What can long-term and continuous acceleration measurements on terrestrial wildlife telling us?
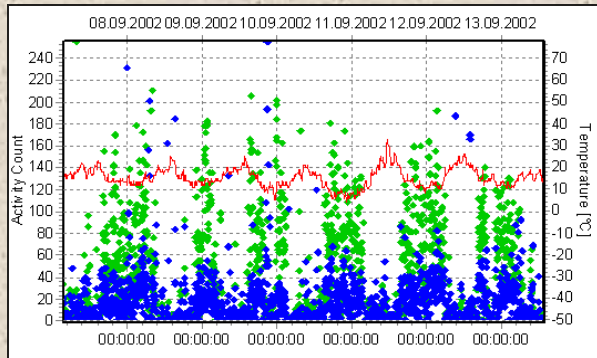
Anne Berger, Ilja Heckmann, Stephanie Kramer-Schadt

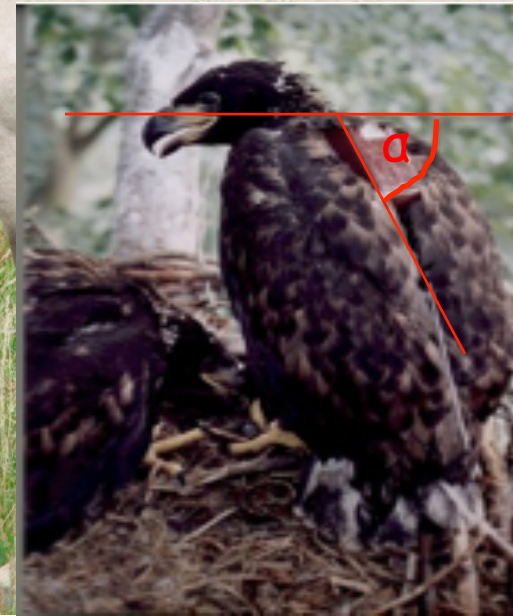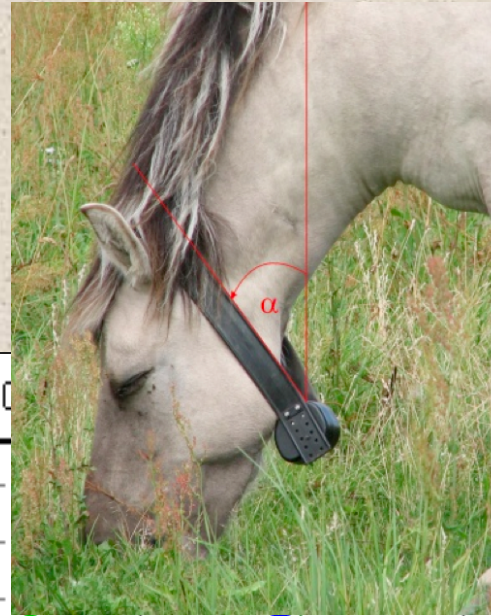Leibniz-Institute for
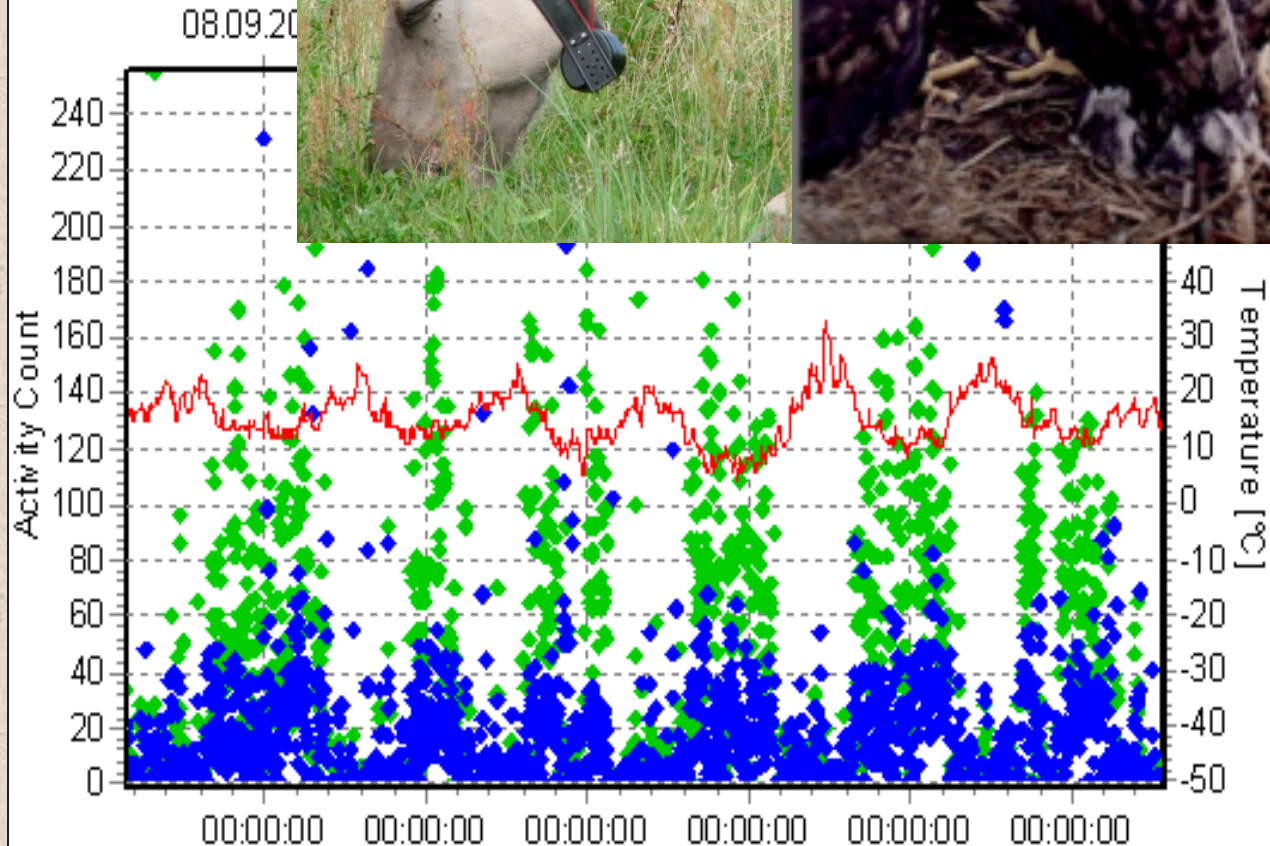Zoo and Wildlife Research
Working group „Chronoecology"

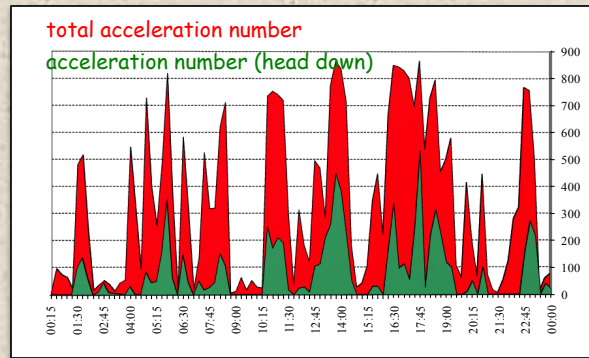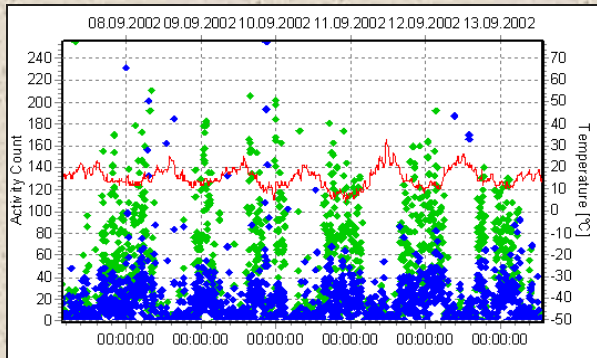# Different types of accelerometers

Raw data

* measure: difference in acceleration bet-ween two consecutive measurements (6-8 per sec)
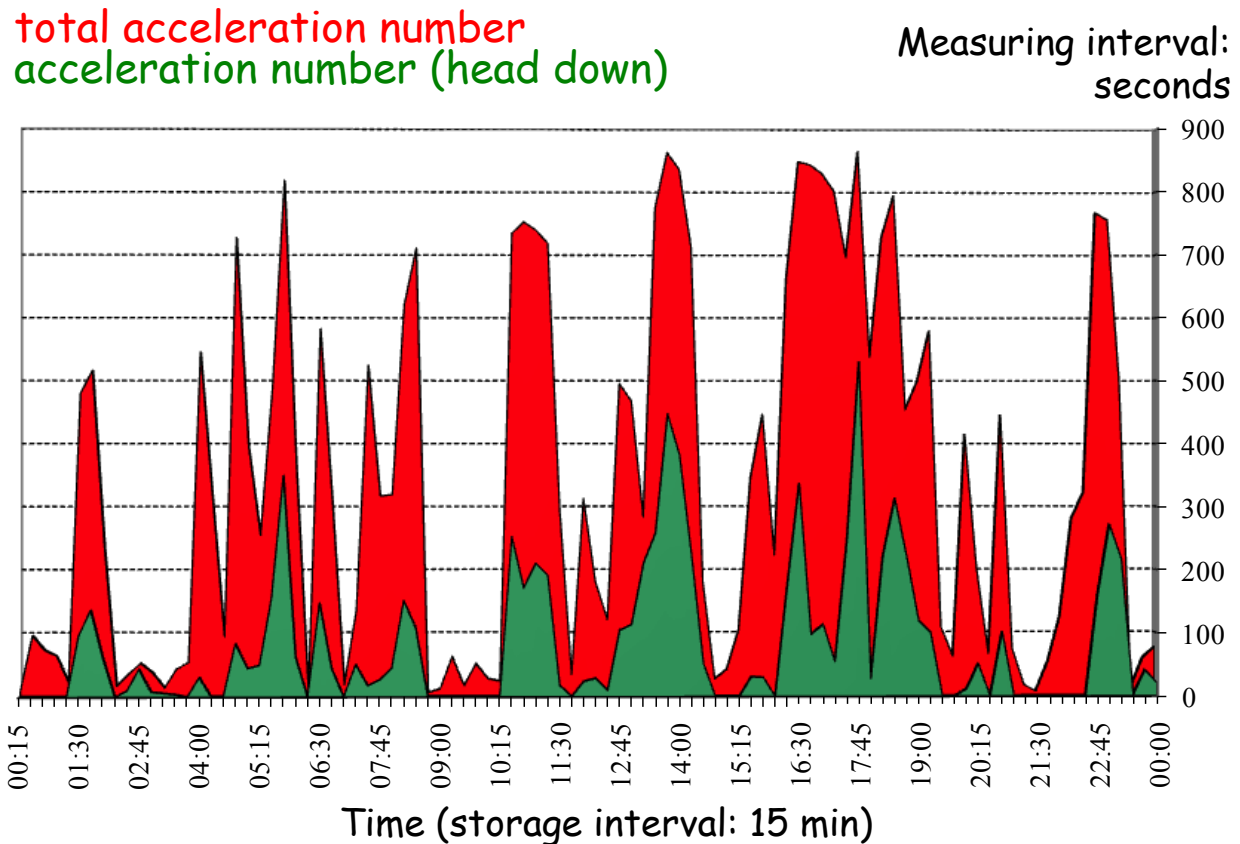* sampling: means (given within a relative range) per storage interval (2-5 min)
* threshold tool
* 1–2 dimensions
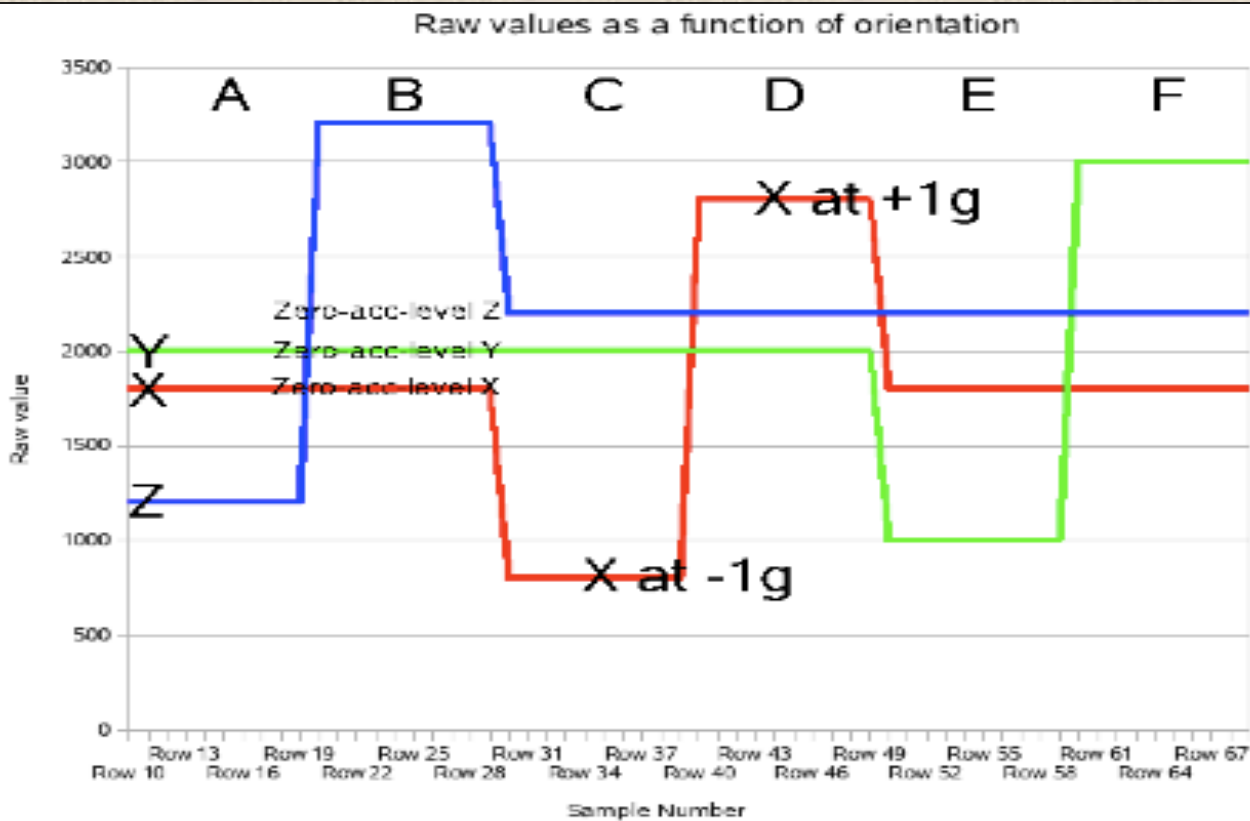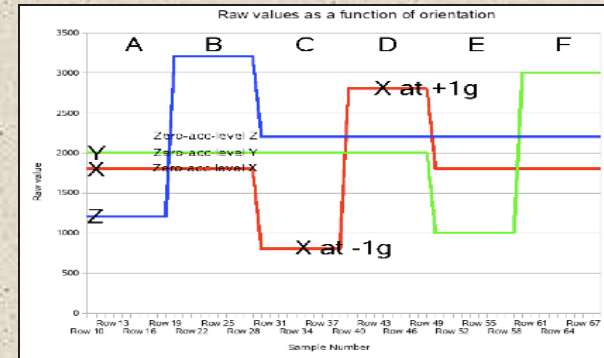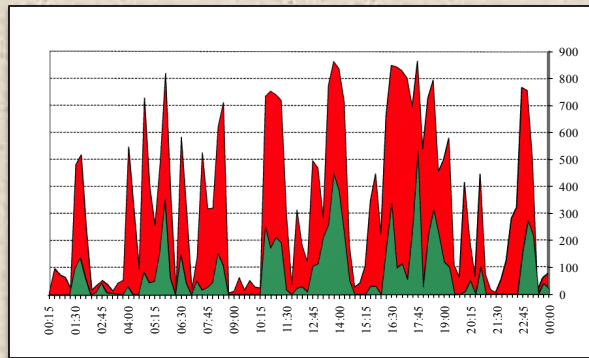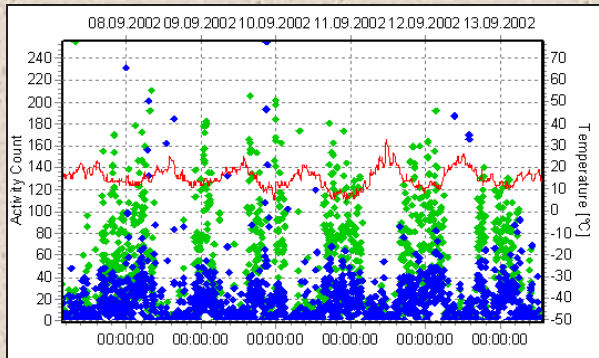* e.g., Vectronic

Different types of accelerometers

* measure: existence of vibrations within a time interval (1 sec) given as zero or one

* sampling: total numbers per storage interval (1-15 min)

* angle position tool
* 1 in all dimension
* e.g., Ethosys, Esys

total acceleration number
acceleration number (head down)

Measuring interval: seconds
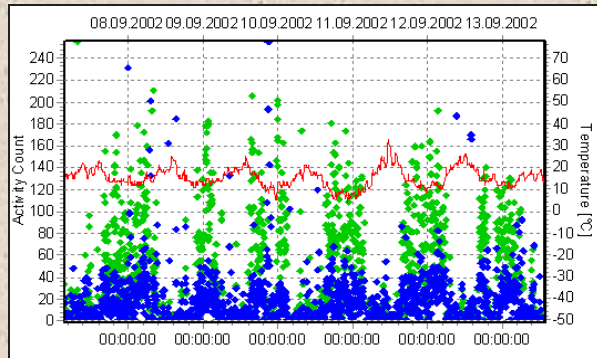
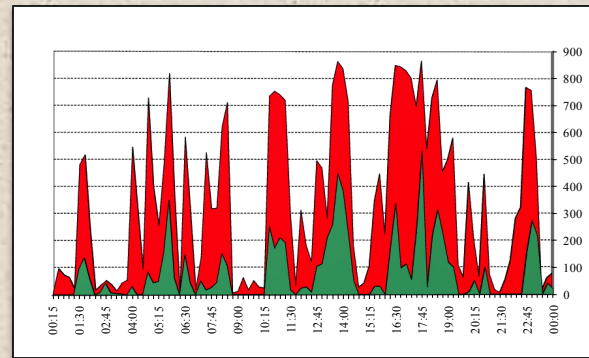Time (storage interval: 15 min)

Different types of accelerometers

* measure: linear accelerations in the three axes of space within a time interval (10-1000 msec)
* sampling: absolute values within the record interval (10-1000 msec)
* no threshold tool
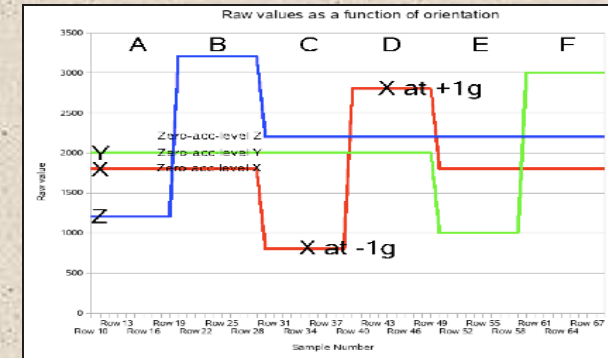* 3 dimensions
* e.g., E-obs, WAS

Different types of accelerometers

* measure: difference in acceleration bet-ween two consecutive measurements (6-8 per sec)
* sampling: means (given within a relative range) per storage interval (2-5 min)
* threshold tool
* 1 – 3 dimensions
* e.g., Vectronic

* measure: existence of vibrations within a time interval (1 sec) given as zero or one
* sampling: total numbers per storage interval (1-15 min)
* threshold tool
* 1 in all dimension
* e.g., Ethosys, Esys

* measure: linear accelerations in the three axes of space within a time interval (10-1000 msec)
* sampling: absolute values within the record interval (10-1000 msec)
* no threshold tool
* 3 dimensions
* e.g., E-obs, WAS

Different types of analyses

Male moose (*Alces alces*), Scandinavia
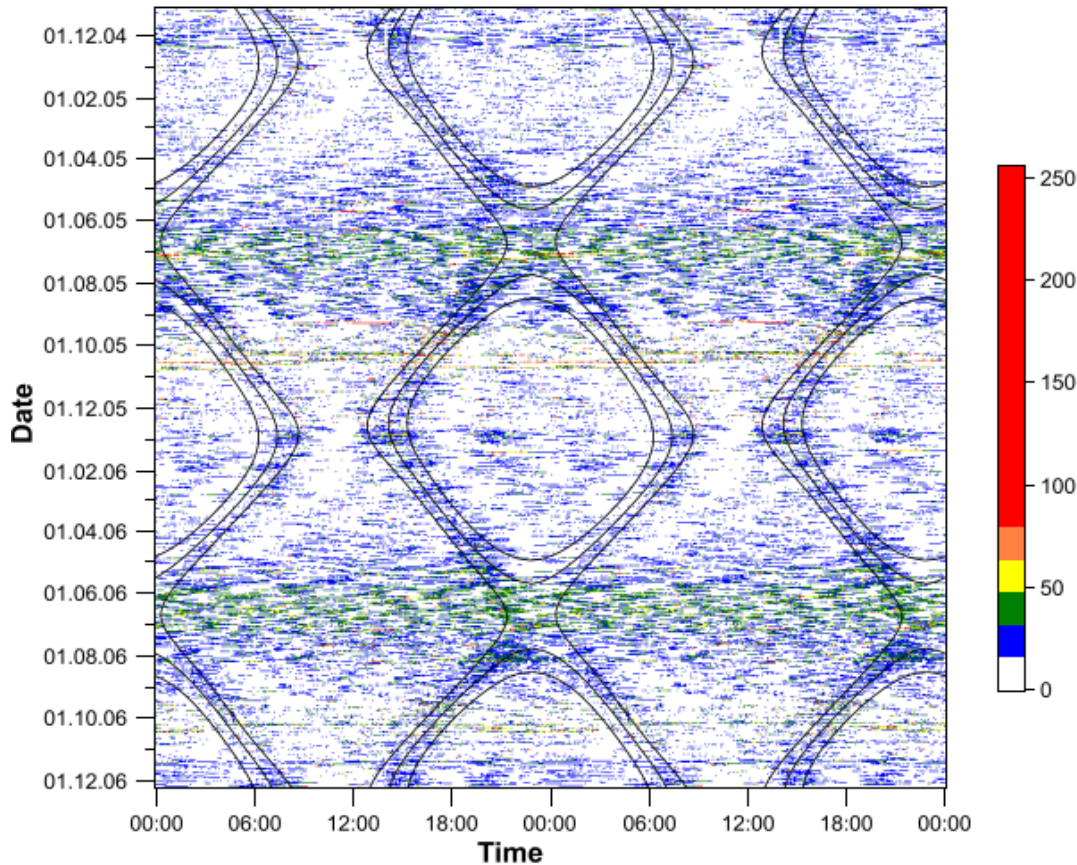
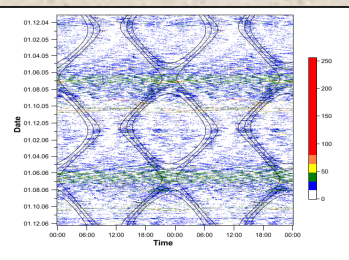**Detailed daily & annual activity pattern**

Calculation of:
- means / medians
- day-night relation
- number, length and duration of daily activity or resting phases

Output:
- general activity pattern (basic research)
- adaptation to seasons and habitats
- influence of special events (reproduction, migration, hunt…)

- Berger et al. (1999), Appl. Anim. Behav. Sci. 64.
- Berger et al. (2002), Biol. Rhythm Res. 33.

Different types of analyses

Illness on mouffon (*Ovis orientalis*)
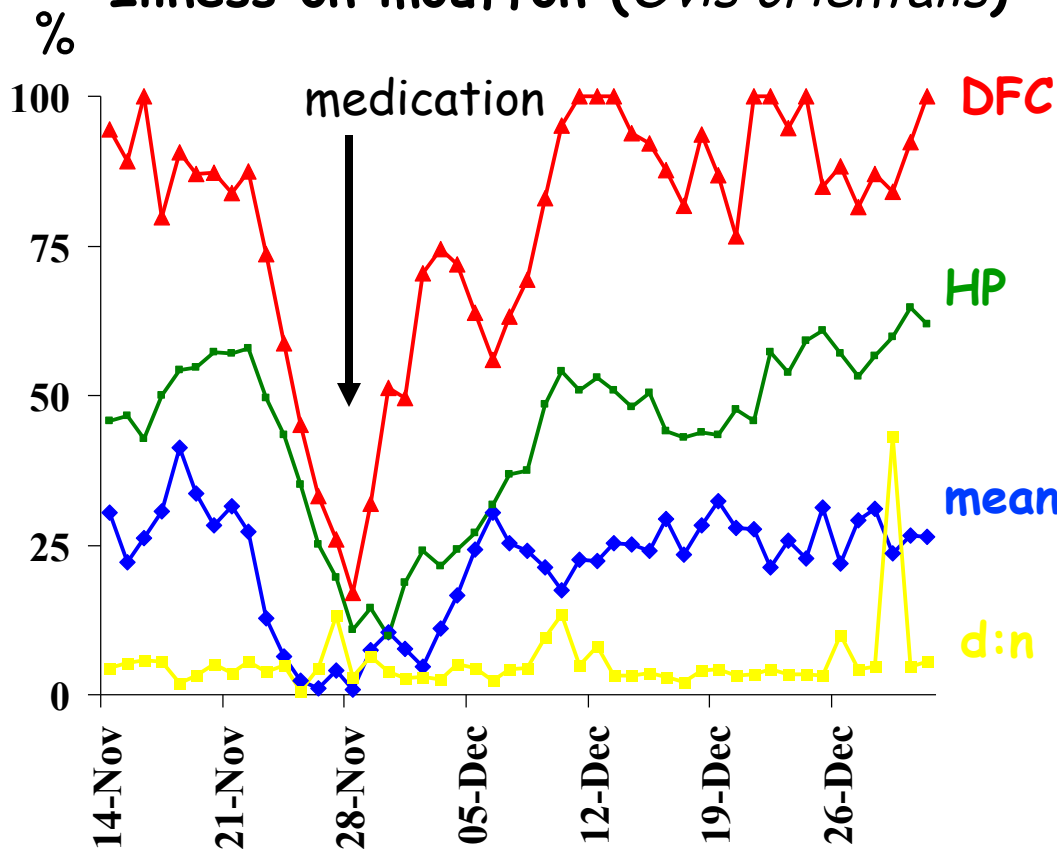
Detection & evaluation of disturbances / stress

Calculation of:
- autocorrelation
- power spectrum
- Degrees of Functional Coupling (DFC)
- harmonic parts (HP)

Output:
- coupling between internal rhythms (infradian, circadian, ultradian) and external periodicities,
- detection of disturbances and stressing conditions
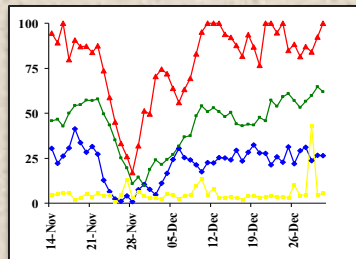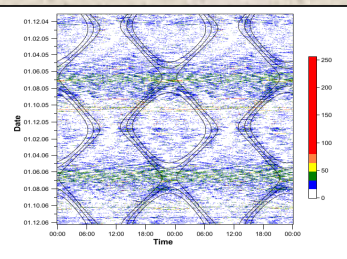
-Berger et al. (2003), Behaviour Research Methods, Instruments & Computers 35 (3).
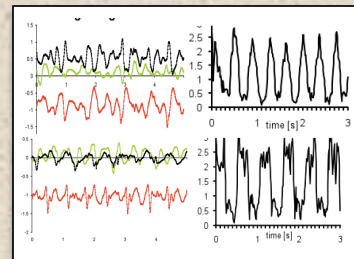
Different types of analyses

grazing (cow)

trot (horse)

walking (cow)

gallop (horse)

Detection of different behaviours (3D)

Calculation of:
- periodogramm
- frequency distribution
- fractal dimension
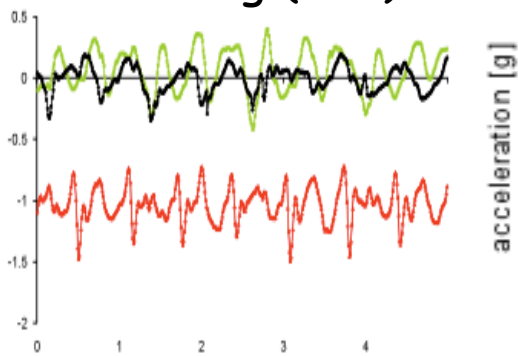
Output:
- differentiation of several behaviours (fine scale)
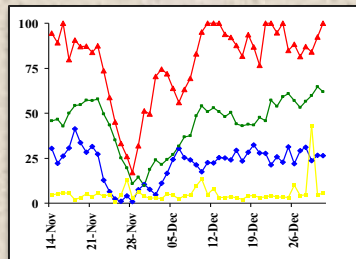- only possible for behaviour of characteristic pattern in space and time

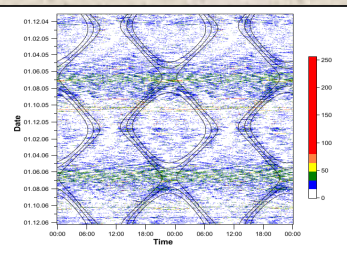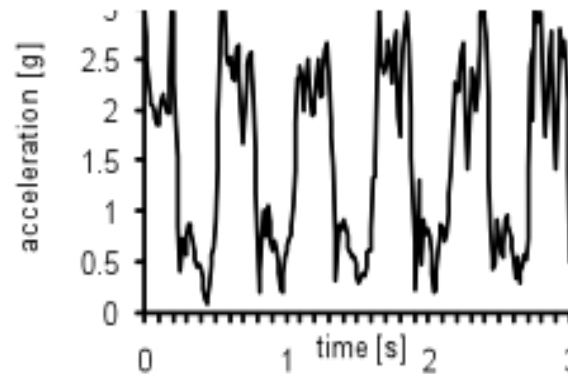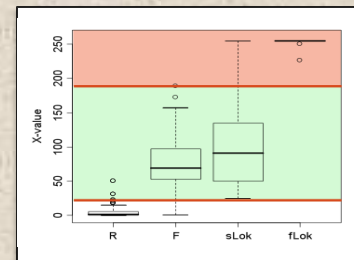- Scheibe & Gromann (2006), Behaviour Research Methods, Instruments & Computers 38 (3).

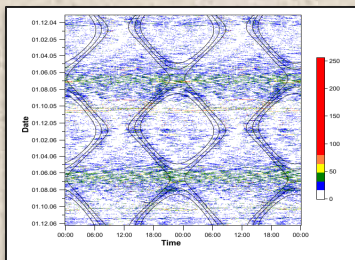# Different types of analyses
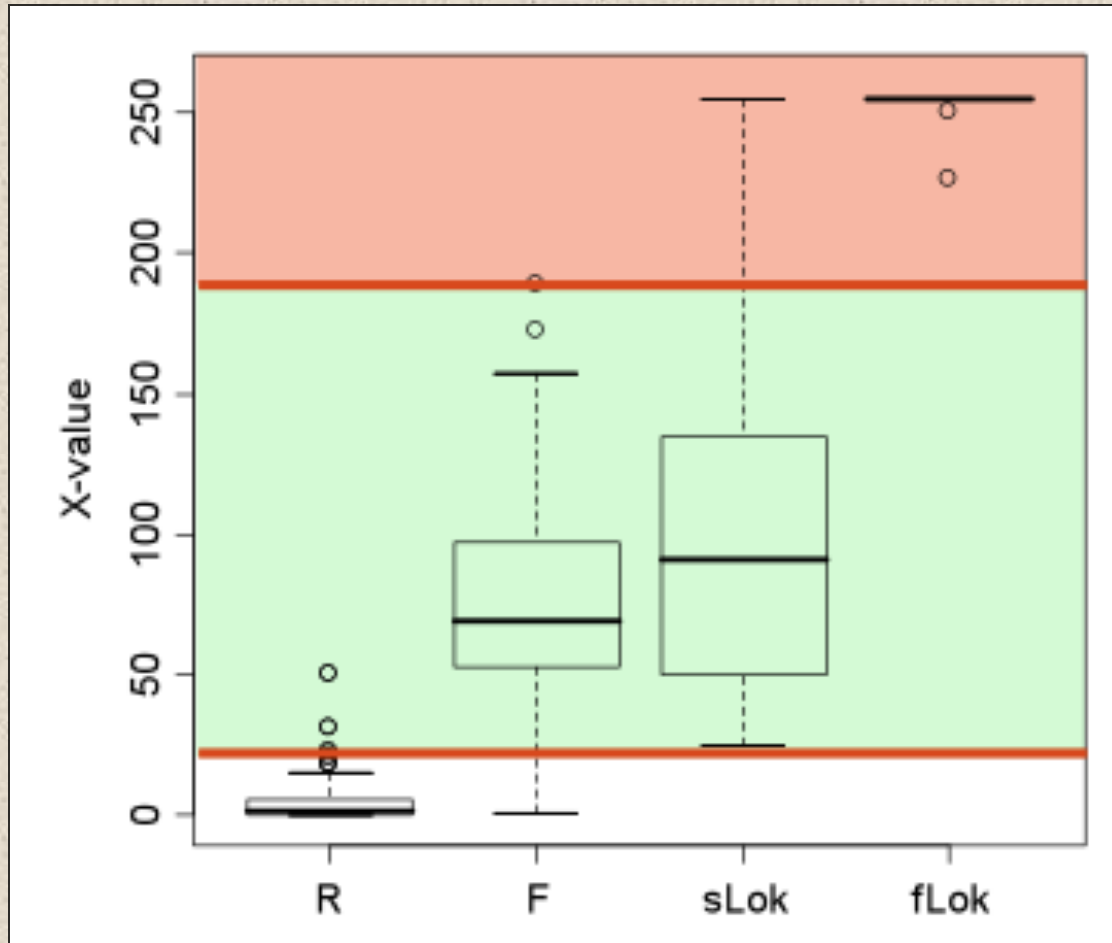
Detection of different behaviours (1D)

Calculation of:
- comparison of observed behavioural categories and acceleration values at the same time
- ANOVA

Output:
- determination of thresholds to differ activity states
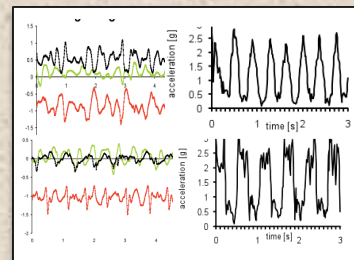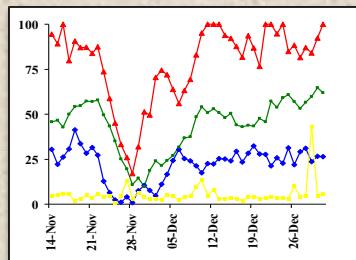
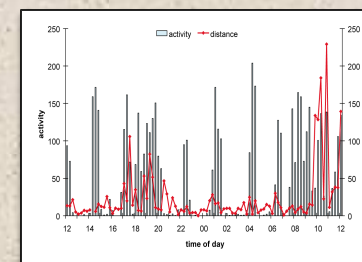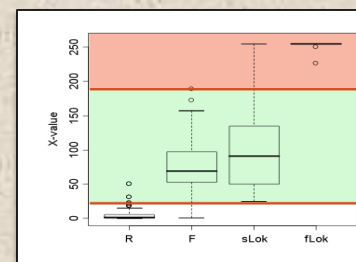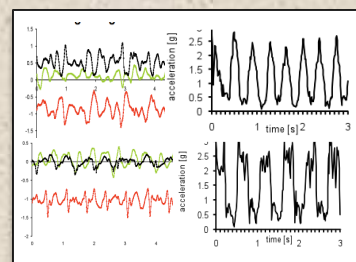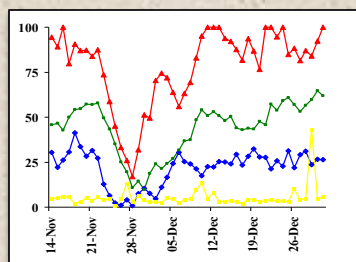Löttker et al. (2009), Wildlife Biology 15.
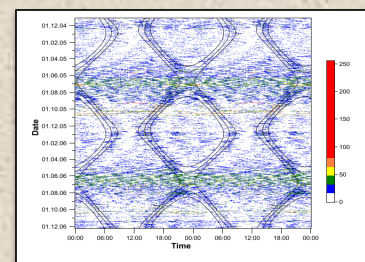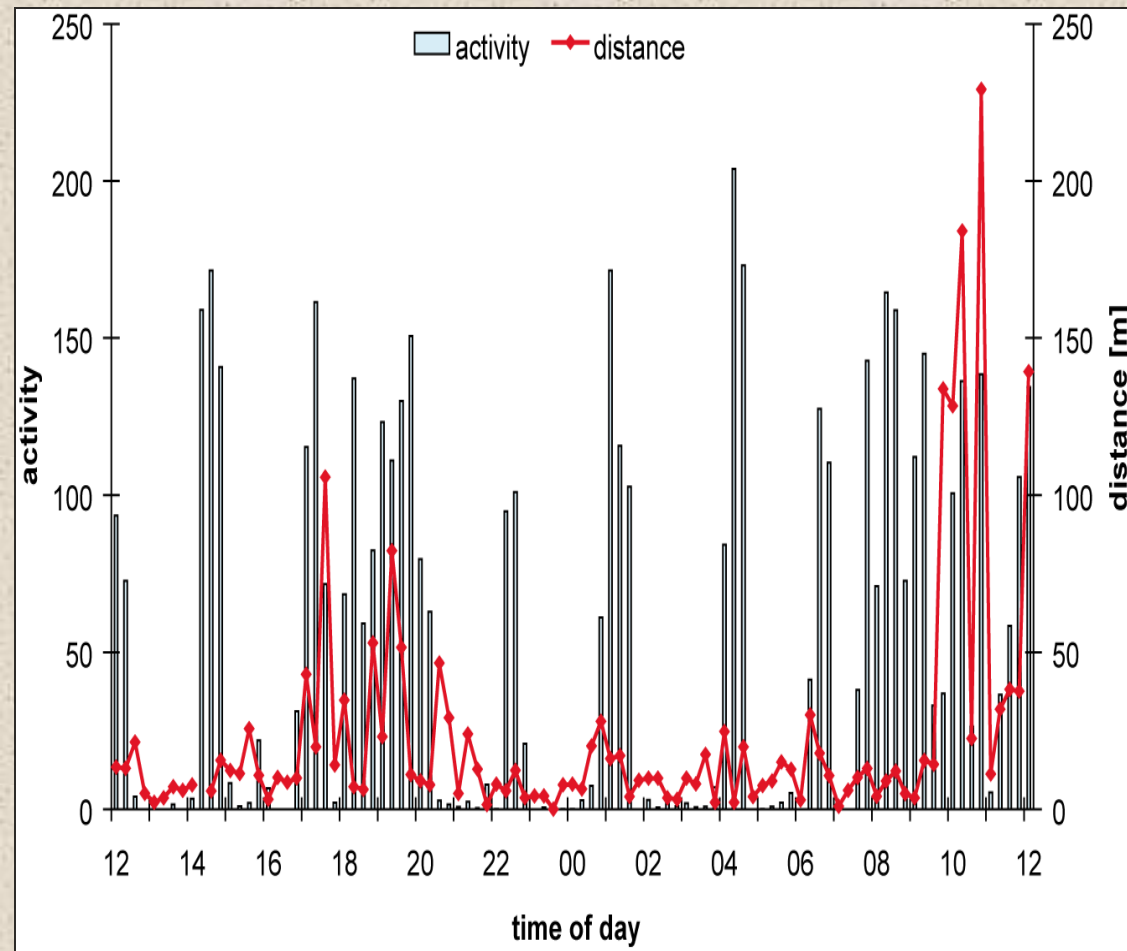
Different types of analyses

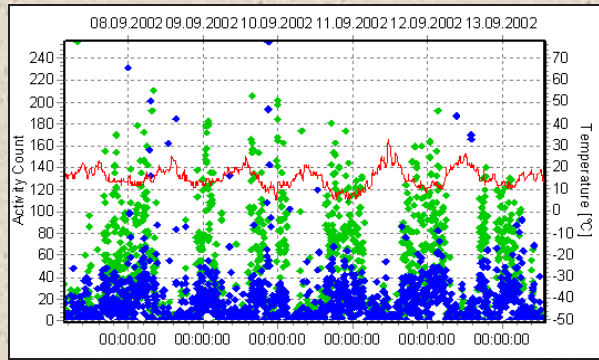Comparison between GPS-positions & acceleration data

Calculation of:
- differences between acceleration data and speed data (GPS)
- connect GPS-positions to special behaviours (accel. data)
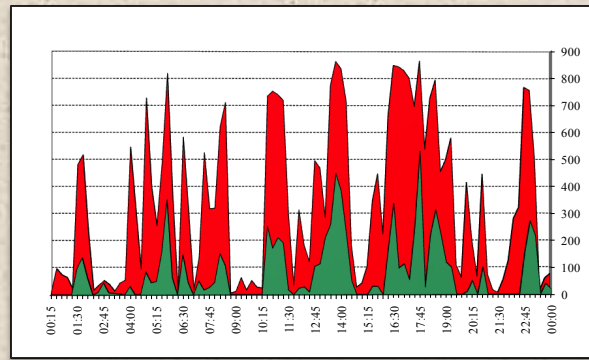
Output:
- functional habitat map (resting places or places of high activity & no locom.)
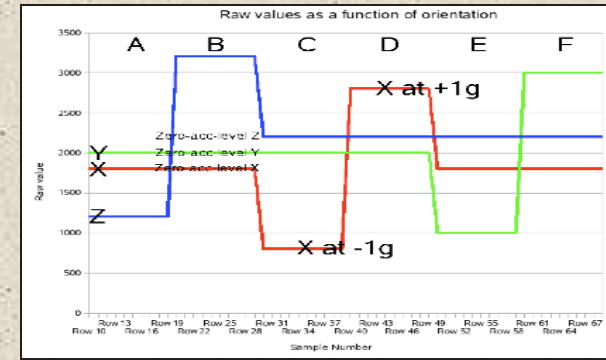
Which accelerometer suits to which analysis ?
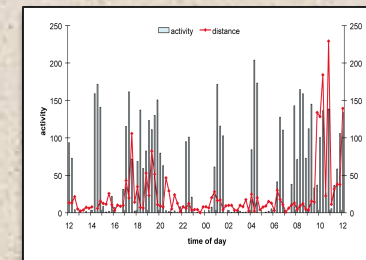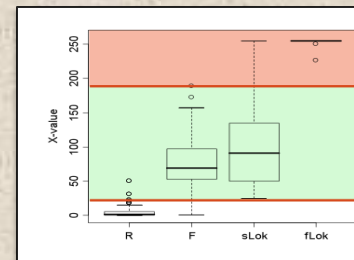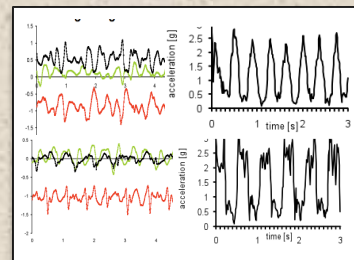

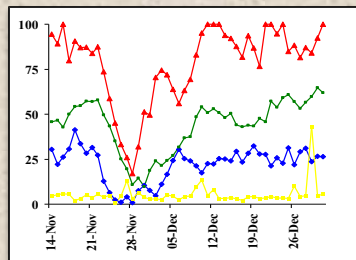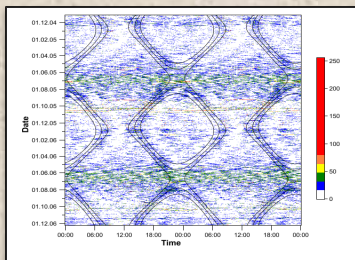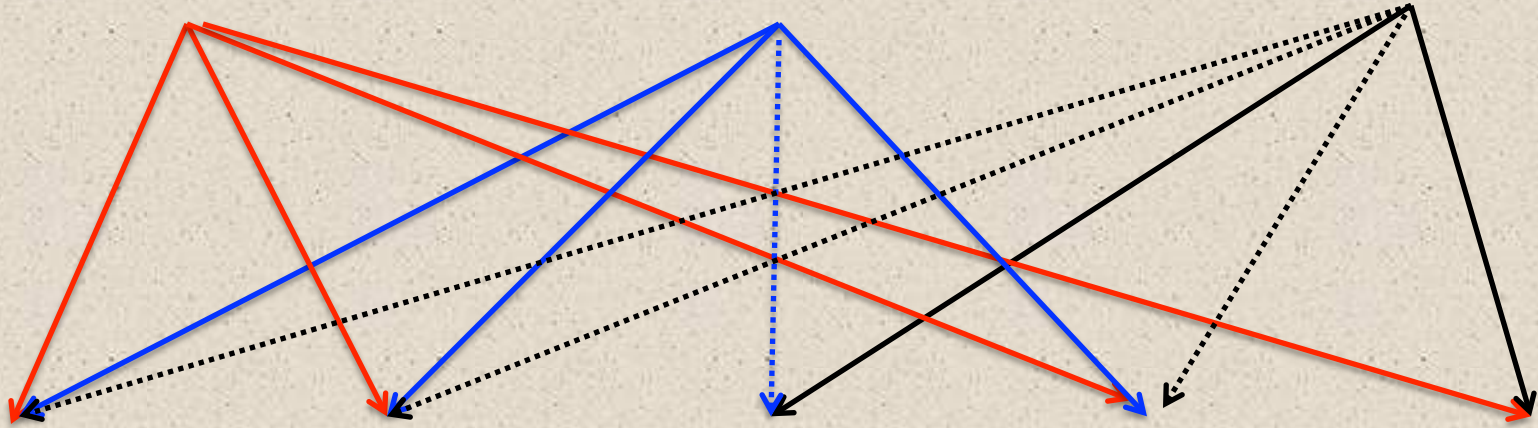GPS-Vectronic

Ethosys, Esys

E-obs, WAS

Annual basic pattern

Stress detection

To differ behaviours

To differ activity states

Compare to distances/GPS

Thank you for your attention !