INTERNATIONAL AUDIO LABORATORIES ERLANGEN
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AUDIO LABS

Exploring a Long-term Dataset of Nature Reserve Ambisonics Recordings

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1 – Introduction

- There are already several databases of soundscape recordings [1, 2].
- **Recordings** of a particular **location in a nature** reserve done **over years** with exactly the **same recording equipment placed at the exact same location and recorded in 3D** are not known.
- → **Such recordings and first analyses are presented here.**

3 – Analysis Methods

- **Manually tagging**: according to a list of descriptors recordings are tagged and a list of sound-events is created.
- **Long-term Spectrum analysis**: time-averaged magnitude spectrum of the Short-Term Fourier Transform (window length of 1024 samples hop size 512 samples). Example see fig. 1.
- **Energy Measurements in Frequency Bands**: to approximate energy in frequency bands the lowest and highest value of energy in predefined bands was taken and averaged (example fig. 2). Bands were defined according to sound sources.
- **Spatial Analysis**: the ambisonic recordings were decomposed into two spatial regions: upper and lower hemisphere (fig. 3). For both regions, we estimated the long-term magnitude spectrum. Energy ratio between these two hemispheres was computed.

6 – Conclusion

1. **Dataset (52 recordings) offers a big potential for further analysis.**
2. Need of more detailed methods of algorithmically based analysis and correlations to tagging lists.
3. Need of a bigger dataset (more years) of recordings and interrelated/-connected (internet-) data concerning the framework of each recording.

7 – Future Work

- **Continue monthly recordings** (preferably **permanent**, waterproof **installation**). Add **datalogging of onset data** (temperature, windspeed & -direction etc.) during recordings.
- Use **detailed analysis** results to get to a **deeper understanding** of processes in **climate change**.

2 – Dataset Description

Start in 10/2017. **Recording location**: within a **nature reserve** at the **Birds Island** of the Altmühlsee (a lake in south Germany, 49.146173 N, 10.705281 E). Field of observations includes sounds generated by e.g., various bird species, frogs, beavers, insects. There are sounds caused by the wind (e.g. rustling leaves, moving branches etc.). Sounds created by human intervention are found as well.
Each month (except 02 & 05/2020), a **two hour Ambisonics 1st order recording** is done. The recording **starts one hour before sunset** and **stops one hour after it**. Weather conditions are documented manually and by photos are taken from sky and surrounding landscape of the recording spot.
We have started to **cross-reference internet-based, historic sensor data** (e.g. weather and sun quality).

4 – Results of Analyses

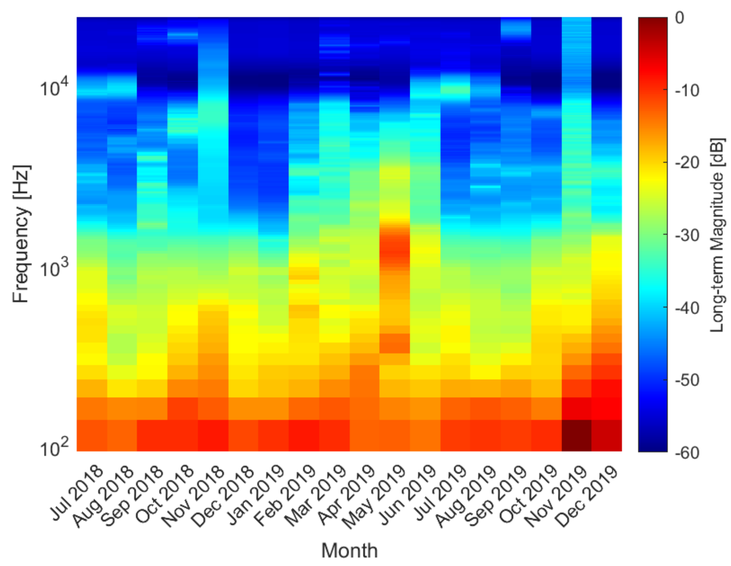

Fig. 1: Long-term spectrogram over 1.5 years, July 2018 to December 2019. May 2019 contains much energy in mid Freq. due to a lot of bird song activity.

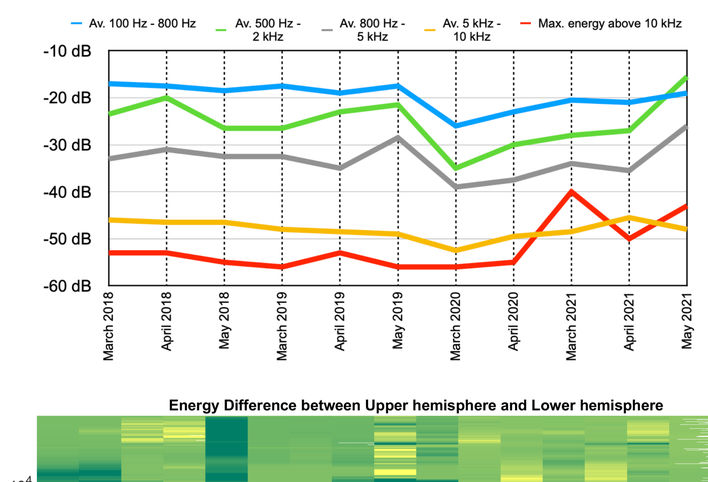

Fig.2: Energy in frequency bands. See reduced energy due to the lockdown in March 2020.

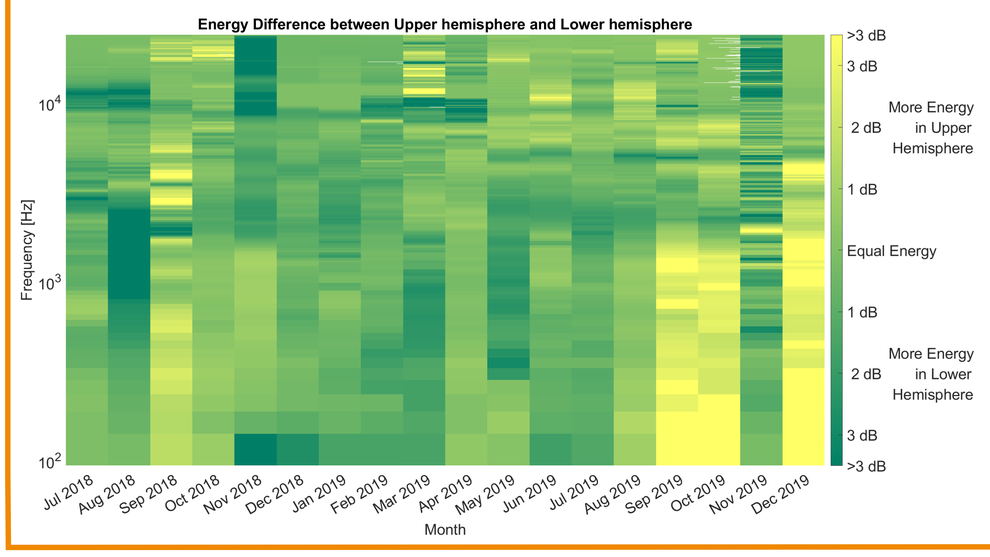

Fig.3: upper and lower hemis-phere

8 – References

[1] 2022. **Center for Global Soundscapes**. https://centerforglobalsoundscapes.org/
[2] A. Mitchell,T. Oberman,F. Aletta,M. Erfanian,M. Kachlicka, M. Lionello & J. Kang. 2021. **The International Soundscape Database:** An integrated multimedia database of urban soundscape surveys – questionnaires with acoustical and contextual information. https://www.zenodo. org/record/5914715#.YnwwoGDP00Q