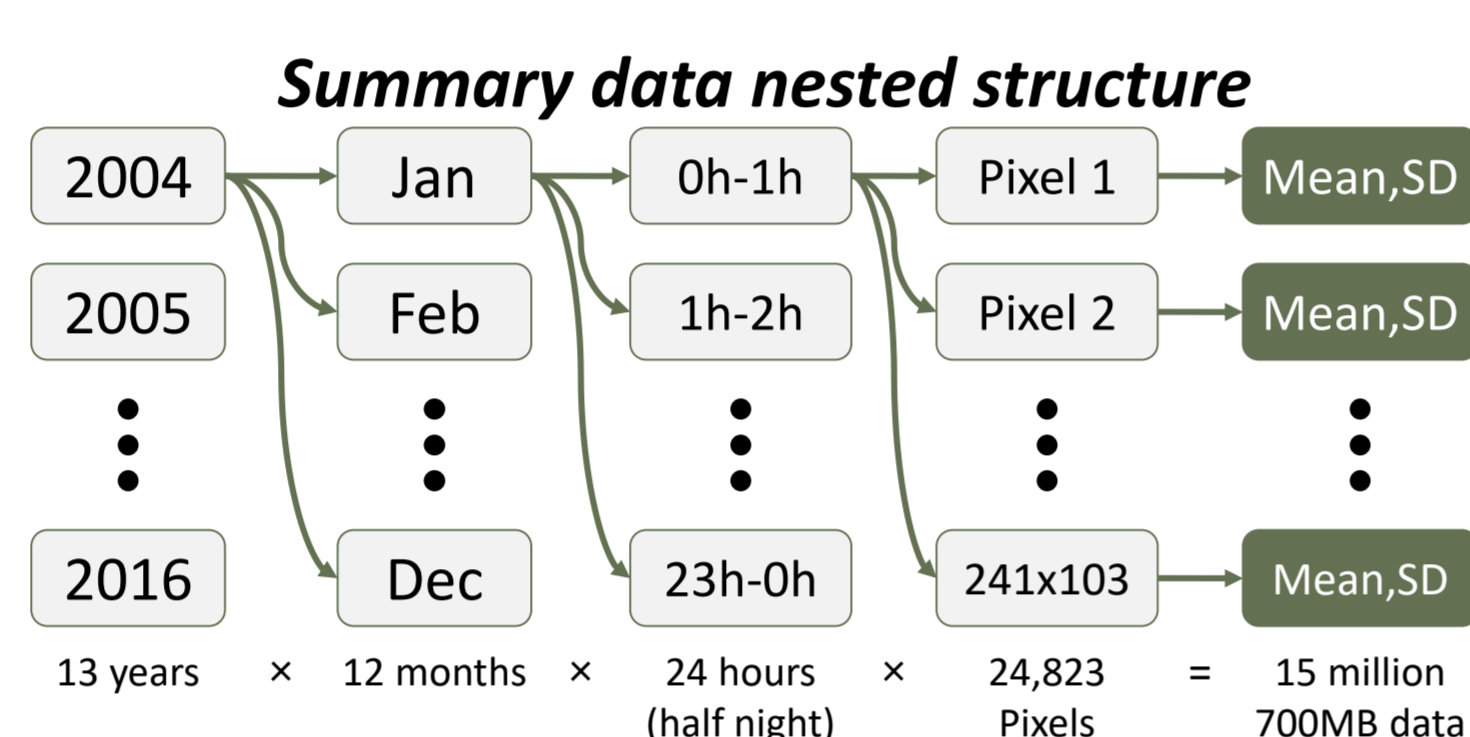
- Long-term (i.e. chronic) exposure to UV is known to damage skin and cause **basal cell carcinoma** and **squamous cell carcinoma** (cancers)
- Maps of average UV irradiance show where chronic effects are greatest

Problem...

- Dataset **not portable** (336GB)

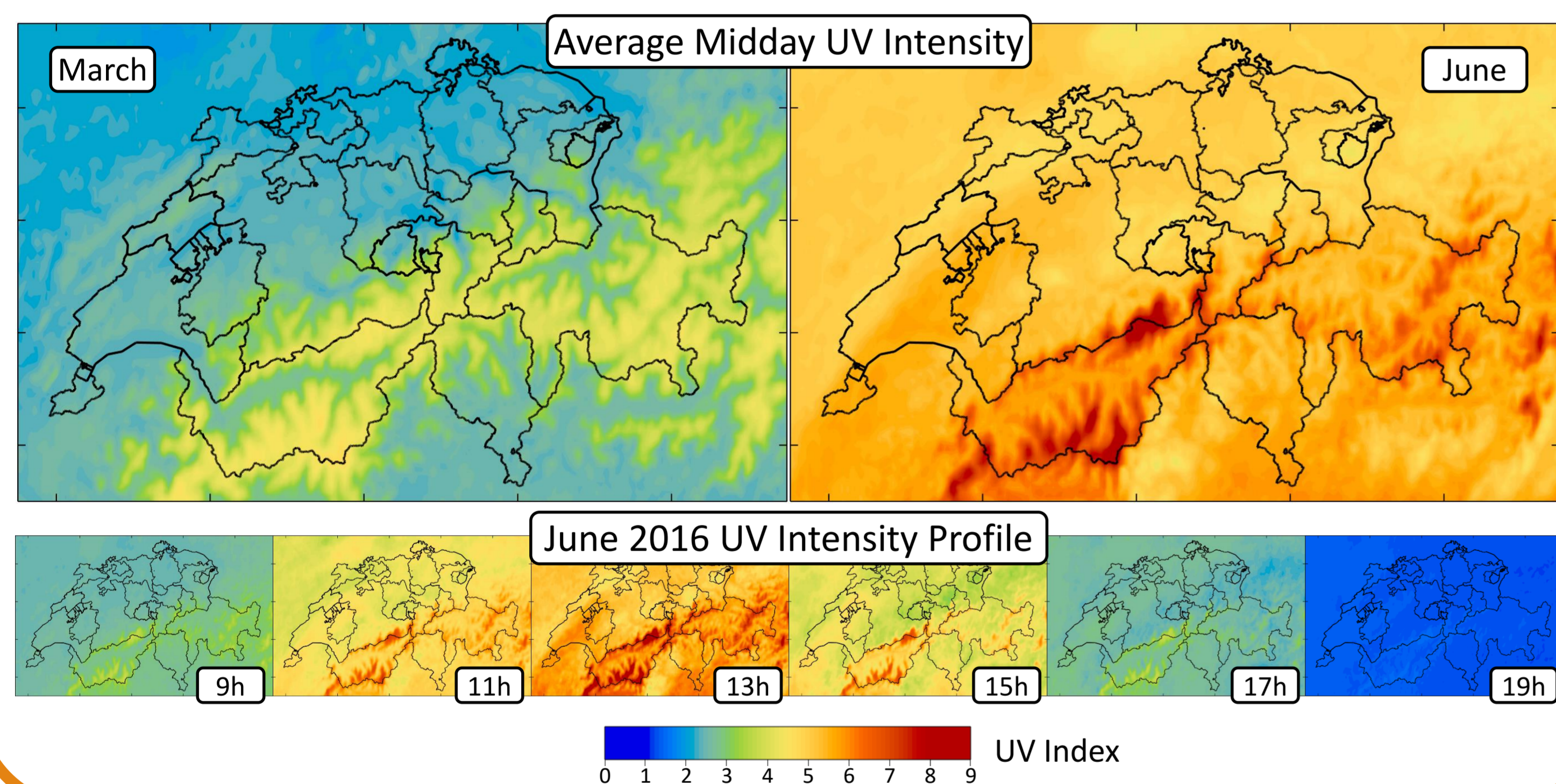
Solution...

- Take mean & standard deviation (SD) of each hour in each month for summary data files



UV-MM (Map Maker)

- Simple tool to **view and compare** data, find average irradiance patterns
- Option for user-defined units e.g. non-linear, piecewise etc.
- Can make many maps in one run → **animation** option in development



Daily Dose

- Cumulative daily UV exposure is the best indicator for chronic effects

Problem... Some people work outdoors, some in offices etc.

*How to account for **different activities**?*

Solution... We developed an **exposure schedule** system

UV-CAT (Chronic Analysis Tool)

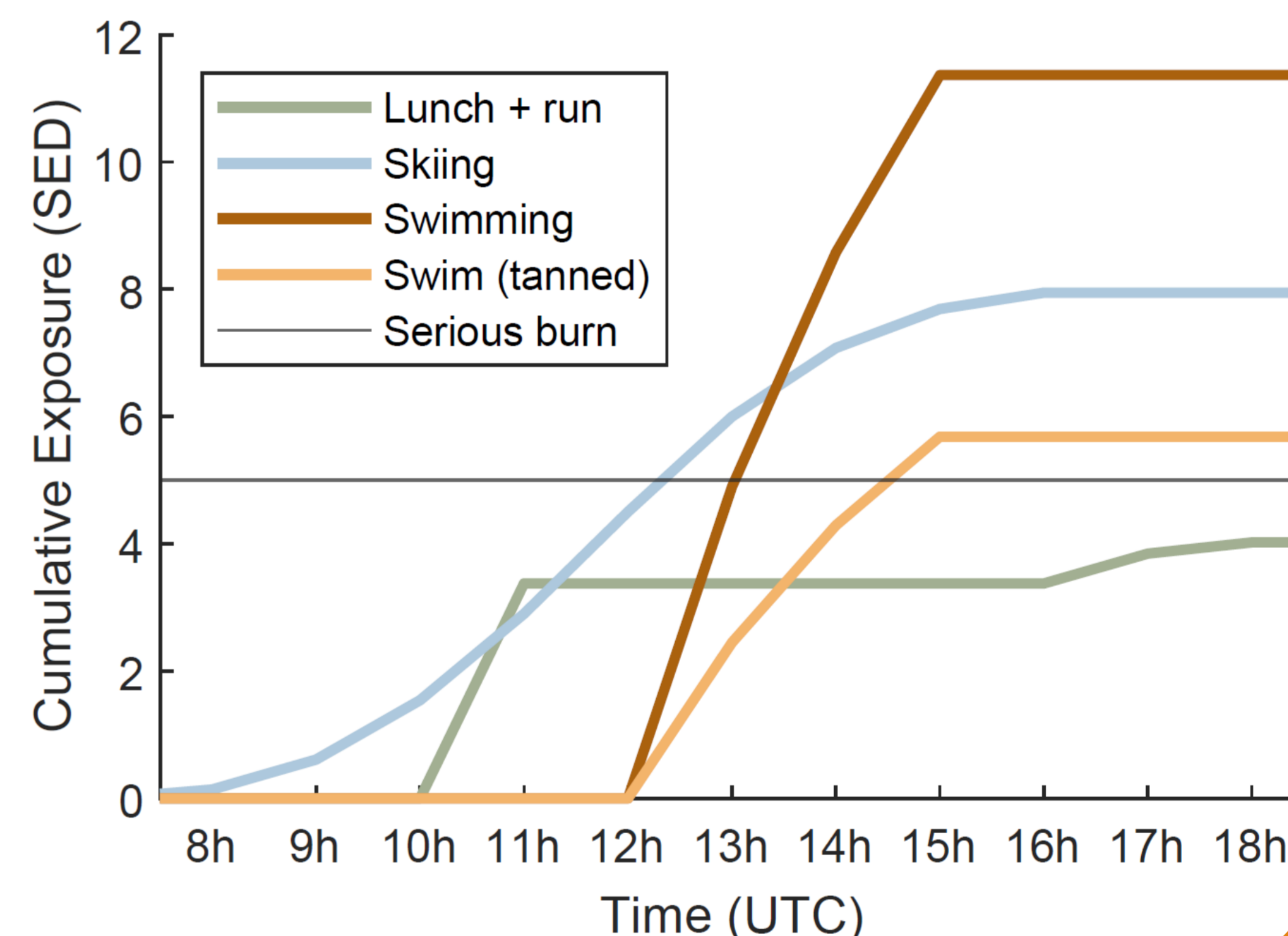
Compare scenarios

- Work life in Lausanne (Jun)
- Skiing in Crans-Montana (Feb)
- Swimming at Saint-Sulpice (Jun)
- Swimming with skin type IV (vs I)

- Schedules can account for shade, skin colour, clothing, posture, sunscreen application...
...highly extendible
- Applicable for occupational cancer, health insurance, epidemiology, person use - *are your habits risky?*

Determine chronic exposure risk

Time	Lunch + run	Ski	Swim	Swim (tanned)
0h	0	0	0	0
1h	0	0	0	0
2h	0	0	0	0
3h	0	0	0	0
4h	0	0	0	0
5h	0	0	0	0
6h	0	0	0	0
7h	0	0	0	0
8h	0	1	0	0
9h	0	1	0	0
10h	0	1	0	0
11h	0	1	0	0
12h	0.75	1	0	0
13h	0	1	0	0
14h	0	1	1	0.5
15h	0	1	1	0.5
16h	0	1	1	0.5
17h	0	0	0	0
18h	0.5	0	0	0
19h	0.5	0	0	0
20h	0	0	0	0
21h	0	0	0	0
22h	0	0	0	0
23h	0	0	0	0



Acute exposure

- Short-term high intensity UV exposure (i.e. acute) events are known to cause **melanoma** (cancer)

Problem...

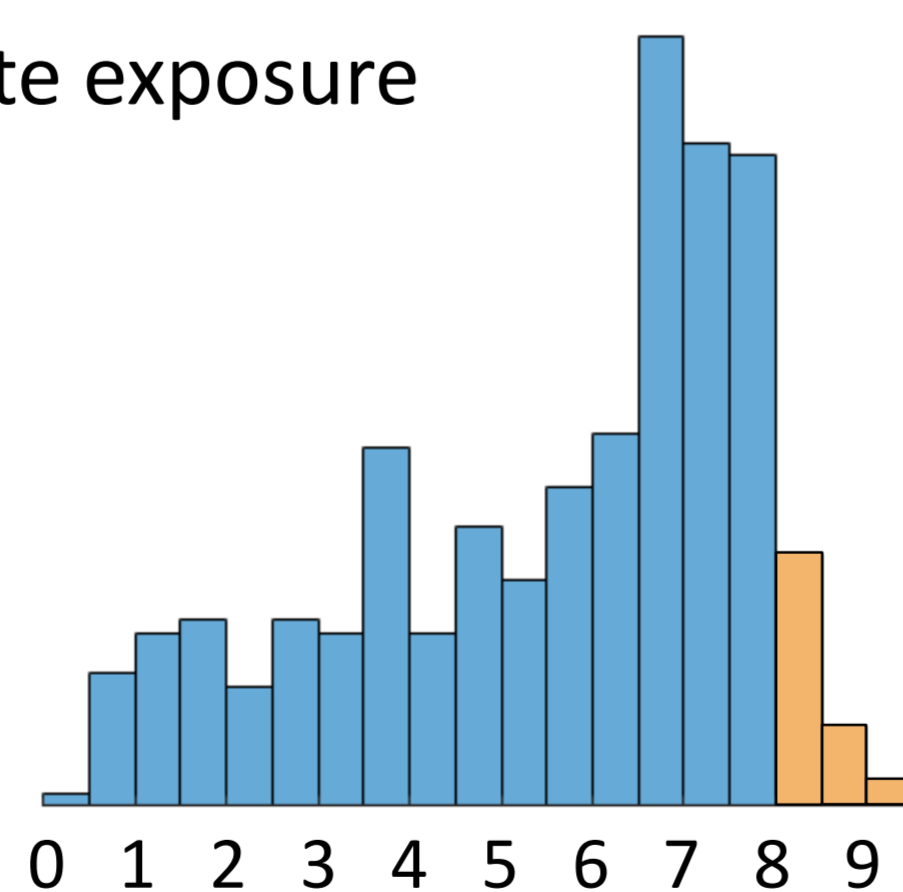
- Need to determine **probability** of acute exposure

Solution...

- **Construct UV histograms**

- Generate summary data as above
Histograms in place of mean, SD

- Obtain the probability of **exceedance** of a user-defined threshold

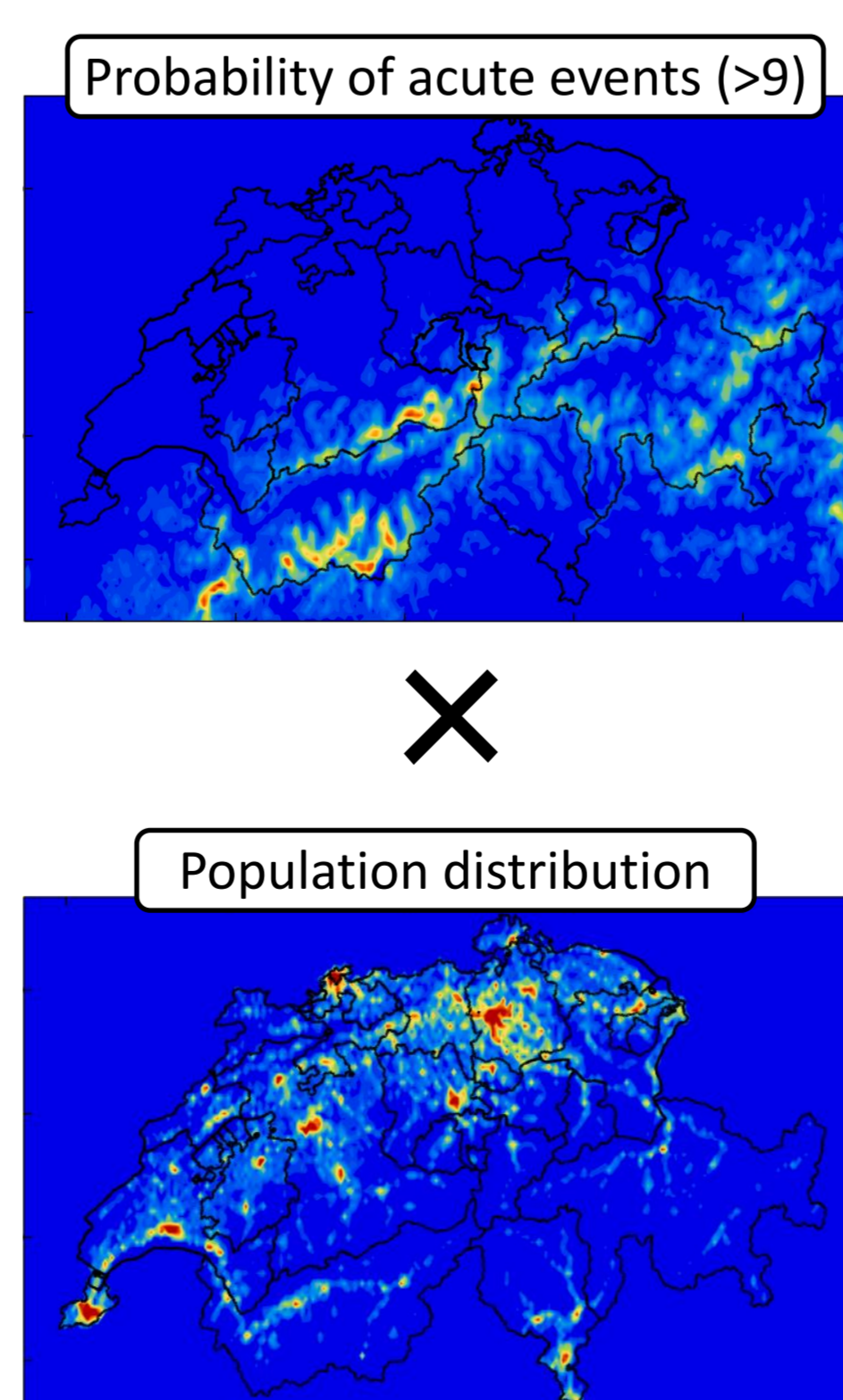


- Combine probability with **population** distribution
 e.g. **residents**, employees, specific occupations, etc.

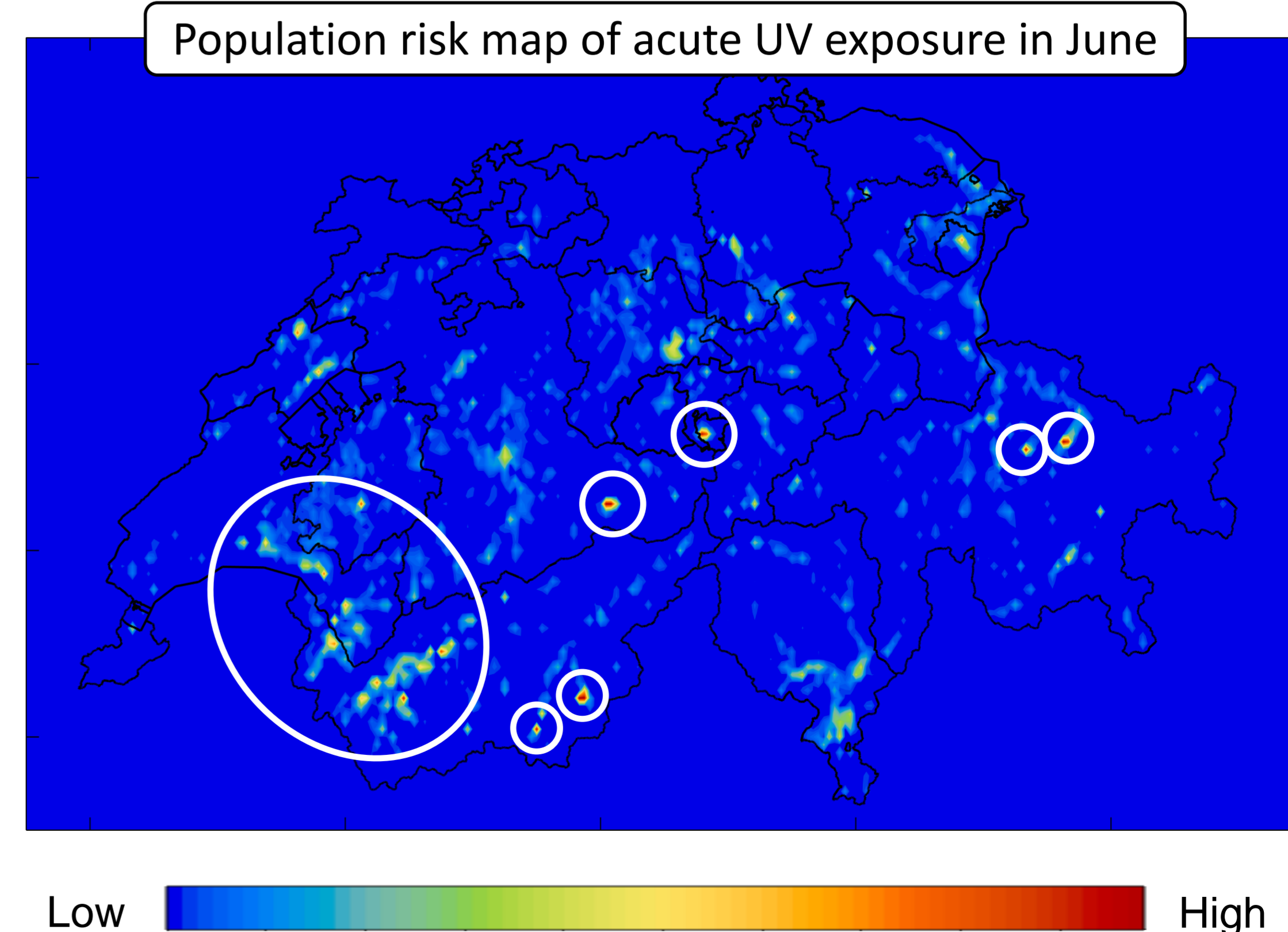
- Multiply population by probability to give **population risk**

- Find regions with the most individual **acute** exposure events

- **primary targets for public awareness**



UV-PRAE (Population Risk of Acute Exposure)



Conclusion

- **UV-TAMER** includes easy-to-use tools for assessing exposure **danger**
- **Chronic and acute exposure** risk of UV, pollutants, or other data...
- **Simple** representations of risk + **accurate** data for research
- Suitable for government, epidemiology, public use (web integration)