Statistical issues at online surveillance

- I Inferential framework
- II Demonstration of computer program
- III Complicated problems - examples

Complications

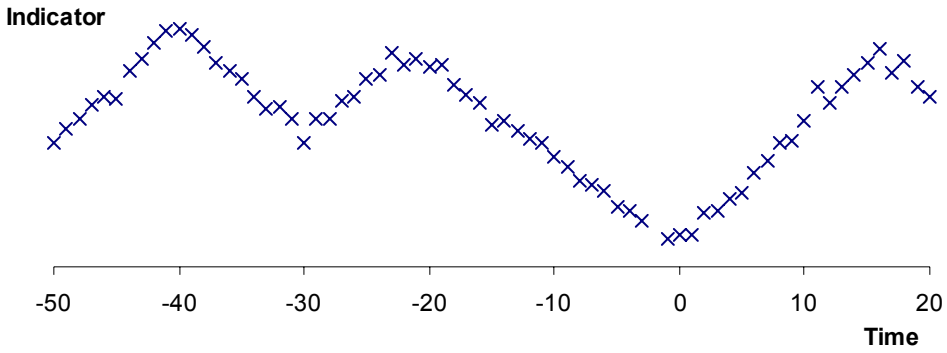
- Complicated changes
- Non-normal distribution
- Dependency
- Multivariate

  – Frisén, M. (in press), Statistical Surveillance. Optimality and Methods., *International Statistical Review*.

Type of change

- Gradual change
- Change from unknown baseline
- Change of dependency structure
- Change in monotonicity

Hormone cycles



No parametric assumption for the curve

Maximum likelihood ratio

$$\left\{ x_s : \quad \frac{\max f(x_s | C)}{\max f(x_s | D)} \geq k' \right\}$$

- ***ML estimation*** *under* ***monotonicity*** *restrictions*
- Frisén, M. (1986) Unimodal regression. *The Statistician,* **35,** 479-485.
- Andersson, E., Bock, D. and Frisén, M. (2002) Statistical surveillance of cyclical processes with application to turns in business cycles. *Submitted*.

Non-normal distribution

- Occurrence of diseases
  - Sonesson, C. and Bock, D. (2002): A review and discussion of prospective statistical surveillance in public health. *Journal of the Royal Statistical Society* ser. A (2003), **166**, part 1, pp. 5-21.

Dependency

- Robustness
- Change of alarm limits
- LR

Monitoring of pregnancy

- Now in Sweden: Shewhart of cross sectional data
- Suggested: Shirayev-Roberts of longitudinal statistic
- Improvements in probability of successful detection

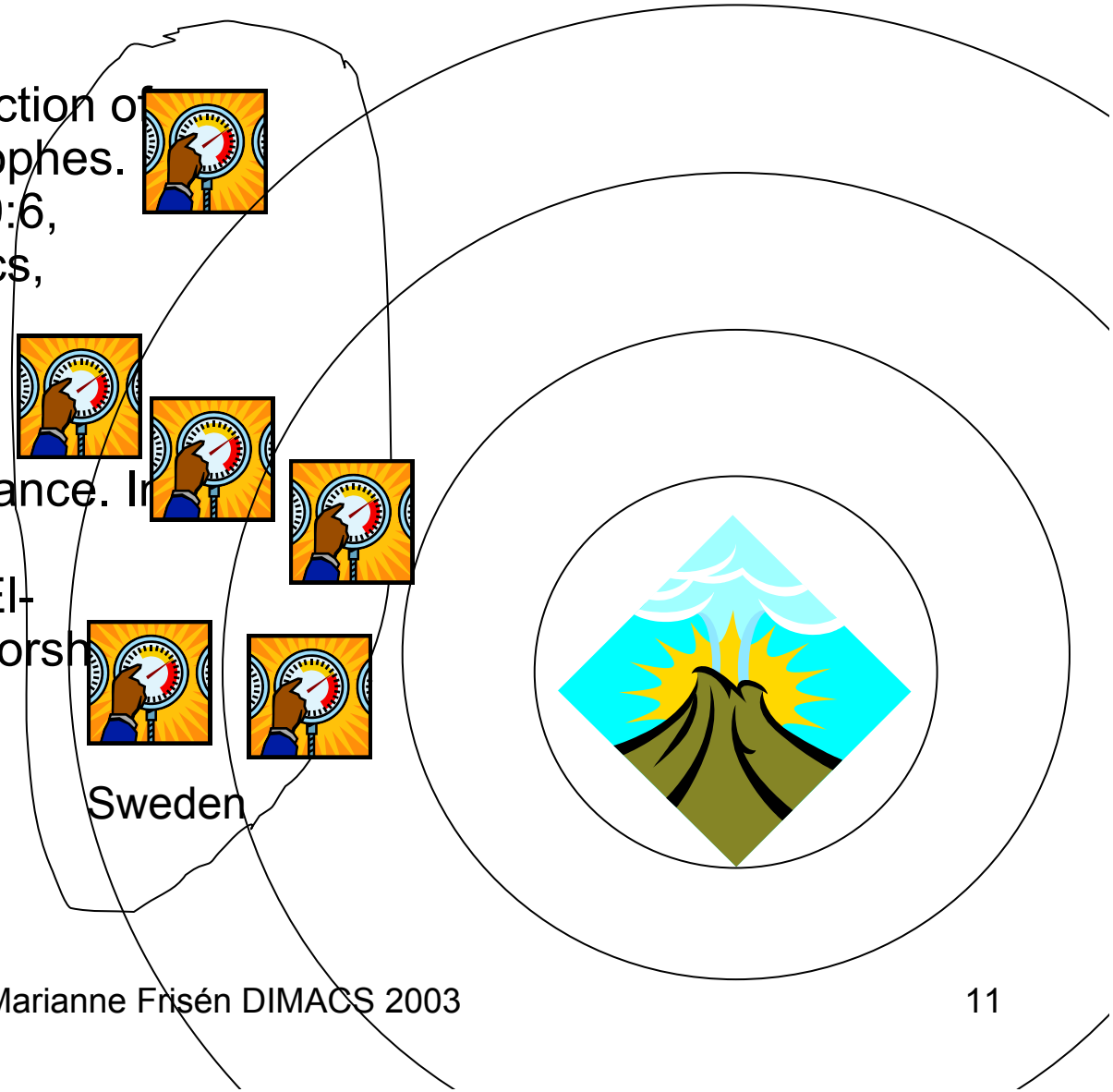
  – Petzold, M., Sonesson, C., Bergman, E. and Kieler, H. (2003): Detection of intrauterine growth retardation. Submitted.

Multivariate surveillance

- Reduction to univariate statistic
- Parallell surveillance
- Likelihood for full multivaraiate problem
  - Wessman, P. (1998): Some principles for surveillance adopted for multivariate processes with a common change point. *Communications in Statistics - Theory and Methods,* 27, 1143-1161.
  - Wessman, P. (1999): The surveillance of several processes with different change points. Research Report 1999:2, Department of Statistics, Göteborg University.

Radiation

- Järpe, E. (2000): Detection of environmental catastrophes. Research Report 2000:6, Department of Statistics, Göteborg University.
- Järpe, E. (2001): Environmental surveillance. In Encyclopedia of Environmetrics, Eds. El-Shaarawi, A. and Piegorsch W.W.



Concluding remarks

- Reductions to simpler problems are often possible
- Likelihood ratio method is a useful tool

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http://www.Statistics.GU.se/forskbquick.html