Methods used in Research Cluster A

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Methods

- EOF Analysis
- POP Analysis (prediction)
- Statistical downscaling (prediction)
- AMOEBA Model
- Cury & Roy Model
- Transfer function modelling
- Threshold Generalized Additive Model (T-GAM)
- Self organizing maps (SOM)

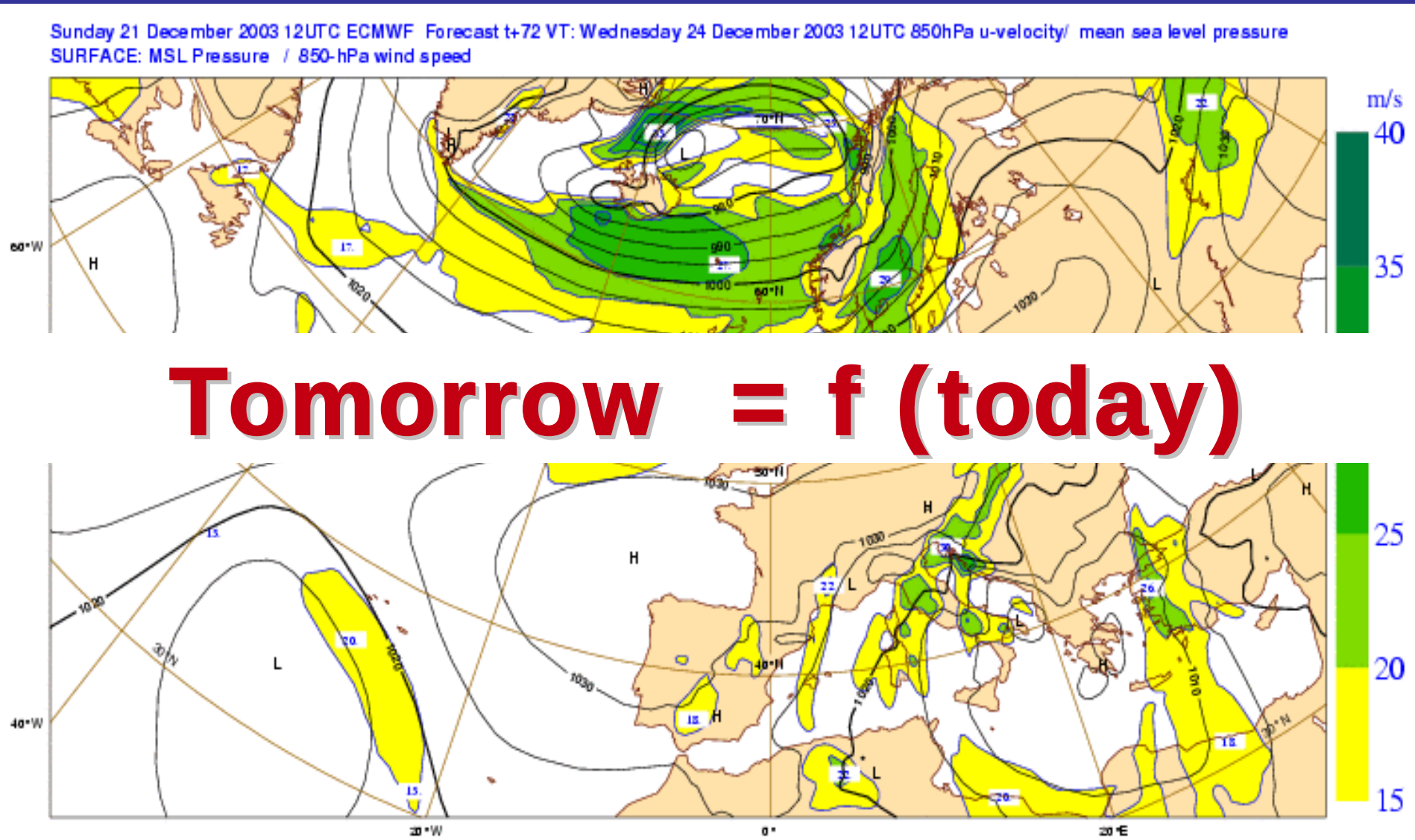
EOF Analysis

- to extract the dominant structure from a data set
- to reduce noise in the data set
- To compress the data set

- $$X'(s,t) = \Sigma\, m_i(s)\, \alpha_i(t) + \text{noise}$$

  - X‘ = anomalies
  - m = EOF pattern fixed in space s
  - α = time coefficients (principle components)

What is prediction?

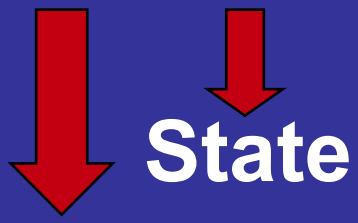


Tomorrow = f (today)

What is prediction?

State (tomorrow) = f [State (today)]

$x_i(t+\Delta t) = f\,[\,x_i(t)]$ $\quad i=1,\ldots,n$



State function

Prediction

- depends on the actual state.
  Do we know the actual state?
- requires a transfer function f.
  e.g. predictor filter, differential operator
- must have a skill better than persistency.
  (quality of prediction)

Transfer Function

$$x_i(t+\Delta t) = \alpha\ x_i(t)$$

• $\alpha = 1$	Persistence	Es bleibt wie es ist.
• $\lvert\alpha\rvert > 1$	System is unstabile	$x \to \infty$
• $\lvert\alpha\rvert < 1$	System dies	$x \to 0$

Conclusion: That cannot work.
It is too simple.

Transfer Function

$$x_i(t+\Delta t) = \alpha\ x_i(t) + N(\mu,\sigma)$$

α is the memory of the system elsewhere called predictor filter ($|\alpha| \leq 1$)

N is white noise

First Order Autoregressive Model (AR1 Model)

Transfer Function

$$x_i(t+\Delta t) = C\ x_i(t) + N(\mu,\sigma)$$

mit $C = \underline{B}_1/\underline{B}_0$

$\underline{B}_1$, $\underline{B}_0$ are lag-1 und lag-0 covariance matrices in a noise reduced EOF space

`Principal Oscillation Pattern´
(POP - Model)

Hasselmann 1988

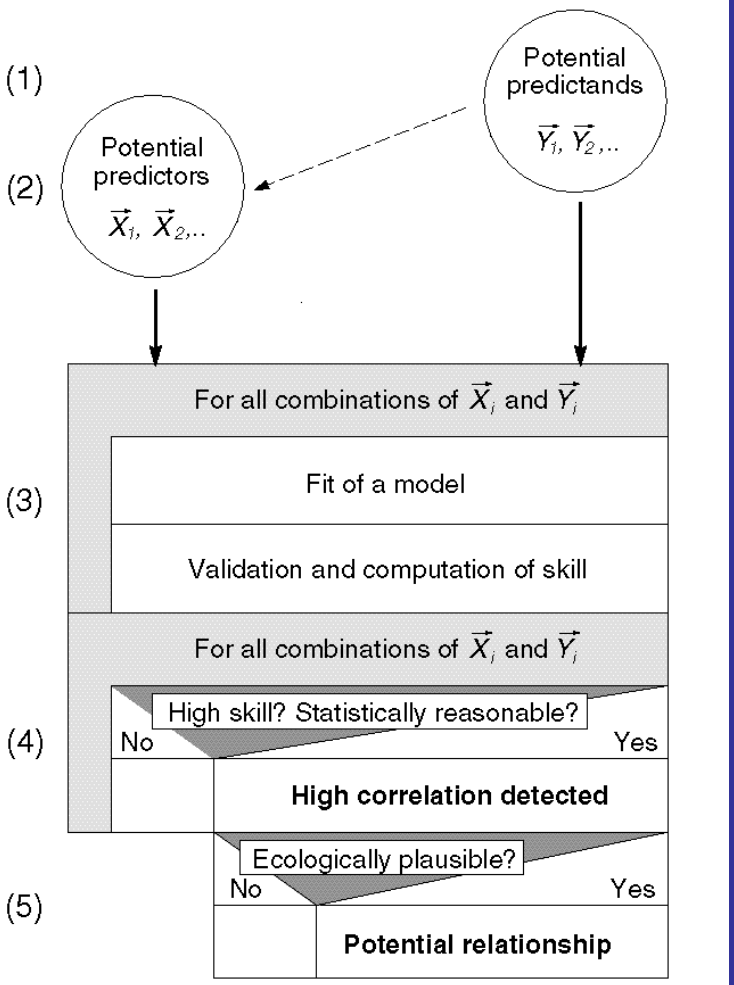
Transfer Function

$$x_i(t+\Delta t) = D\,[\,x_i(t), \ldots\,]$$

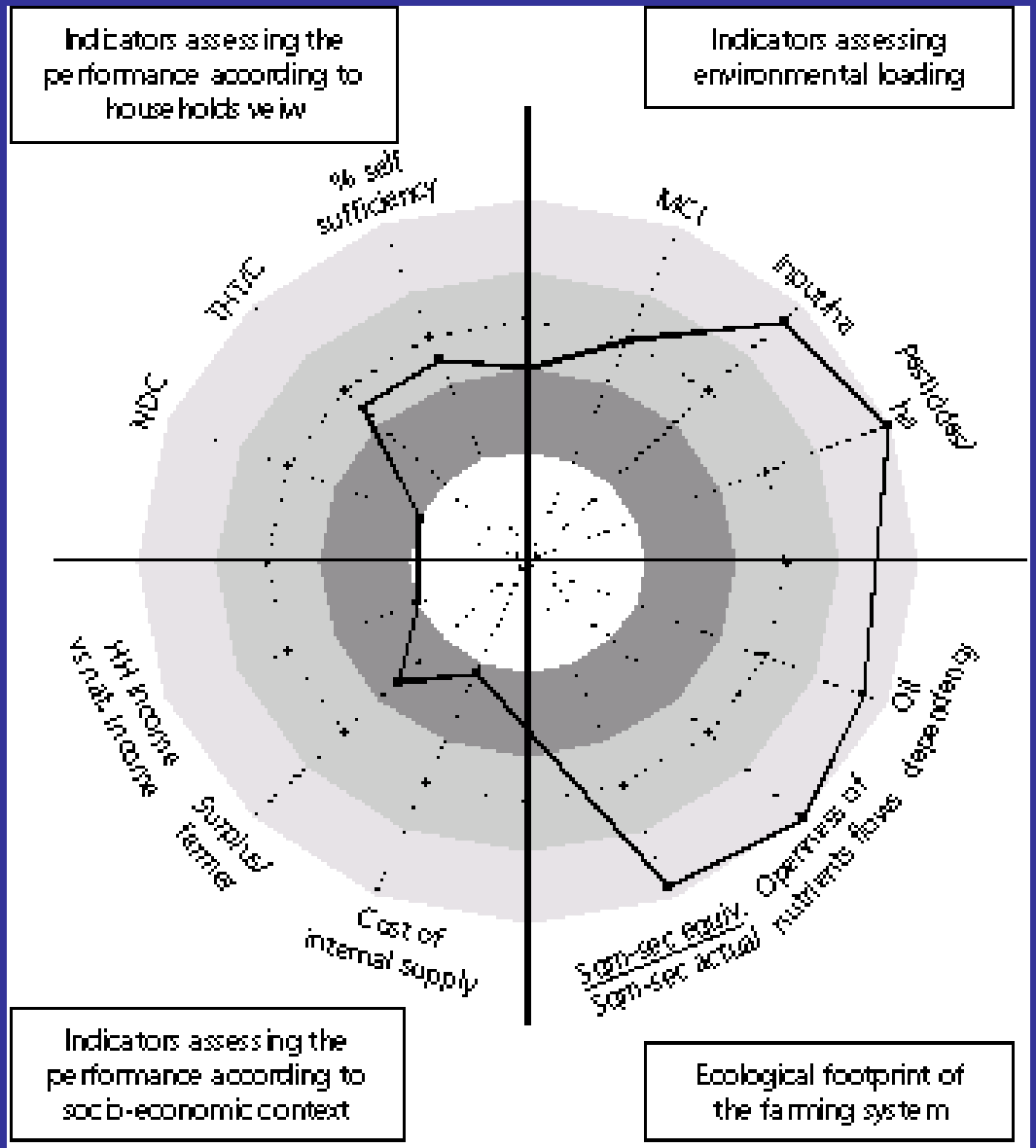
mit D = Differential - Operator

Numerical Model

Statistical Downscaling



AMOEBA - Model



Cury & Roy Model