"Tuning" CORDEX data to reduce uncertainty in climate projections for the Carpathian Region

Csaba Zsolt Torma

Department of Meteorology,
Eötvös Loránd University,
Budapest Hungary

2019- : Assistant professor, ELTE, Budapest
2016-2019: Postdoctoral researcher ELTE-HAS (Budapest)
2012-2016 : Postdoctoral fellow, ICTP (Trieste)
2011: Phd in Meteorology, ELTE (Budapest)
2004: MSc in Meteorology and Astronomy, ELU (Budapest)

Csaba Zsolt Torma
e-mail: csaba.zsolt.torma@ttk.elte.hu

ELTE EÖTVÖS LORÁND TUDOMÁNYEGYETEM

NEMZETI KUTATÁSI, FEJLESZTÉSI ÉS INNOVÁCIÓS HIVATAL

objective

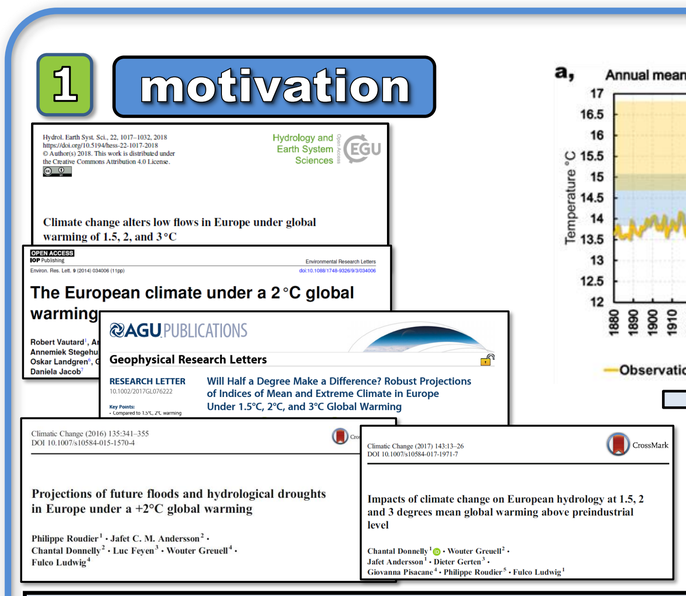
This study investigates the greenhouse gas-induced temperature change signals over the Carpathian Region with particular focus on specific warming levels (**WLs**) at the regional scale. An example for 1.5 °C **ToR** (time of reaching certain threshold) is reported here for the Carpathian Region.

experimental design

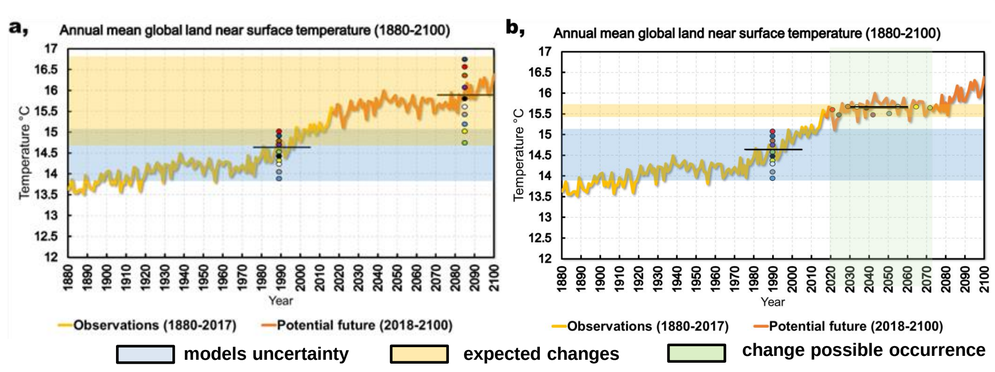
A large number of regional climate model (RCM) experiments have been accomplished over different sub-regions of the globe as part of the international initiative called the COordinated Regional Downscaling Experiment (CORDEX; Giorgi et al., 2009). As the European branches of the CORDEX program: **EURO-CORDEX** and **Med-CORDEX** provide RCM simulations targeting Europe (for Med-CORDEX: Mediterranean region in focus) at grid resolutions of 0.44° (medium resolution) and of 0.11° (high resolution). Investigations of ensembles of driving global climate model (GCM) and nested RCM simulations for the late 21st century with respect to late 20th century from the CMIP5, EURO-CORDEX, and Med-CORDEX experiments are presented at **high resolution (0.11°)**, with a special focus on the **Carpathian Region**. The present work provides an overview on the fine-scale RCM downscaling and GCM-produced temperature change signals under the **RCP8.5** scenario in future climate projections over the regions of interest. The RCM mini-ensemble consists 5 models in total: **ALADIN, CCLM, RCA4, RACMO** and **RegCM**. Driving fields were provided by the following GCMs: **CNRM-CM5, EC-EARTH, HadGEM2-ES** and **MPI-ESM-LR**. Different observational datasets were used at global (GISTEMP, 2020) and regional scales (CARPATCLIM; Szalai et al., 2013).

motivation and results

1 motivation

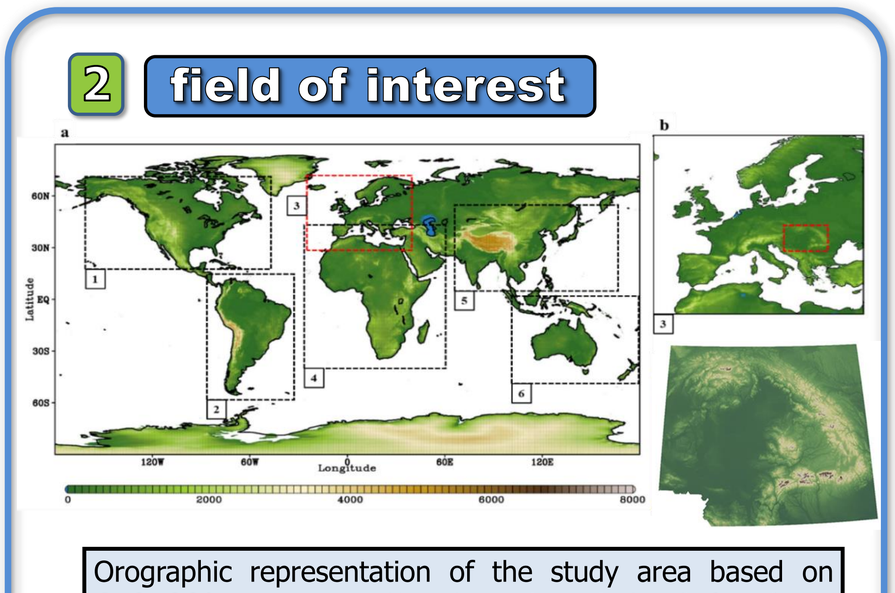


Several studies have been published focusing on climate change in the **EURO-CORDEX region** under different **global warming levels (GWLs)**.



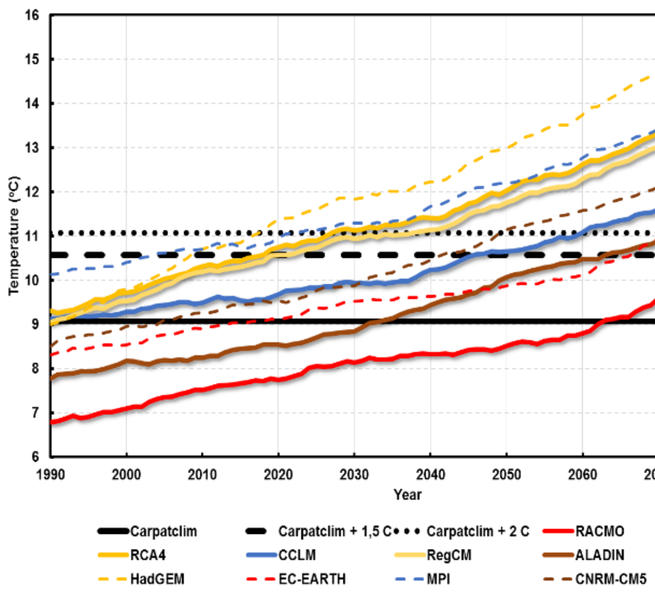
Search for climate change on the **global** scale using the **standard method** by analysing climate model runs for given reference and future periods (panel a), and by analysing climate model runs for given **GWLs compared to observations** (panel b).

2 field of interest

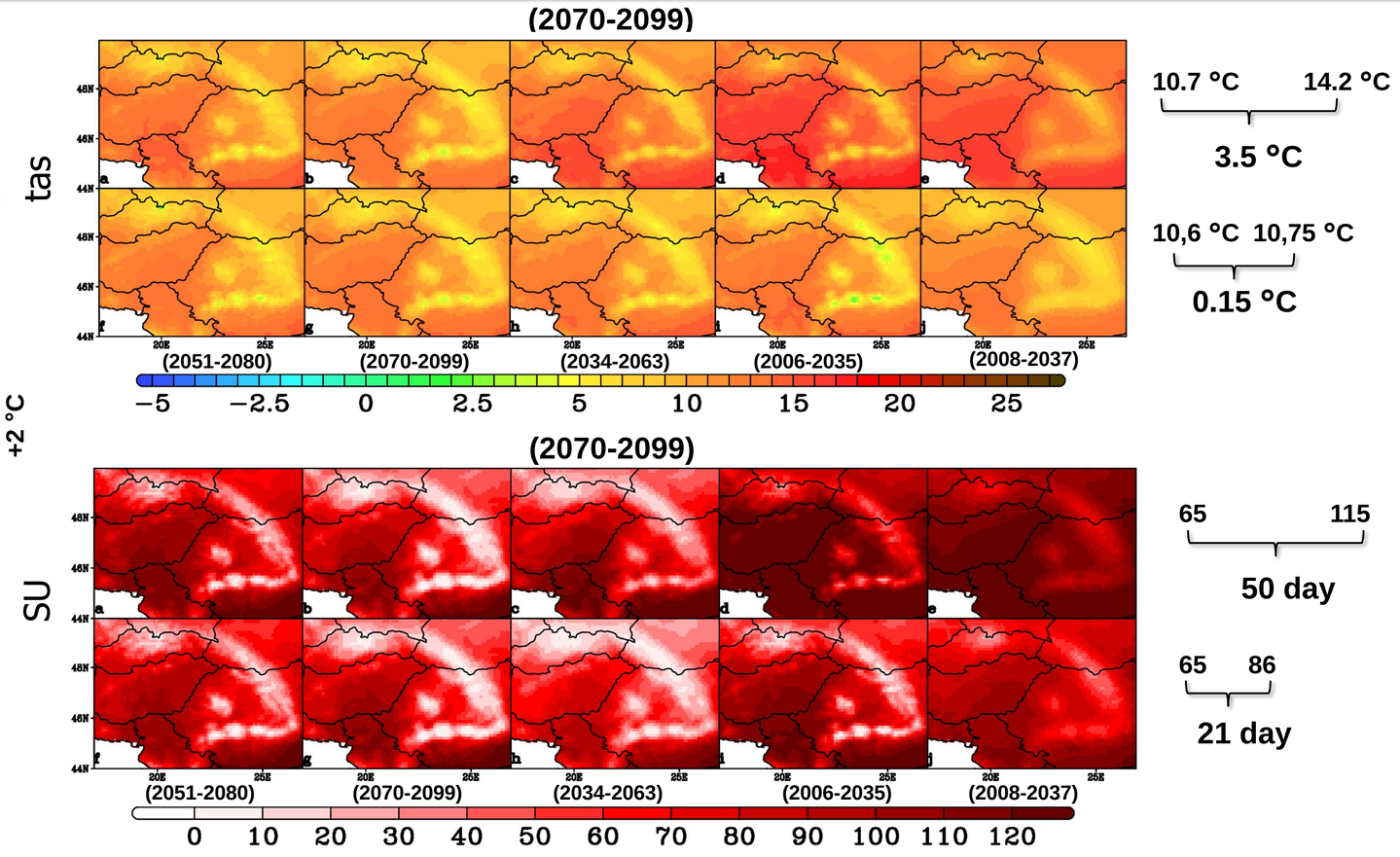


Orographic representation of the study area based on GTOPO30 database at 1′ horizontal resolution (~2 km). Numbers refer to CORDEX regions (3: EURO-CORDEX). **Carpathian Region** located in **EURO-CORDEX region**.

2 results



30-year running mean near-surface air temperature based on observations (CARPATCLIM) on **RCM** and **GCM** data for the Carpathian Region. Thresholds are based on CARPATCLIM.



Expected **near-surface mean air temperature** (tas) and **annual number of summer days** (Tmax > 25°C, 30-year averages) based on RCM simulations following RCP8.5 **under 1.5°C RWL**, relative to the **1976-2005 RCM reference mean** (top panels) and relative to observations (bottom panels). Intervals to the right of the sub-panels are for changes by a **fixed period (2070-2099)** and for the given **RWL**. The **30-year periods** shown below the sub-panels are for **ToR**.

summary

- **Application of GWLs at global scale and use of RWLs at regional scale can improve climate estimates**
- **Reducing uncertainties in climate projections (including climate indices)**
- **ToR is emerging as a new metric in climate projections that can be more accurate with bias-corrected model data.**

Follow the QR code to get the poster in .pdf!

References

Giorgi, F., Jones, C., and Ghassem, A., 2009: Addressing climate information needs at the regional level, The CORDEX framework. WMO Bull (July 2009 issue)

GISTEMP Team, 2020: GISS Surface Temperature Analysis (GISTEMP), version 4. NASA Goddard Institute for Space Studies. Dataset accessed 2020-11-04 at https://data.giss.nasa.gov/gistemp/.

Szalai, S., Auer, I., Hiebl, J., Milkovich, J., Radim, T.. Stepanek, P., Zahradnicek, P., Bihari, Z., Lakatos, M., Szentimrey, T., Limanowka, D., Kilar, P., Cheval, S., Deak, Gy., Mihic, D., Antolovic, I., Mihajlovic, V., Nejedlik, P., Stastny, P., Mikulova, K., Nabyvanets, I., Skyryk, O., Krakovskaya, S.,Vogt, J., Antofie, T., and Spinoni, J., 2013: Climate of the Greater Carpathian Region. Final Technical Report. http://www.carpatclim-eu.org. ; http://www.clker.com/clipart-15149.html

Acknowledgements

The research has been supported by the Hungarian Scientific Research Fund (OTKA FK-142349). All data from EURO-CORDEX and Med-CORDEX modelling groups and GTOPO30 data used in this work are also acknowledged.