



Multimission Science Data Archive

Example-analysis of biomedical
data from AMADEE-20



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OeWF Multi-Mission Data Archive


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Welcome to the multi-mission Science Data Archive of the Austrian Space Forum.

This archive contains information about the scientific and engineering experiments of our field missions, the type and quantity of data collected as well as information about the Principal Investigators and how to contact them.

For questions, please send us a message via the [Contact Us](#) link.

Missions

 **2018 AMADEE-18**
Location: Dhofar region, Oman
Duration: 01-28Feb 2018
[Science Archive AMADEE-18](#)

 **2017 Aouda Test Campaign 17C**
Location: Tirol, Austria
Duration: 21Aug2017

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What can you do with Mission Data?

Extra Vehicular Activities (EVAs)

critical stages of crewed surface missions

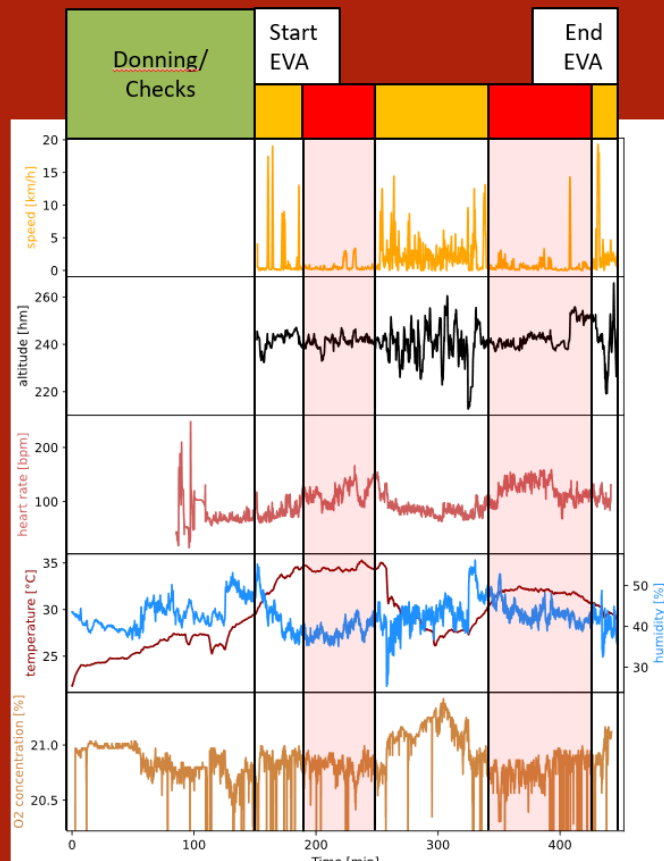
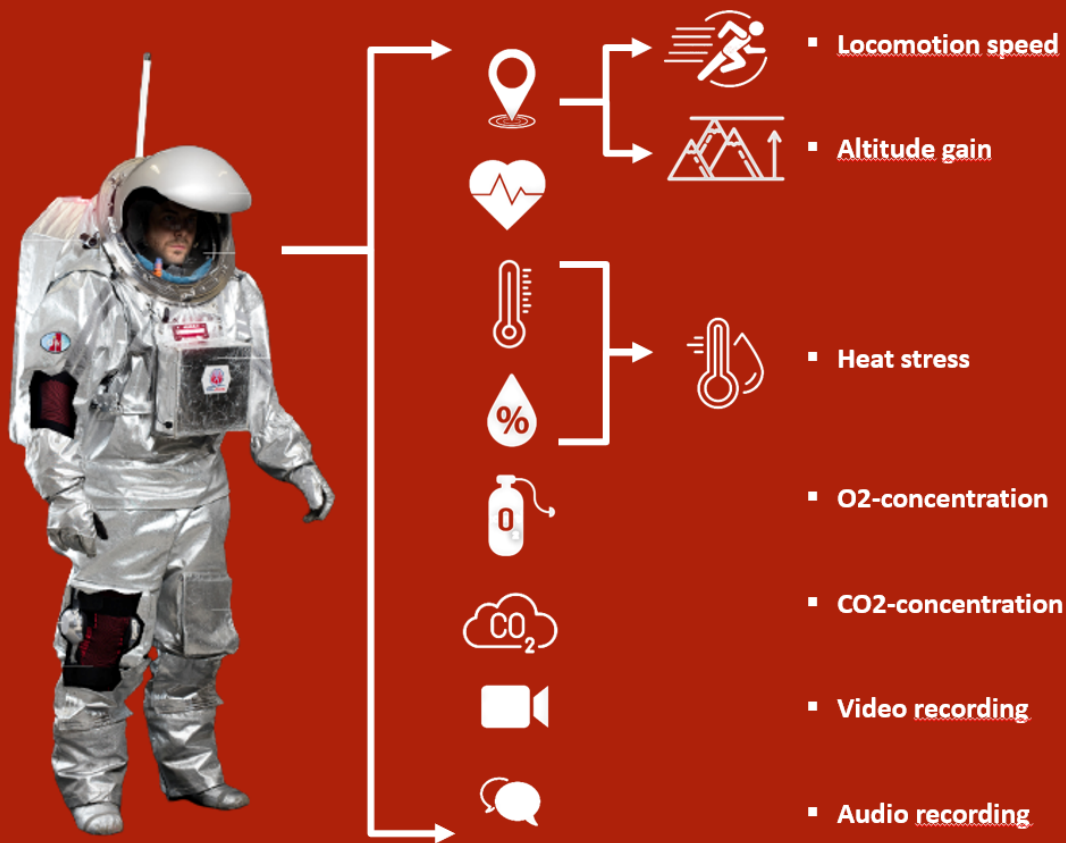
- **Strenuous physical work** - close to limits of physical capability
- **Dangerous working environment** - task failure → severe consequences
- **Variability in individual capabilities**

Aim: Analysis of biomedical data from AMADEE-20.

Conclusions & implications to support flight plan management.



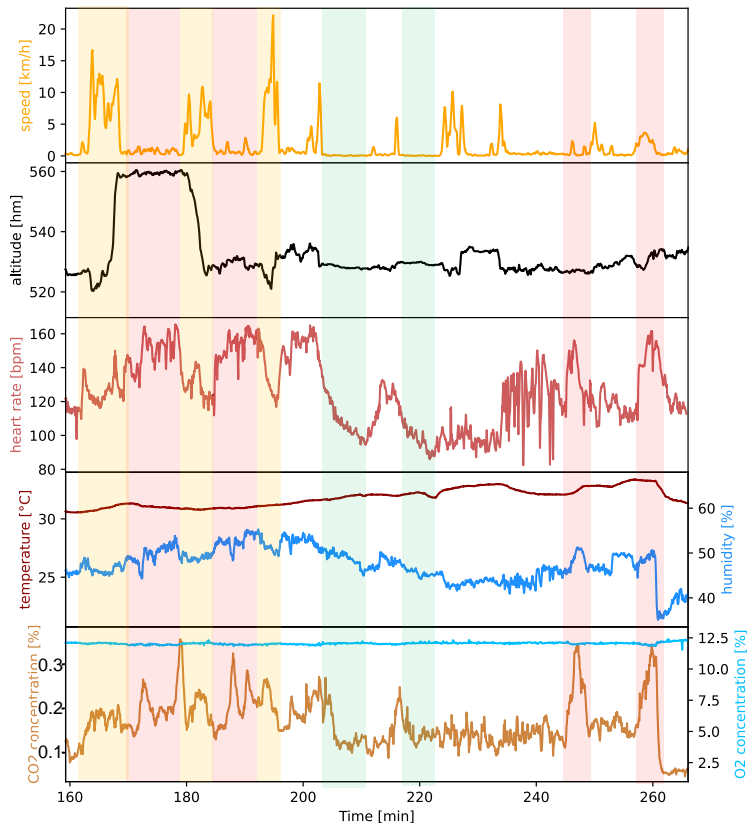
Time-series analysis of suit telemetry from AMADEE-20





Activity phases and physiological responses

2021-10-24 AOUDA_S: AMAZE, Micropotential A



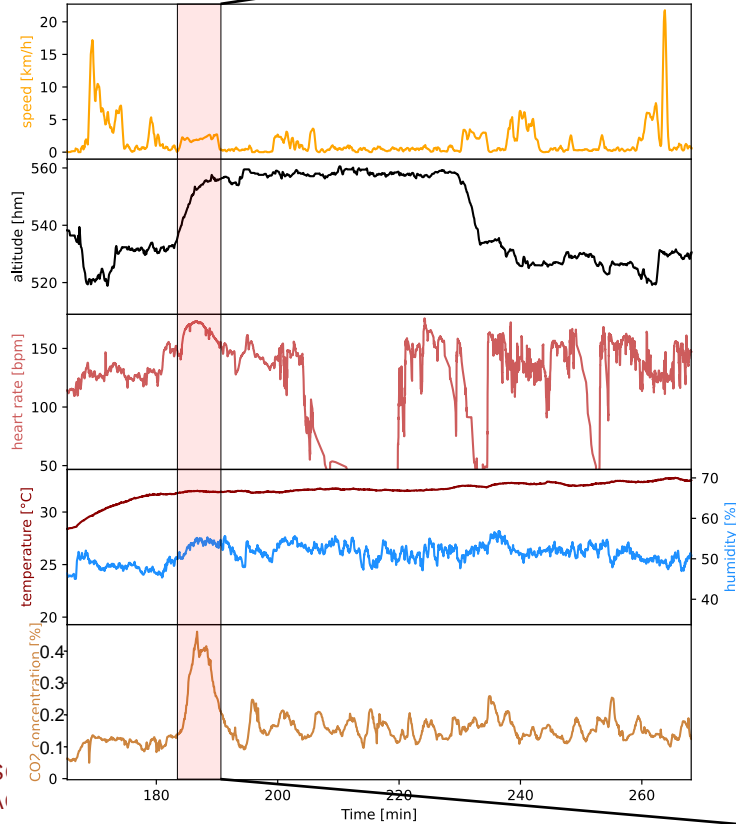
- Motorized locomotion** high speed (> 5km/h)
low intensity (> 140 bpm)
- Walking, stationary work** low speed (> 5km/h)
high intensity (> 140 bpm)
- Breaks**

- **Helmet temperature**
start of EVA -> 20-25°C
rising up to 35°C
- **Helmet humidity**
rising with increased ventilation (due to exertion)
rising with increases transpiration
- **CO2 concentration**
ambient concentration 0.04%
MNDOLI workplace safety 1% for 8 hour work shift
headache, dizziness,... can occur at 0.5%

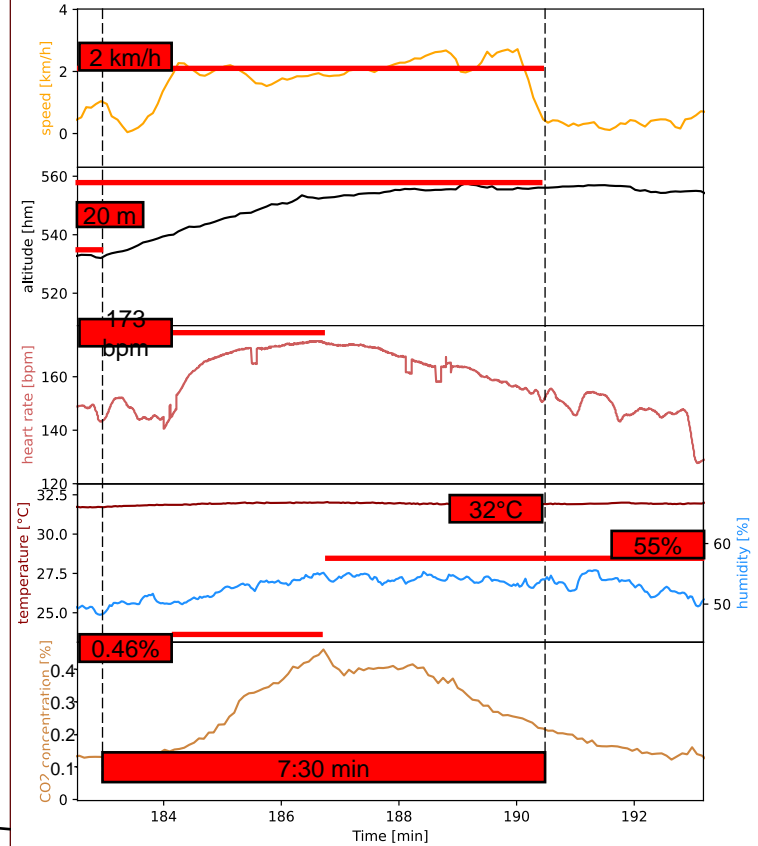
Analysis of exemplary activity – uphill walking



2021-10-18 AOUDA_S: Micropotential A

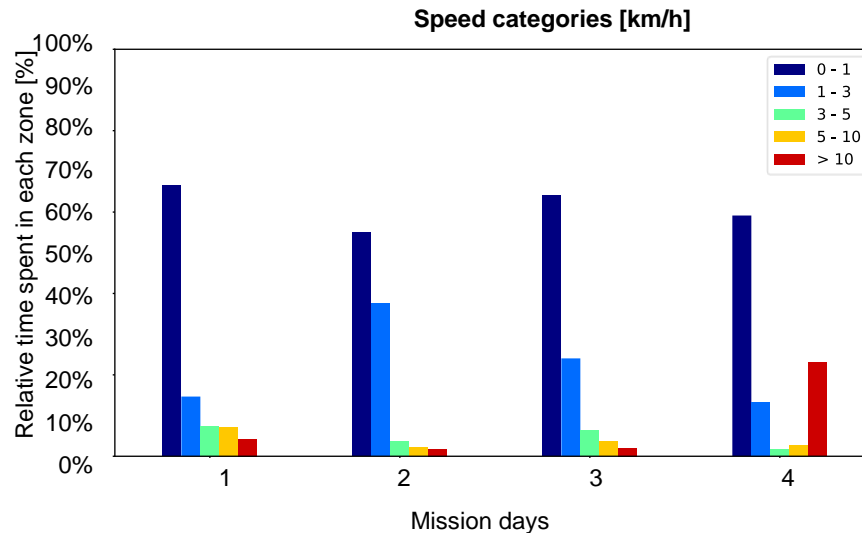
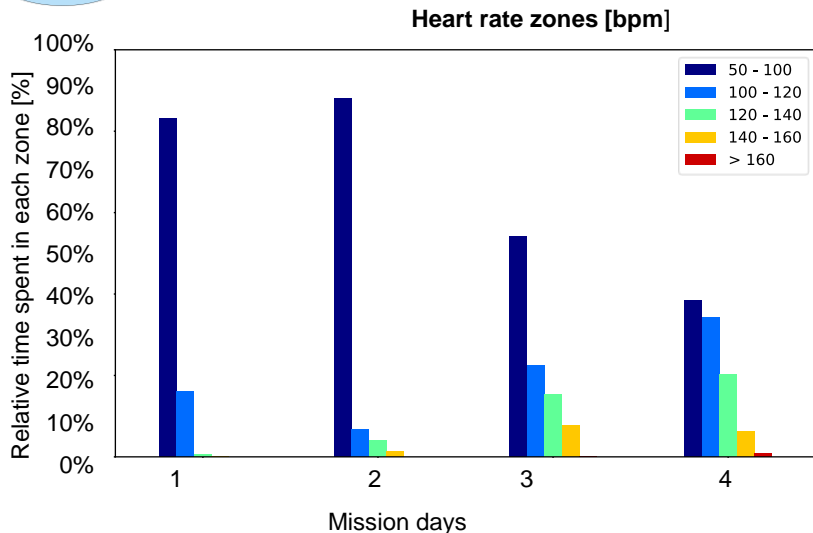


2021-10-18 AOUDA_S: Micropotential A





Aggregated Data Analysis



Day-by-day / Astronaut-by-astronaut comparison

- **Heart rate zones**

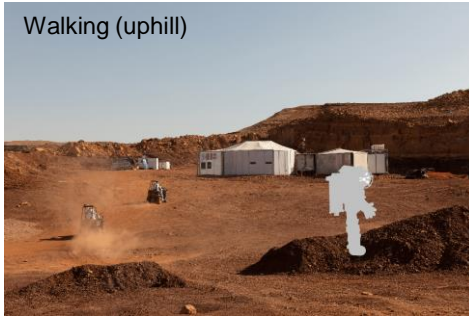
common way to classify and rate systemic physical exertion in sports and other activities
increase validity by including individual HRmax → relative HR zones

- **Speed categories**

a simple method to discriminate between activities and intensities based on locomotion
high proportion in low speed category → lots of breaks or stationary work
high proportion in higher speed categories → fast locomotion (probably motorized)

Move it! Move it! Common tasks and movements

Walking (uphill)



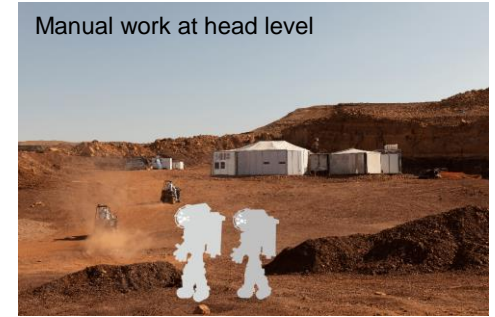
Manual work at ground level



Lifting objects from ground level



Manual work at head level



Biomechanical analysis

- **High additional loads (45kg)**
- **Pressurization**
- **Center of Mass**

increasing incline during walking amplifies exertion
aggravates certain phases of movements (early swing phase while walking)
cranial-dorsal shift due to PLSS weight

What to do with that knowledge?

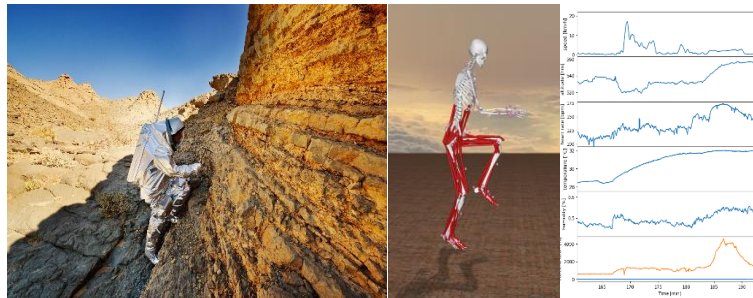
Environment - Task demands - Situational context - Psychological stress

- **Hostile environment** heat stress, rough terrain
- **Tasks** low to mid level of physical exertion; but: long term fatigue accumulation!
- **Demanding working situations** additional loads and coordinative challenges
- **Mid to high psychological stress** performance situation, time pressure, high costs, field experiments

Future implications and developments

- Improvements in long term fatigue monitoring
- Telemetry suitable for prediction model
- Influence of fatigue stress on performance & safety

→ Development of an individualized fatigue simulation system for surface EVAs





What would **YOU** like to know?

