PRELIMINARY TRITIUM ISOSCAPE OF PRECIPITATION ACROSS THE ADRIATIC-PANNONIAN REALM

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INTRODUCTION & AIMS

Tritium is an important natural tracer in the hydrological sciences. Measurements of the tritium activity of precipitation in the Adriatic-Pannonian region began in Vienna Hohe Warte in 1961, which is the longest continuously operating station in Central Europe. The dataset used in the present study is compiled of ~7700 monthly precipitation tritium activity values from 71 stations covering the period from Jan 1961 to Dec 2017. To maximize the spatiotemporal density of the data not only the Adriatic-Pannonian region, but the bordering areas were included in the analyses as well.

The aim of the study was to develop a preliminary isoscape for tritium in precipitation across the Adriatic-Pannonian Realm for the decades around the turn of the 21st century.

MATERIALS & METHODS

- Monthly ^{3}H records from 71 precipitation stations (GNIP (IAEA, 2018), ANIP (Kralik et al, 2003), Palcsu et al. (2018), current project) were acquired along with gridded precipitation data from the GPCC's database (Becker et al., 2013) to derive amount weighted annual tritium activity averages.
- Changes in the availability of ^{3}H data from different stations outlined three time horizons with a relatively high abundance of data: early 1980s (n≈15), early 2000s (n≈15) and the early 2010s (n≈19) (Fig. 1).
- At least one year was chosen for investigation from each period where the station densities reached their maxima (1981, 2001 and 2012 Fig. 1).

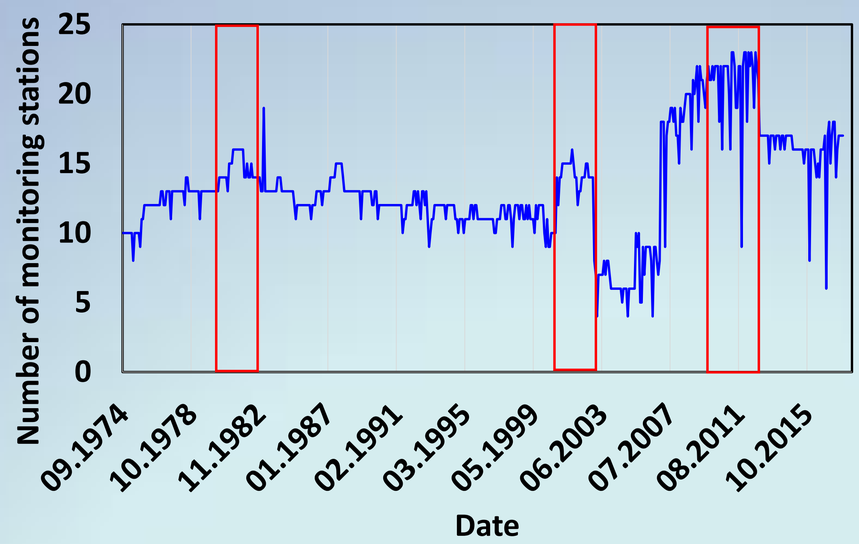


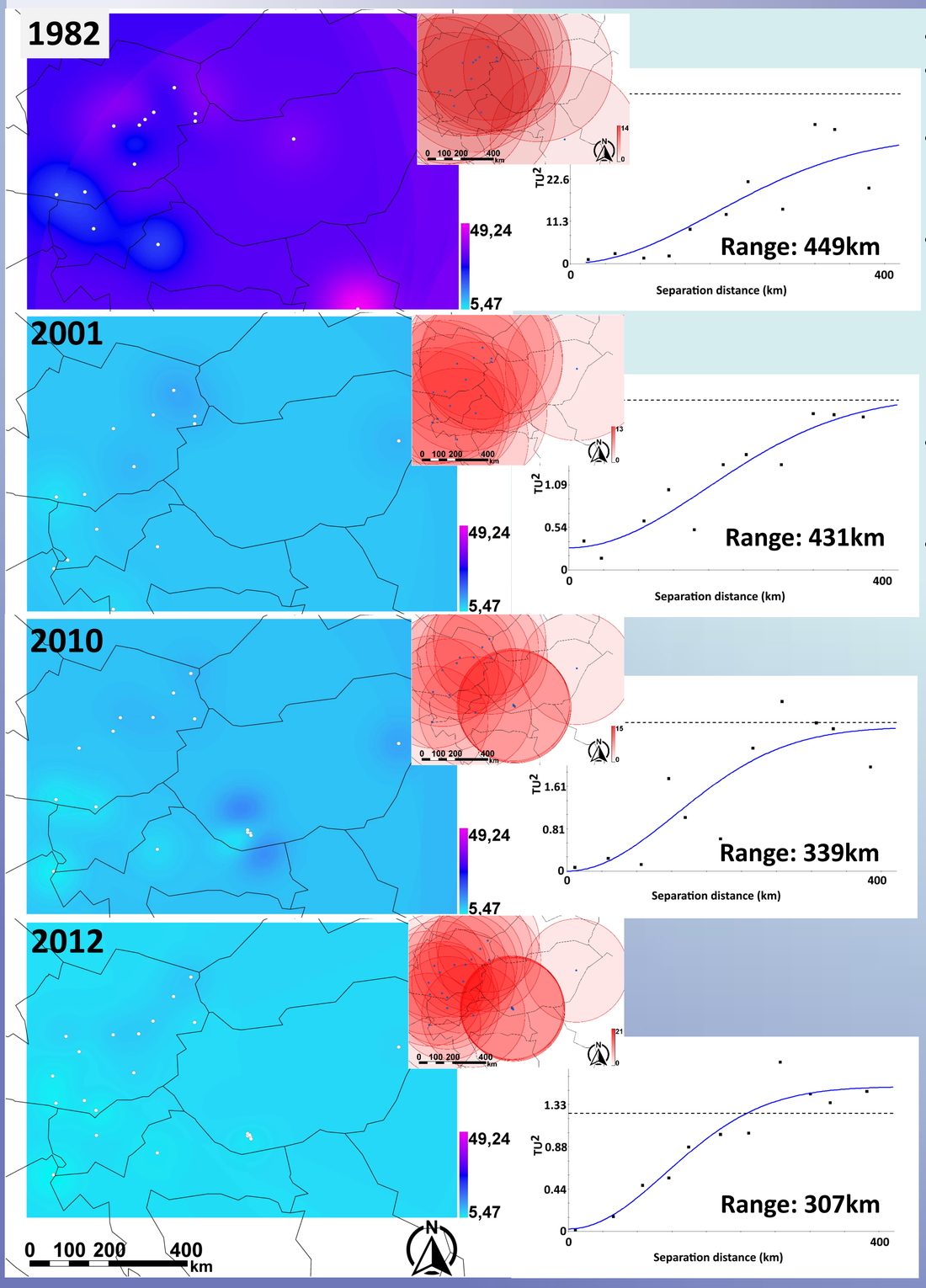
Fig. 1. *Number of precipitation stations producing ^{3}H records for the period 1961-2017, during which continuous measurements were performed. The red vertical rectangles represents the periods the periods for which the highest number of stations contributed data..*

- Years were discarded when more than 15% of the annual precipitation amount did not have corresponding ^{3}H activity
- Detailed quality check was conducted on the chosen years
  - Semivariogram clouds were produced for further filtering of outlying values

- The presence of the documented poleward increasing trend of precipitation tritium on a hemispheric scale (Rozanski et al., 1991) was investigated in the study area.
- Despite evidence, trend removal was not conducted due to the limited latitudinal range of the study area (°5) and the lack of significant linear relationship or the unexplainable negative slopes even in certain years (e.g. 1987).

- The basic function of geostatistics, the variogram (Matheron, 1965) was used to describe the spatial autocorrelation structure of the ^{3}H in the Adriatic-Pannonian Realm to obtain the weights necessary for kriging used to interpolate an isoscape.
- Variogram analysis was conducted on 4 precipitation amount weighted annual average datasets using eleven 36 km bins with a 400km max lag distance

RESULTS & CONCLUSIONS



- Variograms were produced at a minimum number of 14 sampling sites
- An almost trivial requirement: all the stations should not be clustered together, instead well distributed over the region
- The monitoring network provides a proper representativity of the study area in all investigated years (Fig. 2, in-set maps)

- Results suggest a decrease in spatial representativity of the precipitation monitoring stations for the three time horizons: from ~450, to ~310 km between 1982 to 2012 respectively (Fig. 2: right panels)
  - It might reflect the diminishing influence of broadly homogenous anthropogenic disturbance (i.e. global effect of bomb tests) on natural tritium levels of precipitation

- Since ^{3}H activity approximated a natural level in precipitation by the early-1990s (Palcsu et al., 2018) in the region, it can be expected that the ~310 km range obtained for the 2010s characterizes the natural ^{3}H variability
- In years with insufficient data for variography, the weights obtained from the closest year can be used for interpolating a tritium isoscape, taking the monitoring station distribution of the given year into account
  - e.g. the variogram of year 2012 can be used to interpolate tritium for 2013

KEY POINTS

- **Database compiled of monthly tritium activities for the Adriatic-Pannonian Realm for the last ~5 decades**
  - **detailed quality check in progress for the years between the analyzed ones**
- **Spatial representativity of the monitoring network mapped for four years (1982, 2001, 2010 and 2012)**
- **Product to come -> 4D tritium isoscape**

Fig. 2. *Interpolated maps (1 x 1 km grid) of tritium activity in the Adriatic-Pannonian Realm. Left panels show the isoscapes, right panels the empirical- (blue line) and theoretical semivariograms (black squares on right panels) used for kriging. Obtained sampling ranges are marked on the right panels with the variance indicated by the dashed horizontal line.*

The in-set maps indicate the fitted impact areas (red circles shaded according to the degree of overlap) around the sampling locations.

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