Isotope composition of precipitation at Ljubljana and Portorož (Slovenia) period 2011–2015

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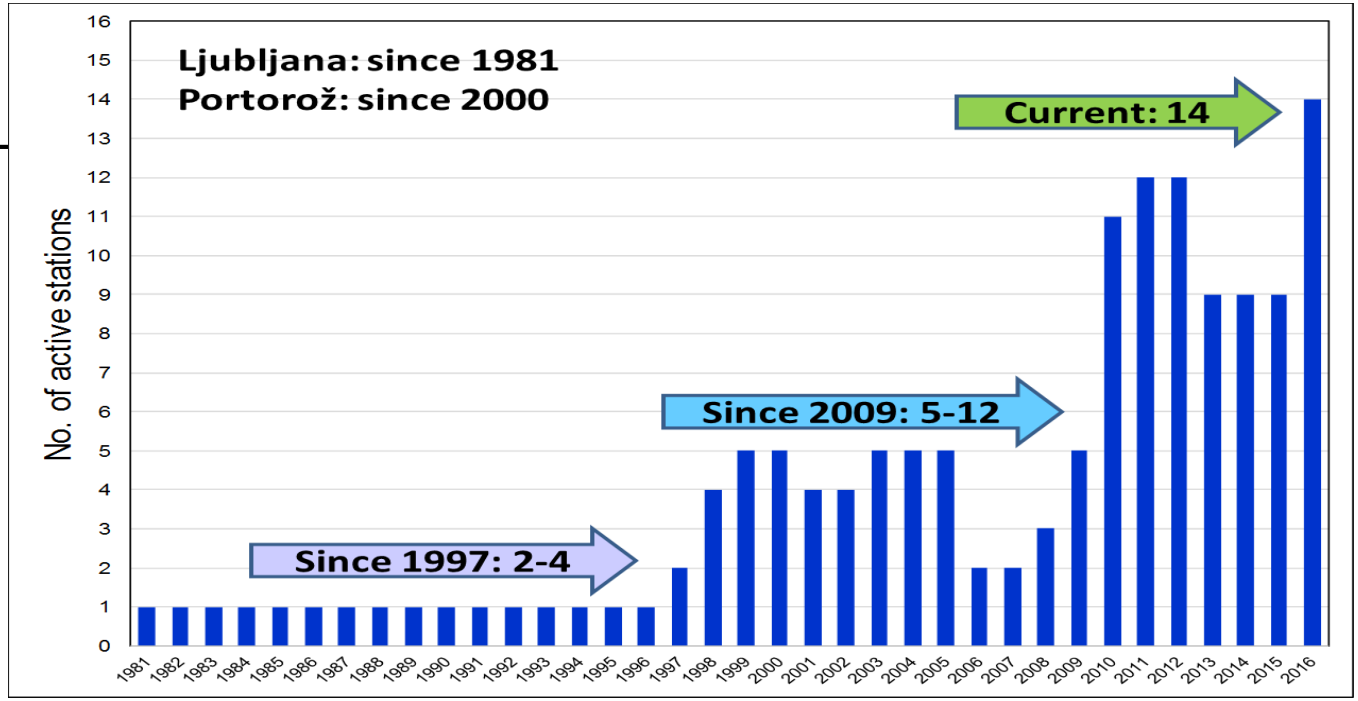
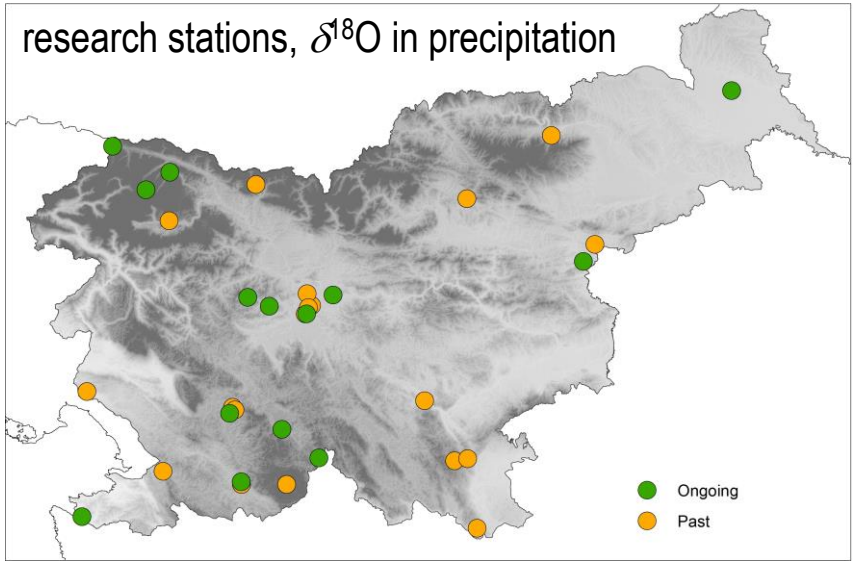
Slovenian Network of Isotopes in Precipitation (SLONIP)

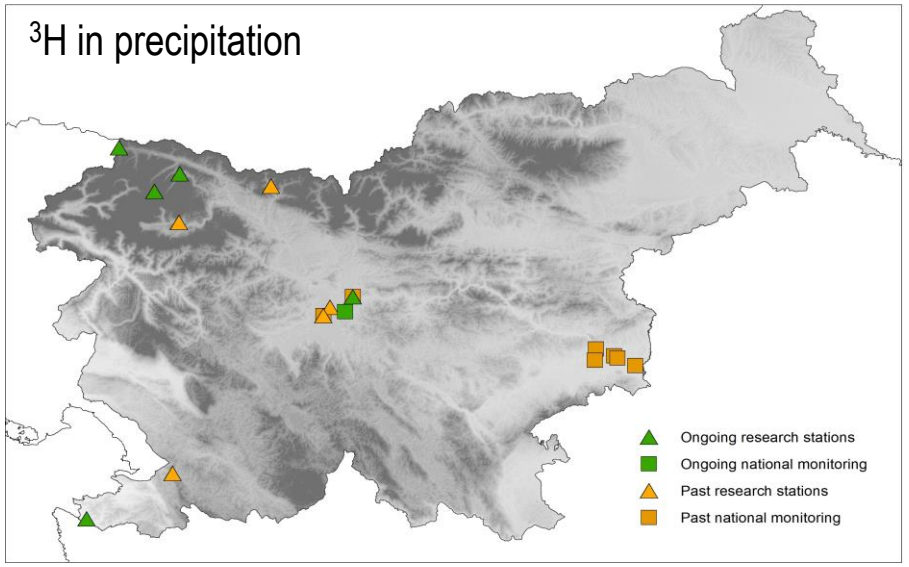
- Isotopes in precipitation monitored in Slovenia:
  - for the first time in the period 1972–1975,
  - regularly since 1981.
- SLONIP is still not a part of a national monitoring programme, such as that operating in European countries (e.g. Switzerland; Schürch et al. 2003).
- Some SLONIP stations are part of the GNIP database organized by IAEA and WMO http://www-naweb.iaea.org/napc/ih/IHS_resources_gnip.html

SLONIP

- all together >30 stations





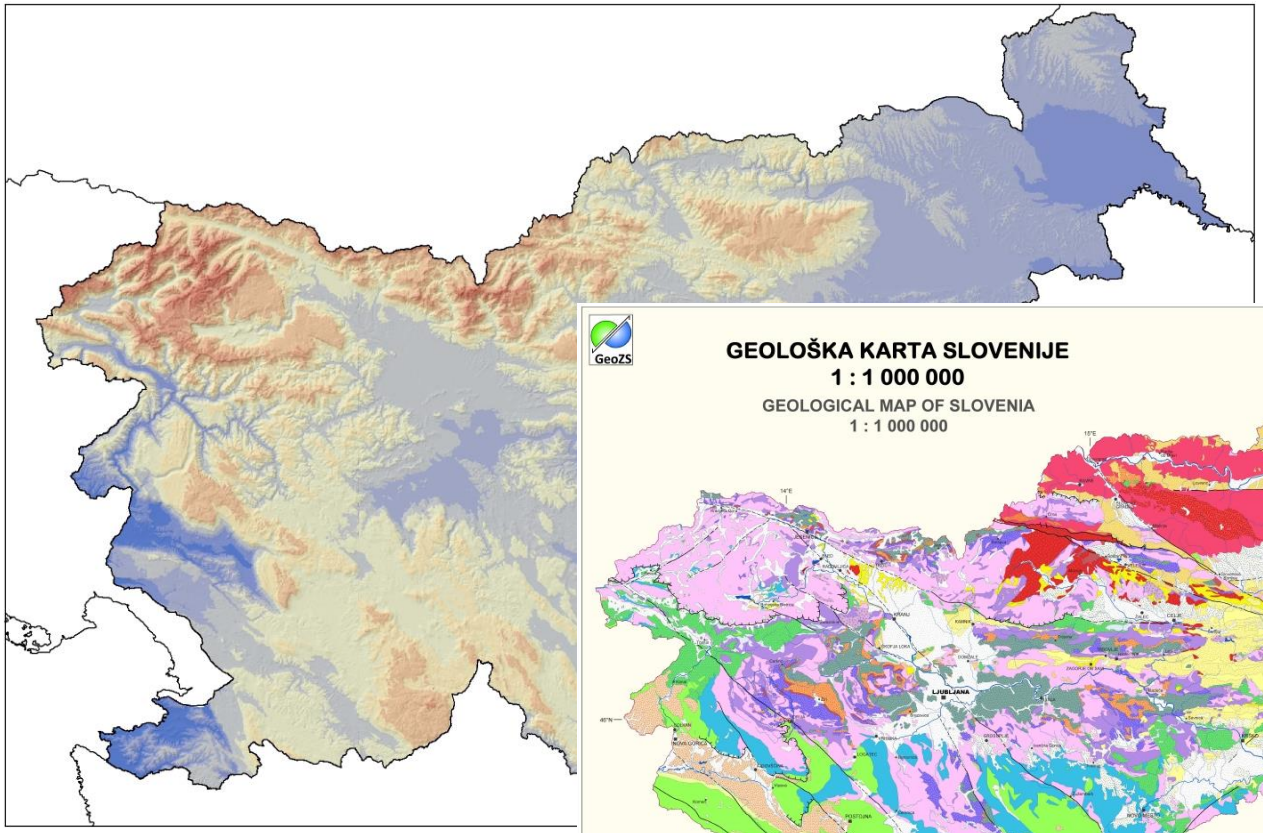


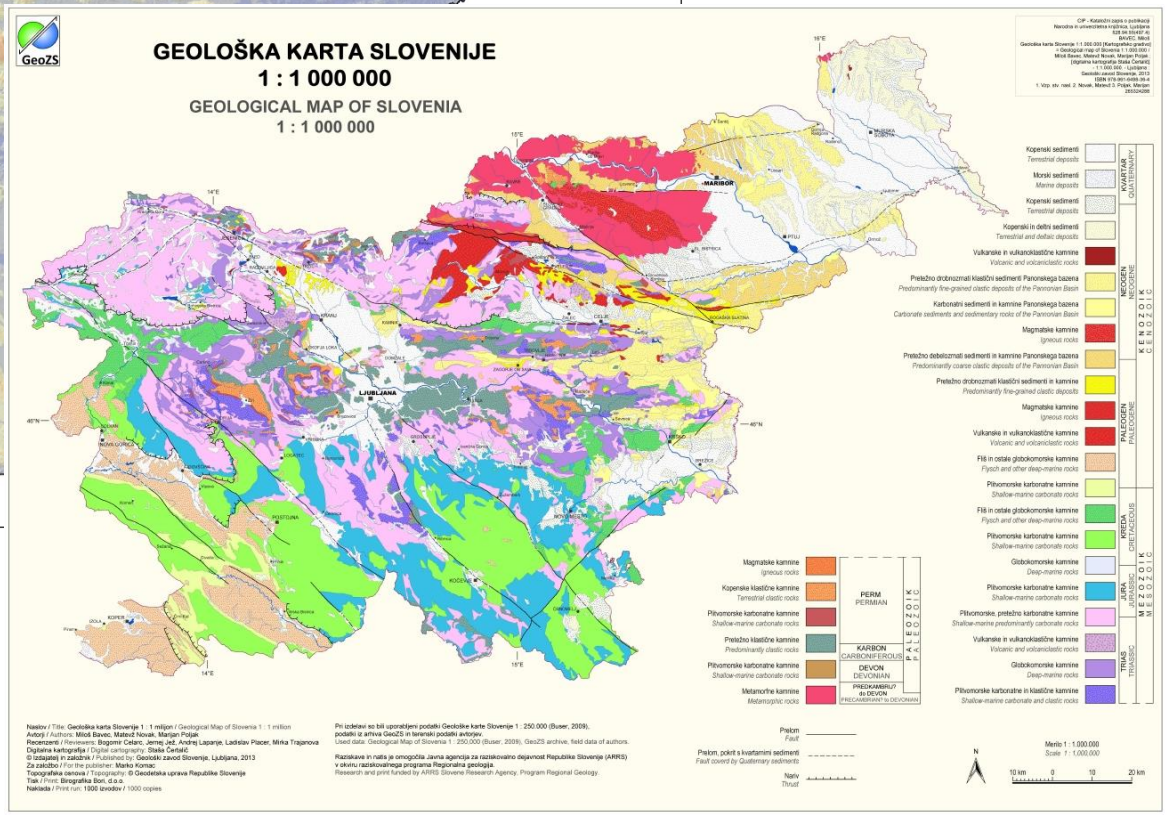
Vreča & Malenšek, 2016, Vreča et al., EGU 2017

Next steps

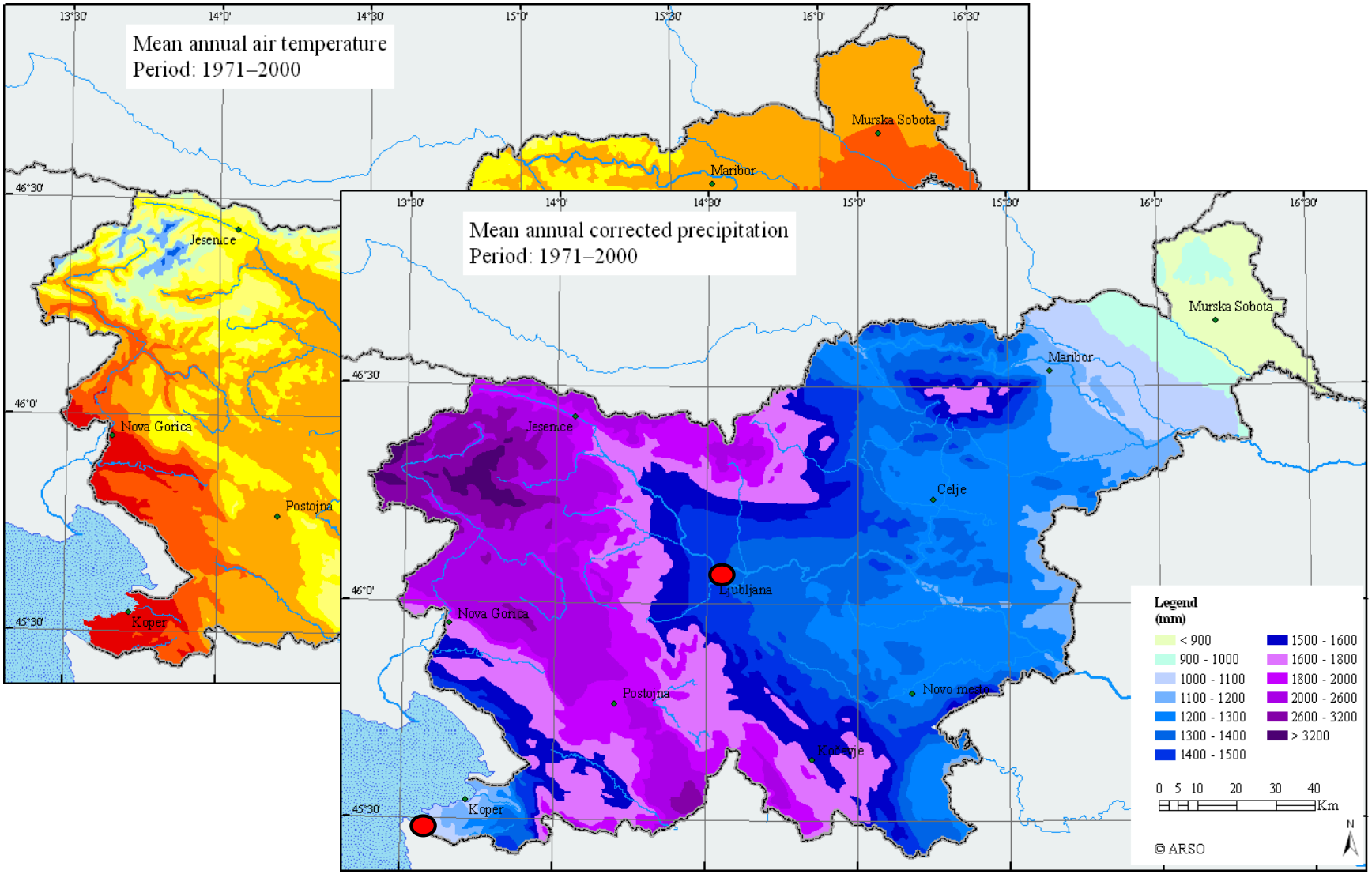
- To collect and evaluate available data before their compilation into a *Slovenian 'ready-to-use' precipitation isotope database*.
- Data further used for geostatistical treatment to evaluate the distribution patterns useful for hydrological, climatological and food authentication applications.
  - To prepare dedicated precipitation isoscape based on coherent periods for a region under the influence of mixing continental, Alpine and sub-Mediterranean climate.

Morphology and geology of Slovenia



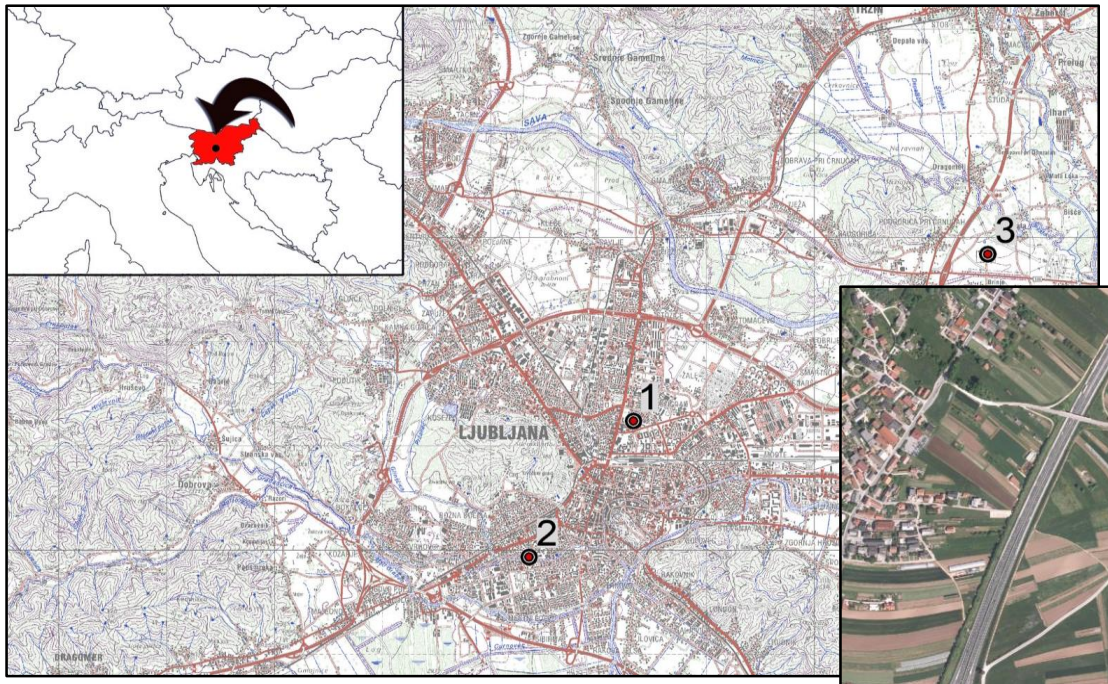


Mean annual corrected precipitation and annual air temperature; 1971–2000



Sampling location Ljubljana–Reaktor

- Precipitation station maintained by JSI
- 46°06'N, 14°36'E; 282 m a.s.l.



Pezdič, 1999, Vreča et al., 2005, 2006, 2008, 2014, Vreča & Malenšek 2016

- Meteorological data from Ljubljana Bežigrad synoptic station

Sampling location Portorož airport

- Synoptic station, part of Slovenian national meteorological network, Slovenian Environment Agency (SEA)
- 45°28'N, 13°37'E; 2 m a.s.l.

Vreča et al., 2005, 2006, 2007, 2011, 2015, Vreča & Malenšek 2016

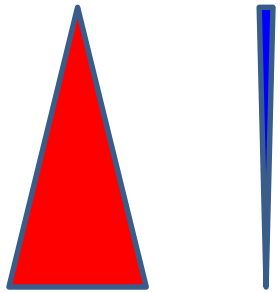
Sampling & Analysis

- Monthly composite precipitation samples
- In the lab:
  - 30-50 mL for the stable isotope analysis ($\delta^{18}O$, $\delta^{2}H$)
  - 1L (or less) for tritium analysis (^{3}H) – not discussed
- Stable isotopes determined at JSI, JR and IAEA by IRMS and laser spectroscopy; results reported as δ values in per mil (‰)
- Meteorological data obtained from SEA http://meteo.arso.gov.si/

Temporal changes in P and T

Ljubljana Bežigrad

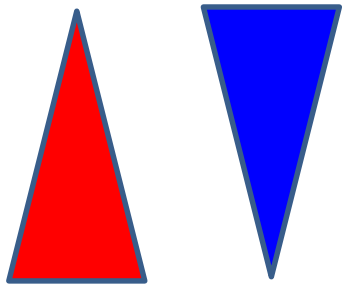
1971–2000:	10.2 °C	1368 mm
1981–2010:	10.8 °C	1362 mm
2011–2015:	12.0 °C	1363 mm



+1.8 °C **-5 mm**

Portorož airport

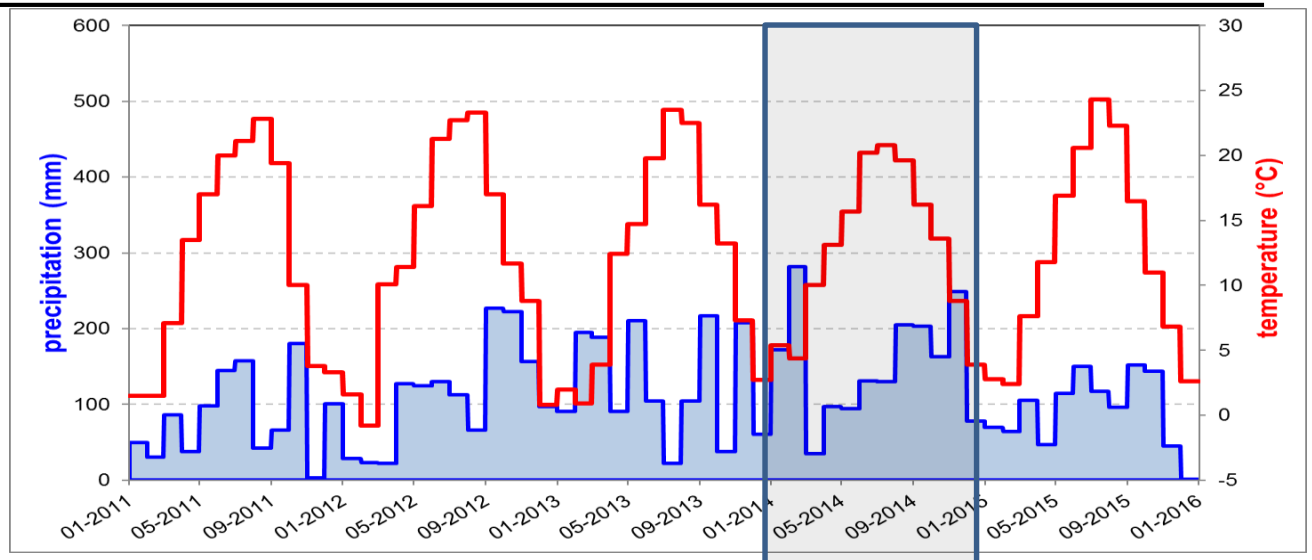
1971–2000:	12.8 °C	991 mm
1981–2010:	13.2 °C	968 mm
2011–2015:	14.2 °C	883 mm



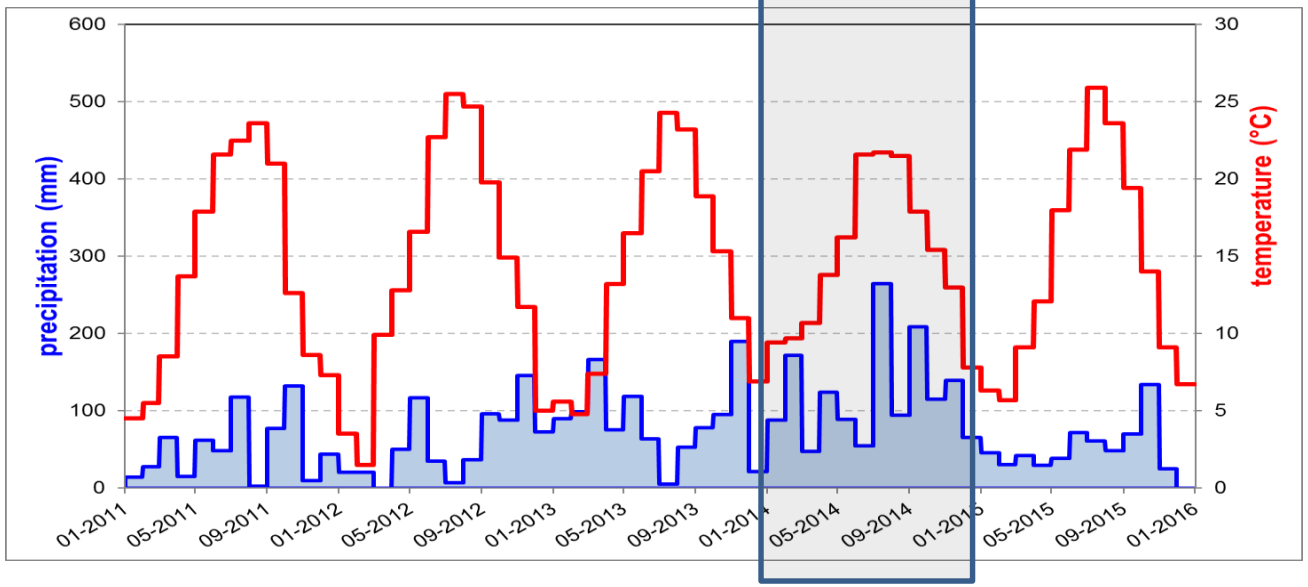
+1.4 °C **-108 mm**

Temporal changes in P and T: 2011–2015

- Ljubljana Bežigrad

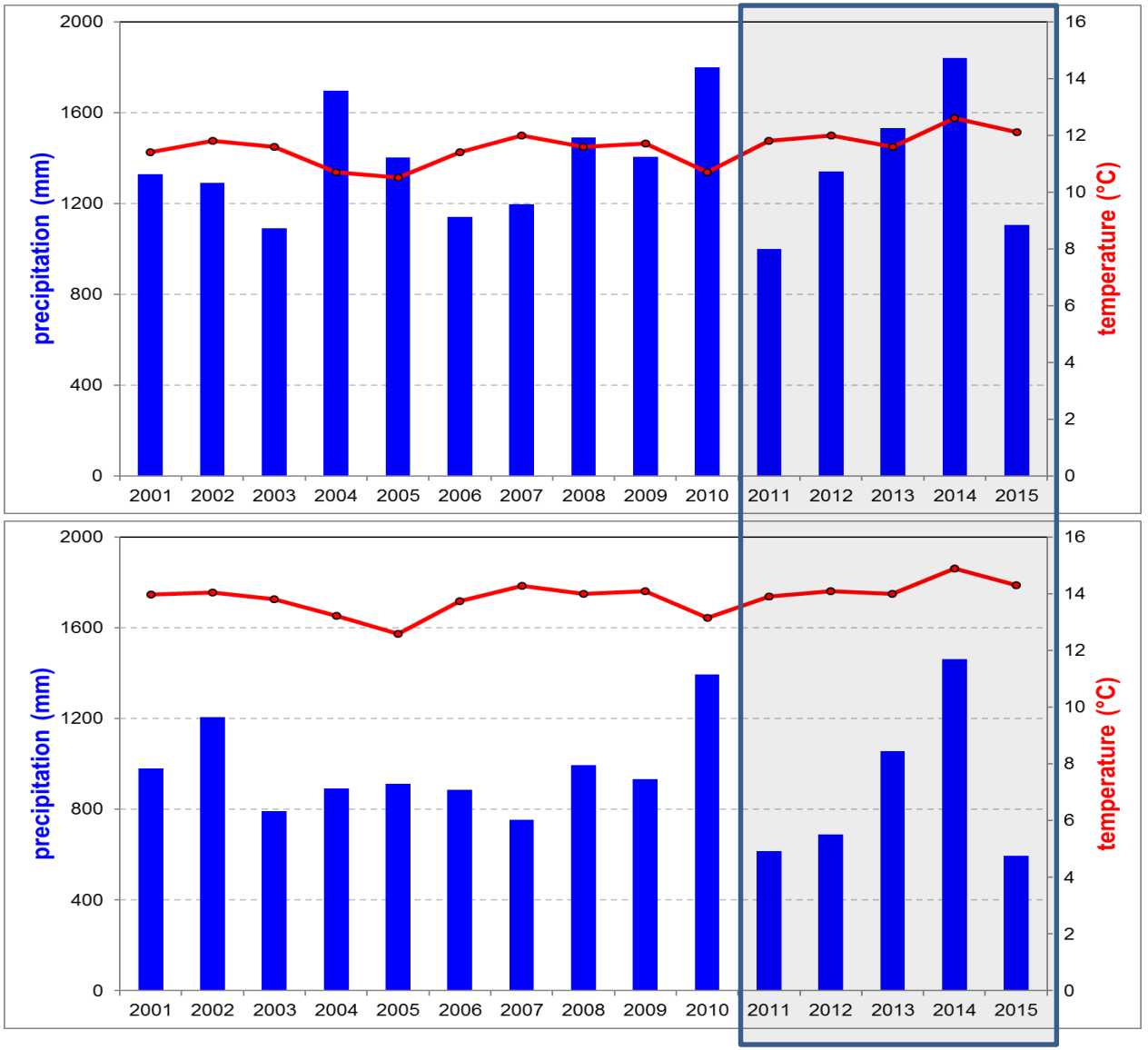


- Portorož airport



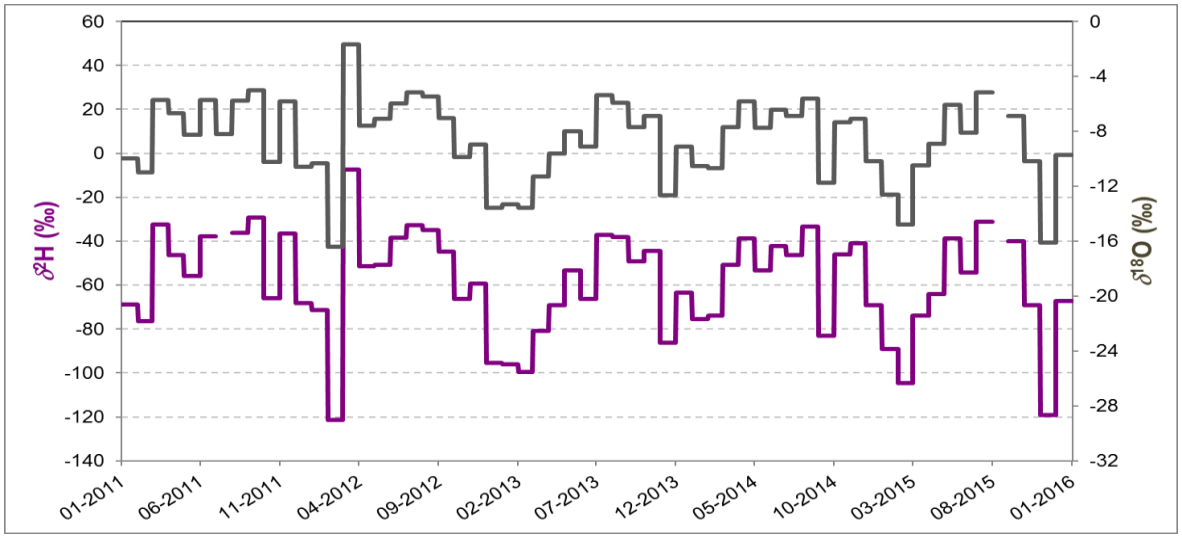
Temporal changes in P and T: 2001–2015

- Ljubljana Bežigrad
- Portorož airport

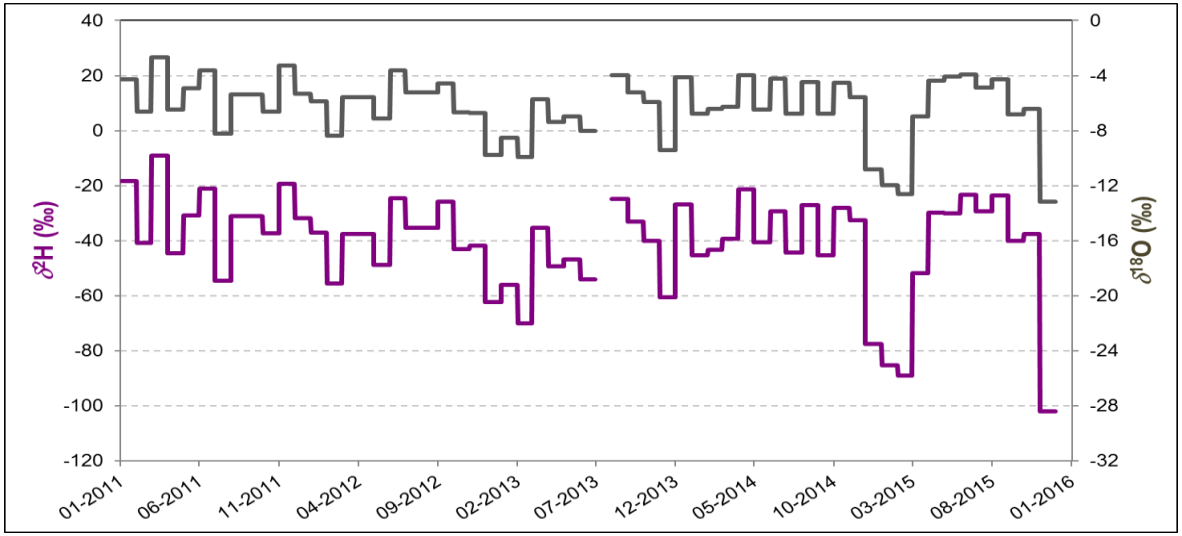


Results O & H – period 2011–2015

- Ljubljana–Reaktor
  - $\delta^{18}O$: –8.45 ‰
  - $\delta^{2}H$: –56.9 ‰

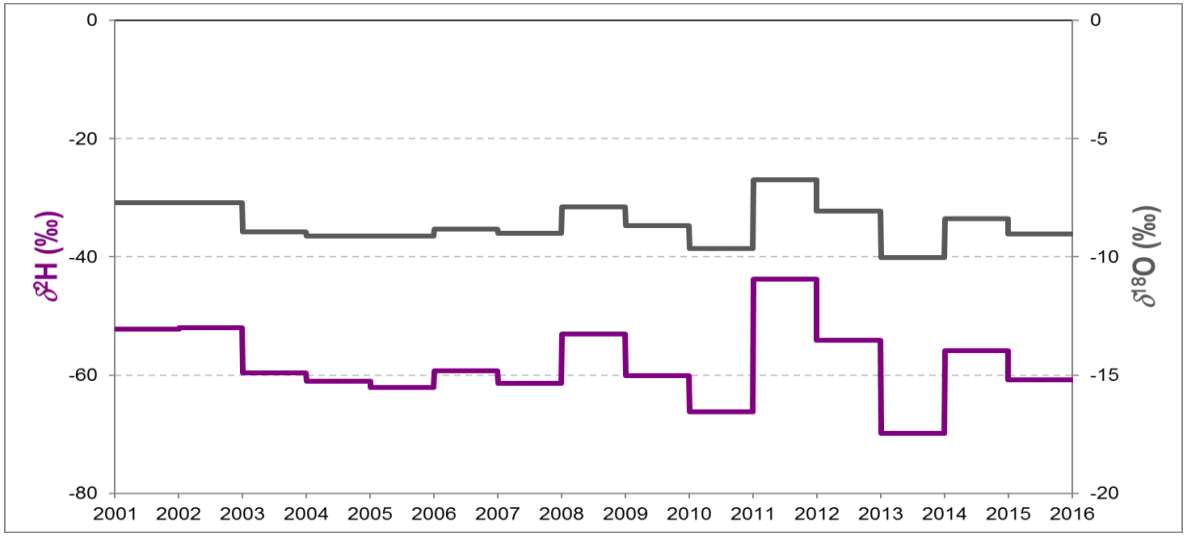


- Portorož airport
  - $\delta^{18}O$: –6.45 ‰
  - $\delta^{2}H$: –41.3 ‰

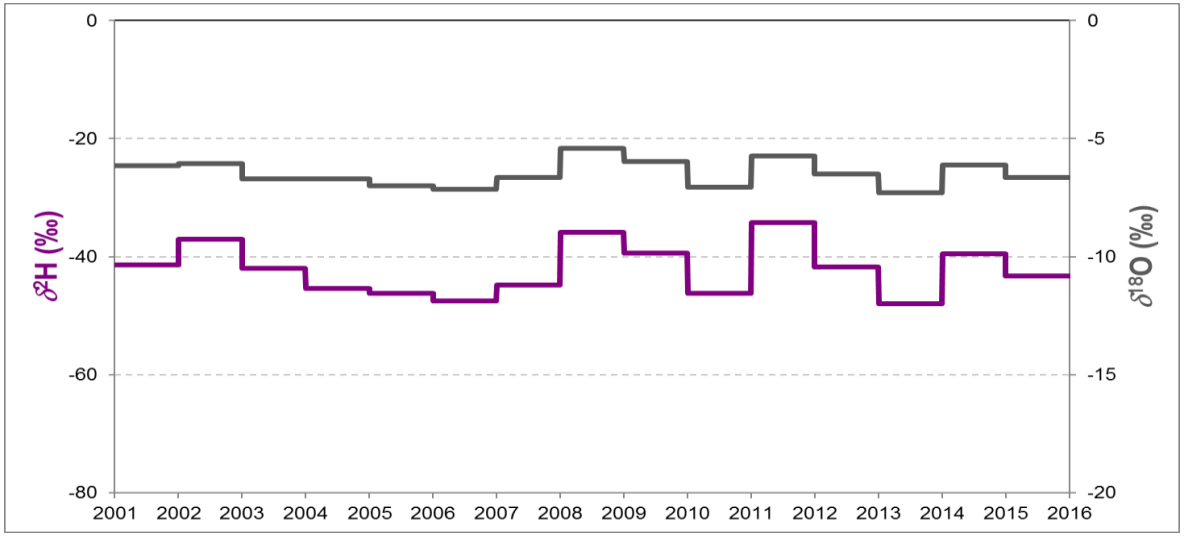


Results O & H – period 2001–2015

- Ljubljana–Reaktor
  - $\delta^{18}O$: –8.59 ‰
  - $\delta^{2}H$: –58.1 ‰

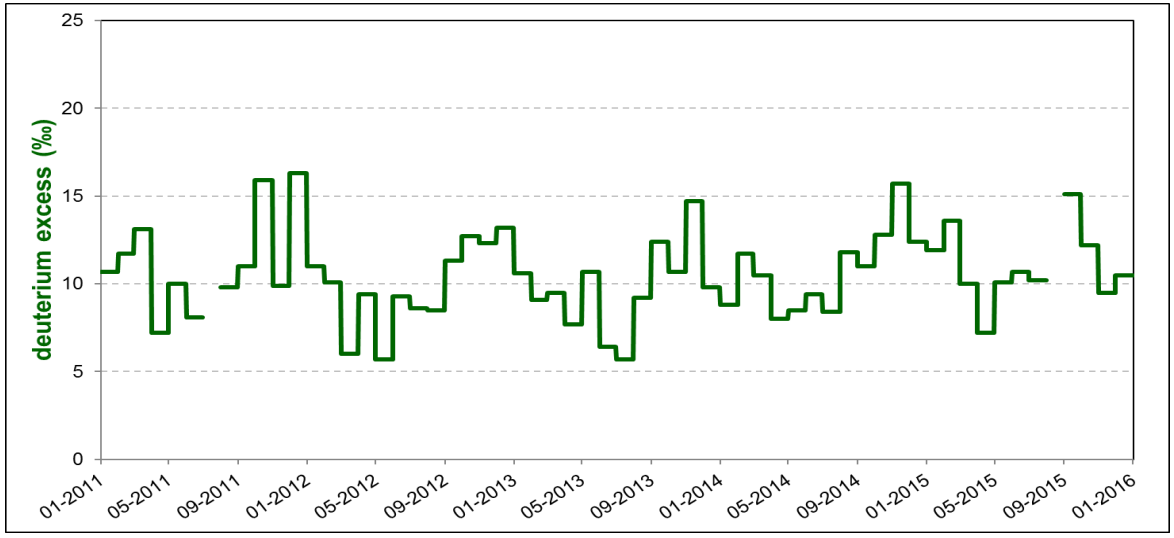


- Portorož airport
  - $\delta^{18}O$: –6.48 ‰
  - $\delta^{2}H$: –42.2 ‰

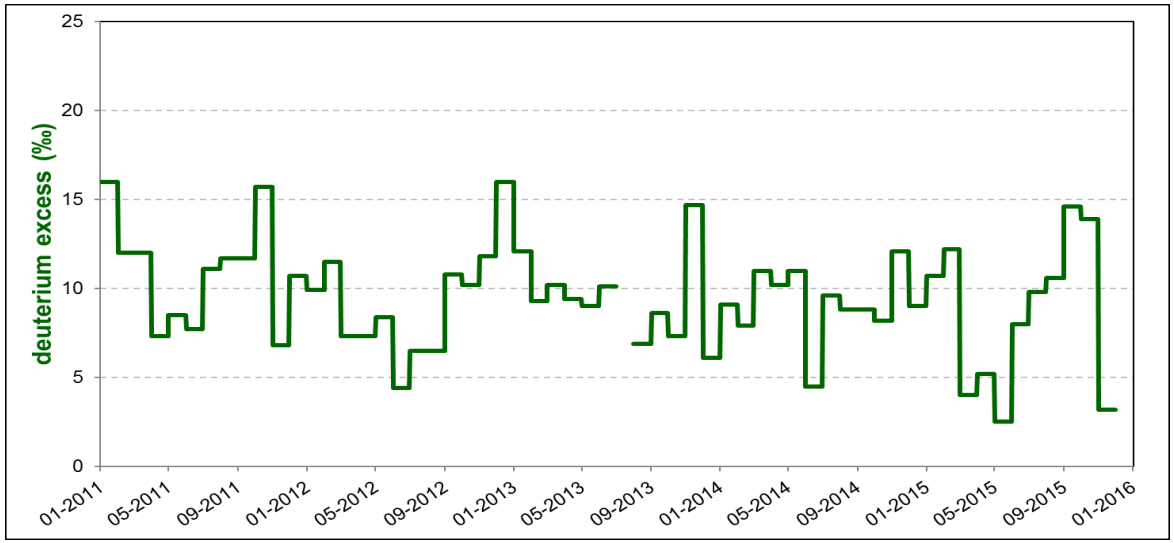


Results *d*-excess – period 2011–2015

- Ljubljana–Reaktor
  - *d*: 10.7 ‰

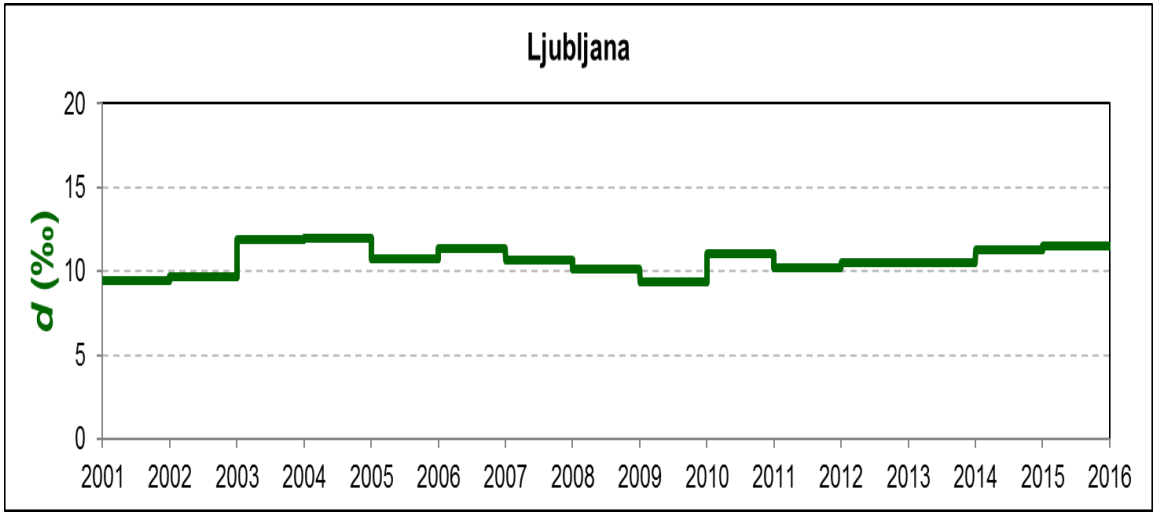


- Portorož airport
  - *d*: 10.3 ‰

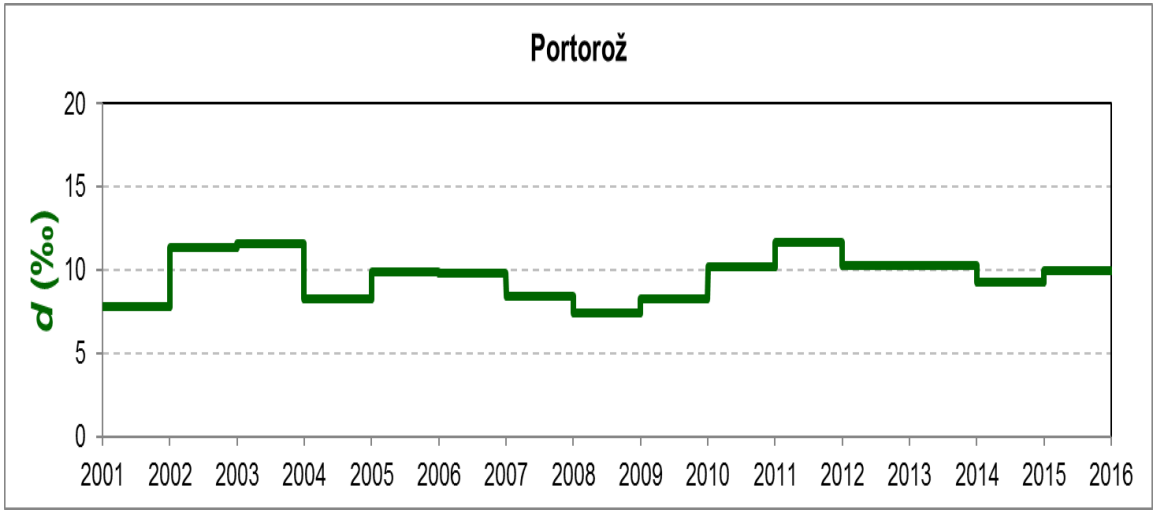


Results *d*-excess – period 2001–2015

- Ljubljana–Reaktor
  - *d*: 10.7 ‰



- Portorož airport
  - *d*: 9.6 ‰



Results – O & H relation

- *Ljubljana PWLSR:*
  - *2007–2010:* $\delta^2H = (7.94 \pm 0.21) \times \delta^{18}O + (9.76 \pm 1.91)$
  - *2011–2015:* $\delta^2H = (7.77 \pm 0.13) \times \delta^{18}O + (9.00 \pm 1.14)$

- *Portorož PWLRS:*
  - *2007–2010:* $\delta^2H = (7.80 \pm 0.28) \times \delta^{18}O + (7.97 \pm 1.87)$
  - *2011–2015:* $\delta^2H = (7.56 \pm 0.18) \times \delta^{18}O + (7.25 \pm 1.21)$

- At both stations decrease in intercept and slope.

Acknowledgement

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