Objective derivation of Climate Indices for the assessment of altered risk-landscapes driven by accelerated climate change

Nikta Madjdi[1], Katharina Enigl[2], and Christoph Matulla[2]

[1]*University of Vienna, Meteorology and Geophysics, Vienna, Austria*

[2]*Climate Impact Team, Climate Research Branch, Zentralanstalt für Meteorologie und Geodynamik*

EGU 2020

Targets of the study

- The detection of damage events contained in the Event Space (Enigl et al., 2019) of the category ‚Floodings‘ inside specified buffers (i.e. 5km) around the Danube
- Seasonal occurences of identified events and detection of the most affected regions around the Danube throughout the year
- Determination of the Danube‘s influents upstream the event‘s location and corresponding drainage basins

Data

- The Event Space (Enigl et al., 2019) consists of the following
  - Included processes
    - Floods (WLV), fluviatile sediment transport (WLV), debris-flow-like processes (WLV), continous rain (VIOLA)
  - Period covered: 1950- Oct. 2017
  - Number of registered events:
    - gravitational mass movements (GM), floodings (FL)
    - WLV: GM 1 357, FL 16 458
    - VIOLA: FL 9246
- Surface water body sub drainage basins, National Water Management Plan (NGP) 2015, Austria (BMLRT)

Methods

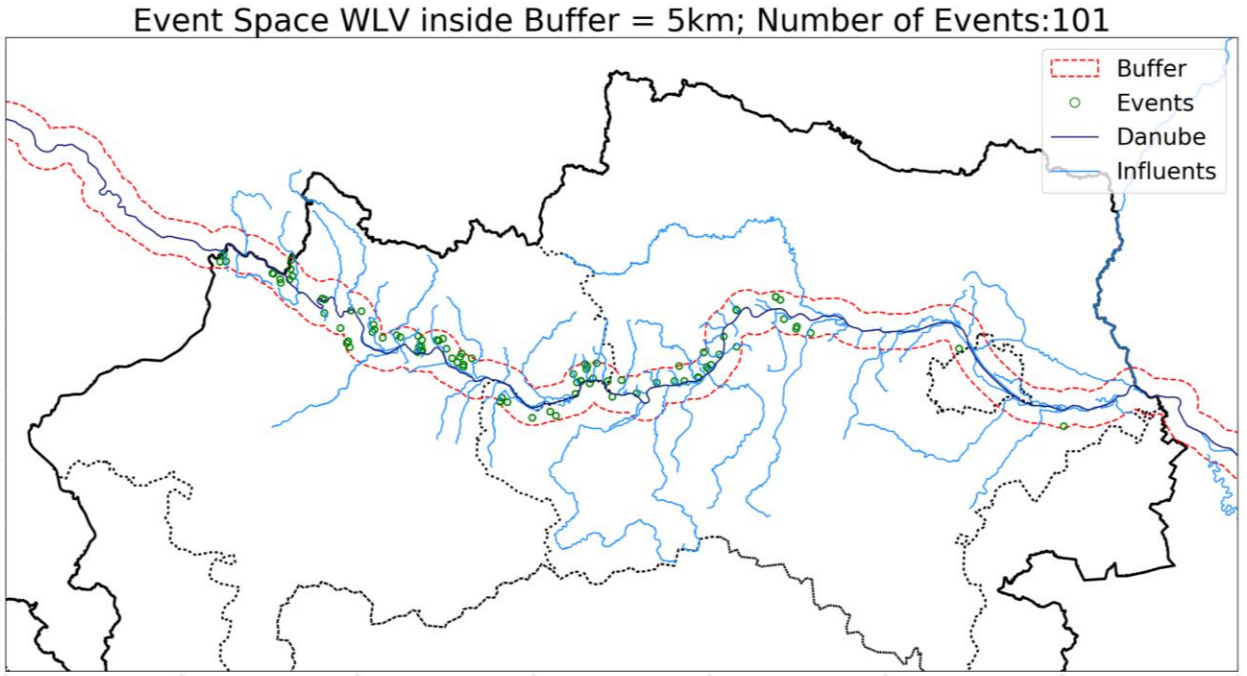
- Identification of events in the Danube region:
  - Buffers with a radius of 5/10 km were placed around the Danube to detect events from the event space within these buffers
  - Analysis of seasonal and monthly distribution
- Detection of influents and their drainage basins:
  - Locate the nearest points on the Danube to these events
  - Splitting the Danube in a western (upstream) and eastern (downstream) part for each nearest point
  - Influents before the event‘s location are those, which intersect with the western (upstream) part of the danube
  - Determining the drainage basins corresponding to the influents through intersection with the sub drainage basins dataset

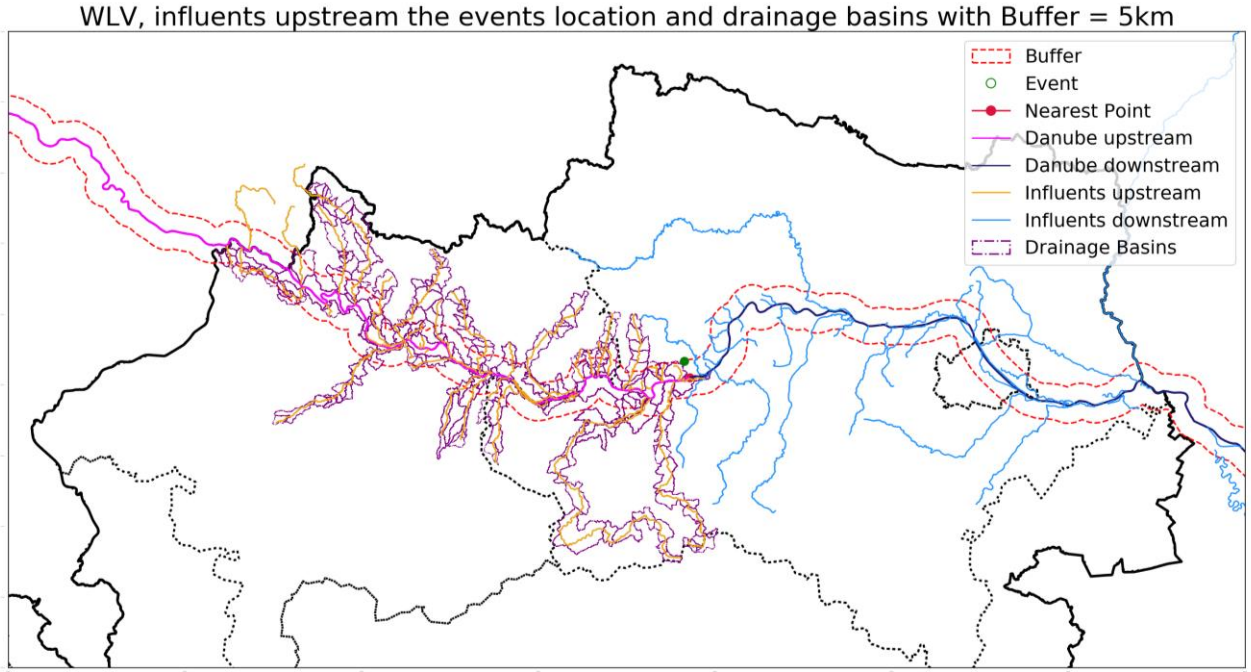
Results

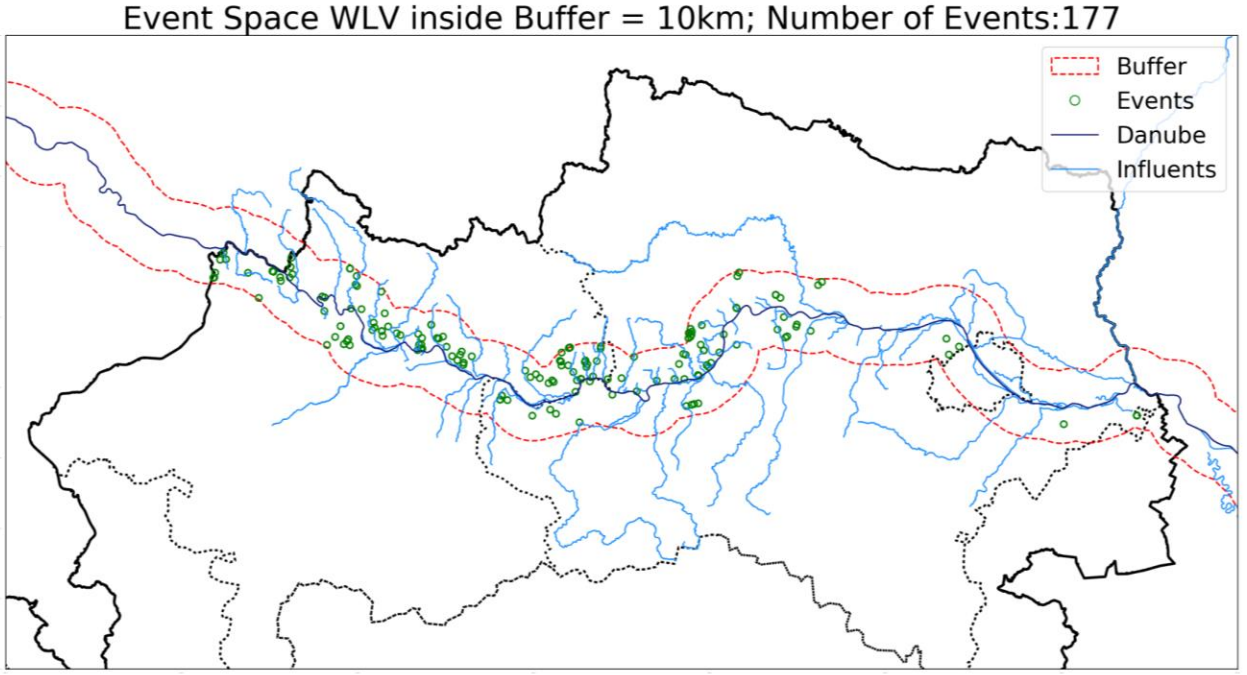
1. Identification of WLV events inside buffers with a radius of 5/10km and determination of upstream influents and corresponding drainage basins

Figure 1 & 2 (top and bottom right): WLV events inside 5 km buffer (upper right) and 10 km buffer (lower right).

Figure 3 (bottom left): Identified influents and corresponding drainage basins using an example in western Lower Austria

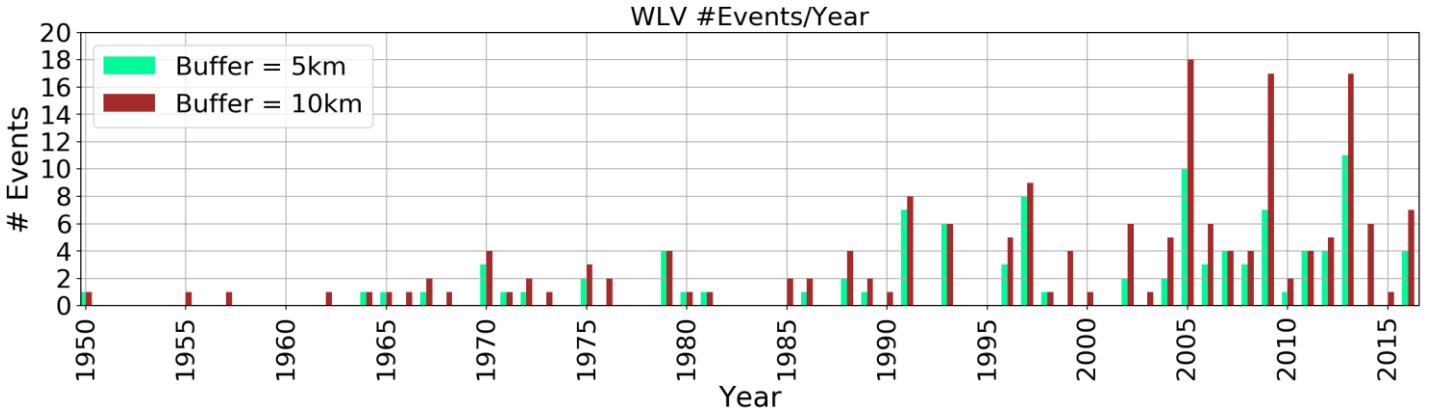






Results

2. Temporal analysis of identified WLV events within buffers 5/10km around the Danube.



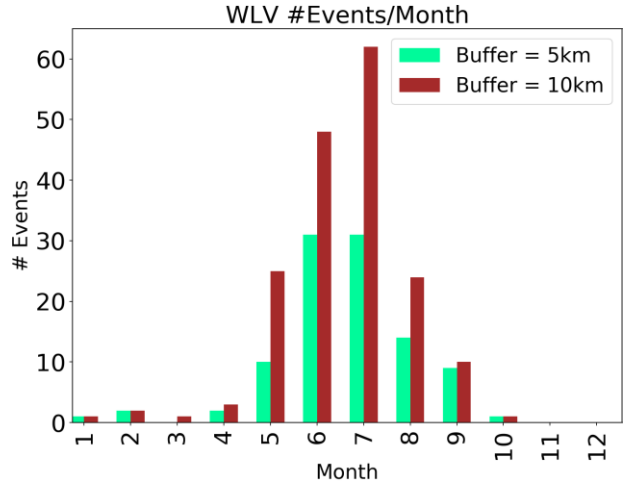
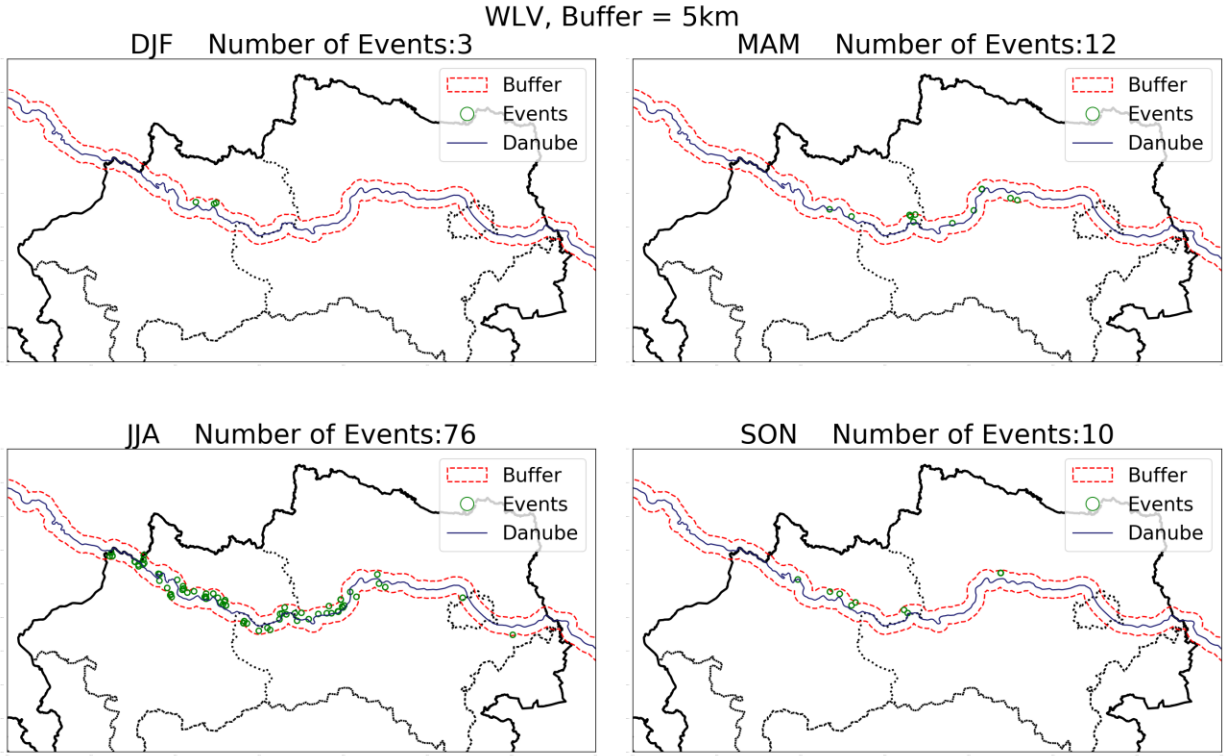
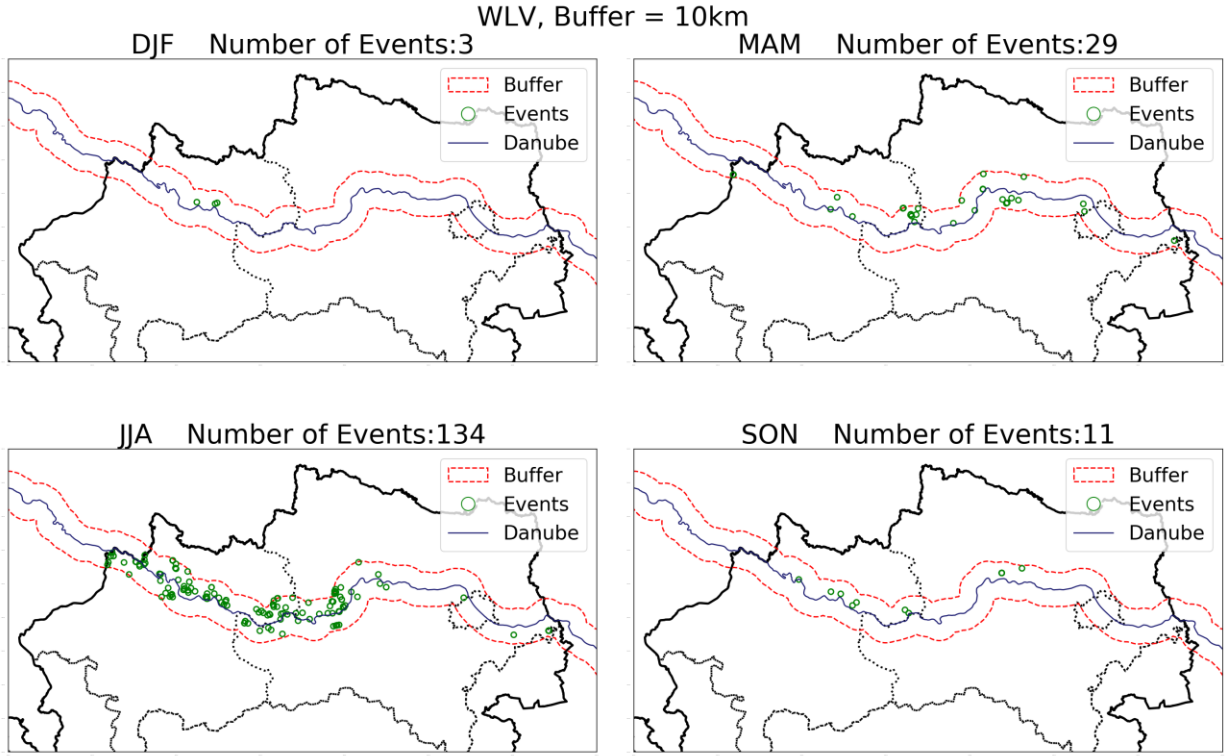


Figure 4 (top left): Number of WLV events per year from 1950 to 2016
Figure 5 (top right): Distribution of the number of WLV events per month
Figure 6 & 7 (bottom row): Seasonal occurences of WLV events within 5km buffer (left) and within 10km buffer (right)





Outlook

- Detection of subregions in the northern lowlands of Austria
- detection and quantification of weather processes triggering these events by blending the drainage basins with daily precipitation data provided by ZAMG (SPARTACUS) with spatial resolution 1 x 1 km (Hiebl & Frei, 2017)
- Derivation of Climate Indices (CI) and Hazard Development Corridors (HDC) representing the shifts in risk-landscapes throughout the century
- Attempt to implement previous results in decision-theoretical concepts i.e. Real Option Analysis (ROA)

References

Enigl, K. et al., 2019: Derivation of canonical total-sequences triggering landslides and floodings in complex terrain of the European Alps

Hiebl J., Frei C. ,2017: Daily Precipitation grids for Austria since 1961 – development and evaluation of a spatial dataset for hydroclimatic monitoring and modelling, Theoretical and Applied Climatology

Matulla, C., E. K. Penlap, P. Haas, and H. Formayer, 2003: Multivariate techniques to analyse precipitation in Austria during the 20th century. International Journal of Climatology 23, 1577-1588. doi.org/10.1002/joc.960