Isotopic composition of winter precipitation in transition zone of Altai

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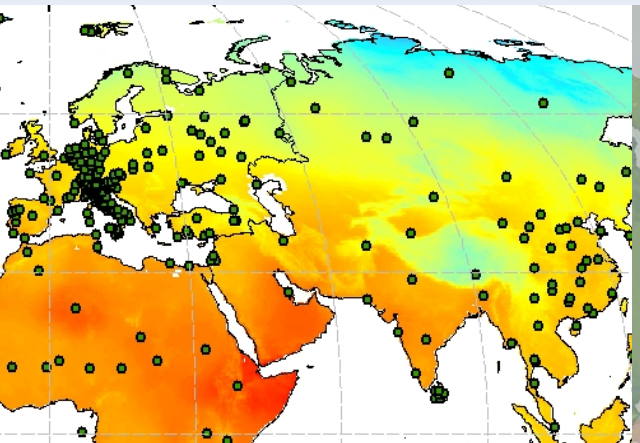
Motivation

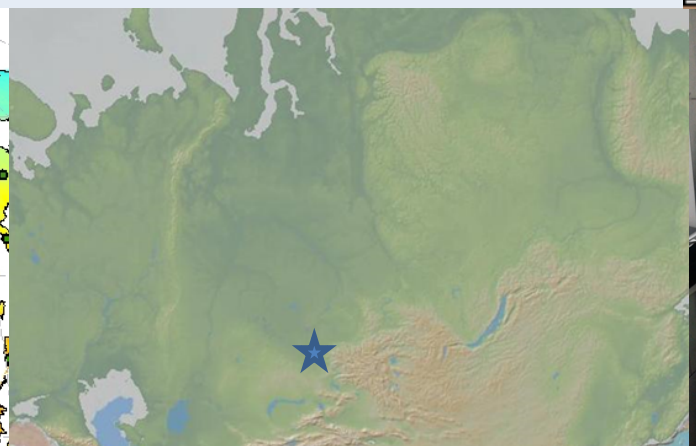
During the past three decades, several atmospheric and oceanic general circulation models (GCMs = ECHAM5-wiso and EMAC) have been enhanced by the capability to explicitly simulate the hydrological cycle of the two stable water isotopologues (water isotopes) HDO and $H_2{}^{18}O$. The input parameters for GCM models that take into account the changes in isotopic composition of precipitation are the results obtained by the GNIP – Global Network of Isotopes in Precipitation. In the wide area of Russia, at different times there were not more than 40 stations, which conducted the sampling of atmospheric precipitation at the same time.

This study presents the results of the isotopic composition of atmospheric precipitation and snow cover sampled in the transition zone of the Altai during winter season 2014-2015.

Isotopic composition of samples was performed with IR laser absorption spectroscopy Picarro L2130-i with WS-CRDS system.

IsoMAP - Isoscapes Modeling, Analysis and Prediction





Isotopic composition of winter precipitation and snow cover (2014-2015)

$\delta^{18}O$: -9.4‰ / -34.4‰

δD: -122.7‰ / -235.0‰

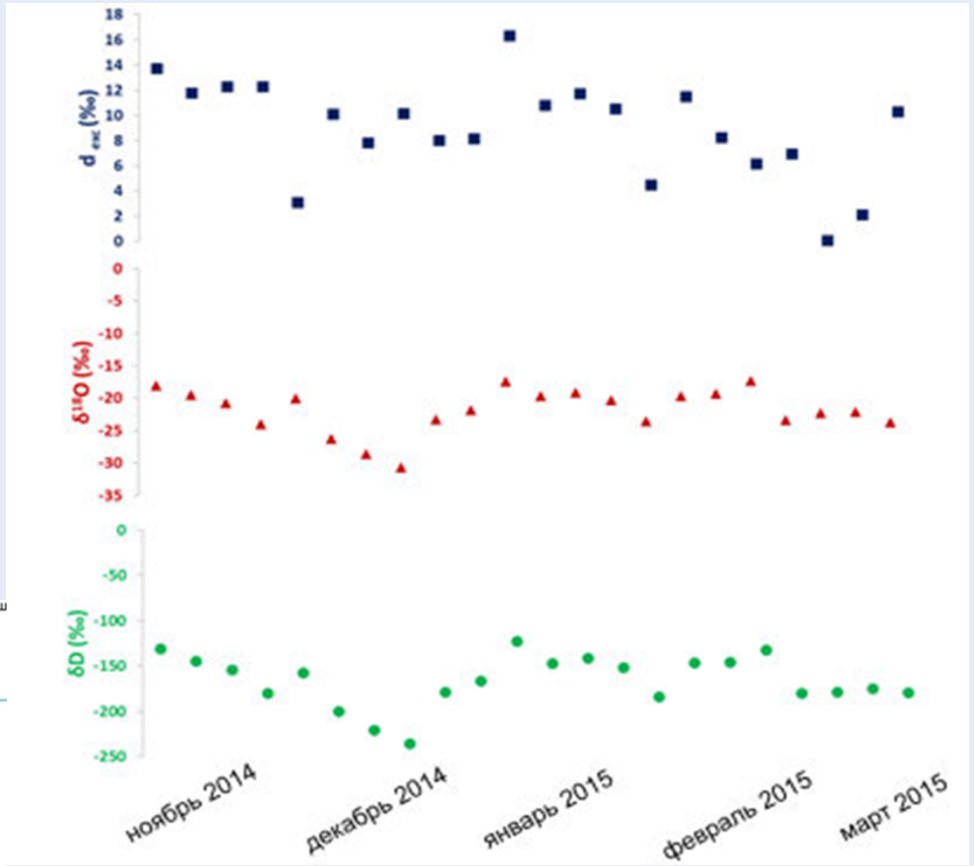
d_{exc} : 0.1‰ / 16.3‰

LMWL

$\delta D = 8.22 \times \delta^{18}O + 13.84$ ($r^2 = 0.98$)

weighted average

$\delta^{18}O$	-21.1‰
δD	-158.1‰
d_{exc}	10.3‰

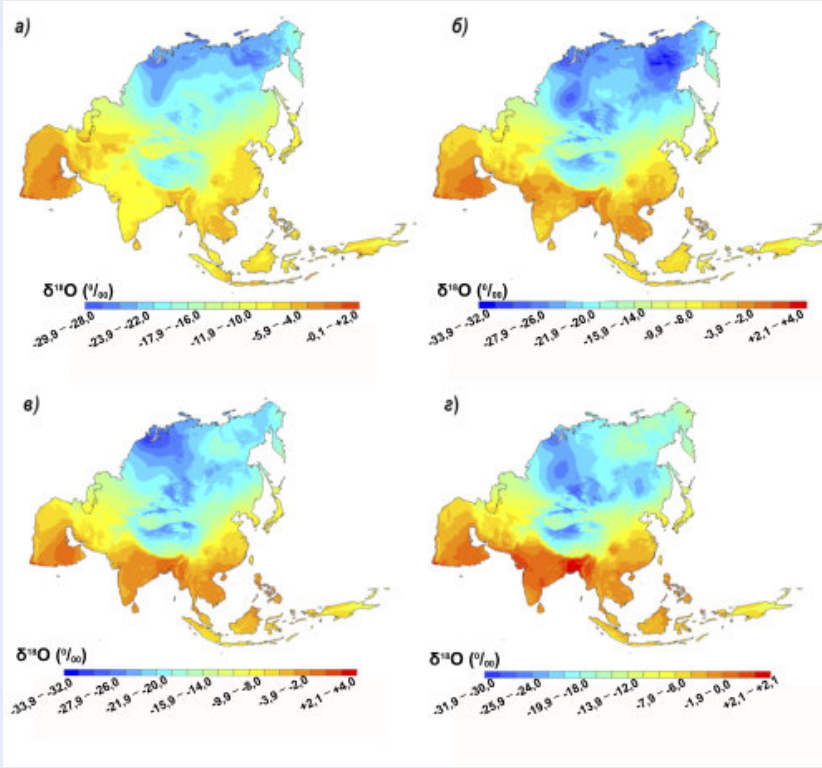


During a period of maximum snow accumulation (early March 2015) the integral sampling of snow cover was conducted within a 100- km radius of precipitation sampling point

Isotopic composition of winter precipitation

		XI	XII	I	II	XI-II
2014-2015	δ ^{18}O (‰)	-20.8	-27.2	-19.4	-20.9	-21.1
	δD (‰)	-154.5	-208.5	-143.3	-158.4	-158.1
	d_{exc}(‰)	11.9	8.7	11.8	8.9	10.3
Iso MAP	δ ^{18}O (‰)	-19.5	-23.3	-20.5	-23.9	-21.8
	δD (‰)	-141.1	-179.6	-162.0	-188.3	-167.5
	d_{exc}(‰)	15.0	6.6	2.1	3.2	6.7

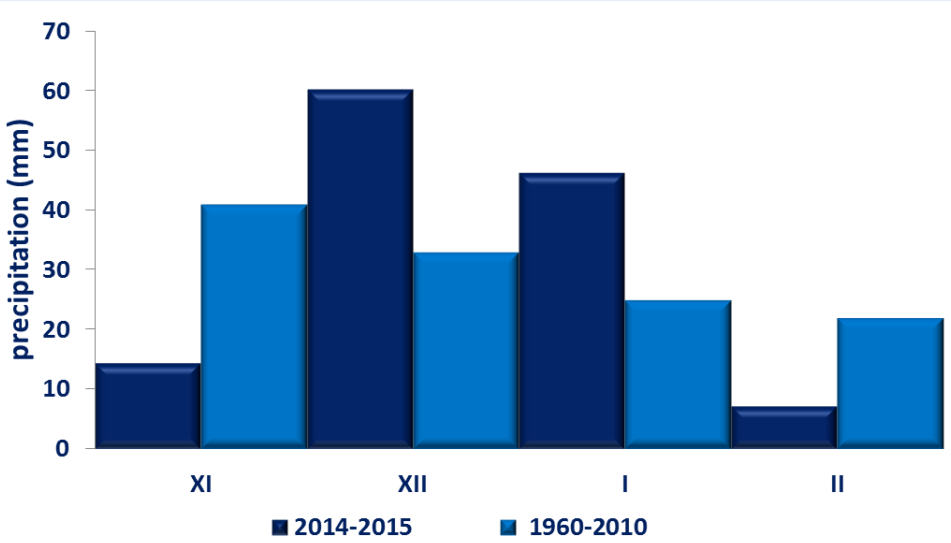
Schematic map for $\delta^{18}O$ values of precipitation in November (*a*), December (*b*), January (c) and February (*d*)



The results showed a nonsignificant difference (not more than 2‰ for $\delta^{18}O$ and 11‰ for δD) between isotopic composition of the integral snow cover samples and atmospheric precipitation in winter 2014-2015.

Despite the occurrence of cryogenic metamorphization in the snow cover (varied d_{exc}), the results of investigation of the isotopic composition of atmospheric precipitation and snow cover during winter period 2014-2015 in the transition zone of the Altai showed a high consistency.

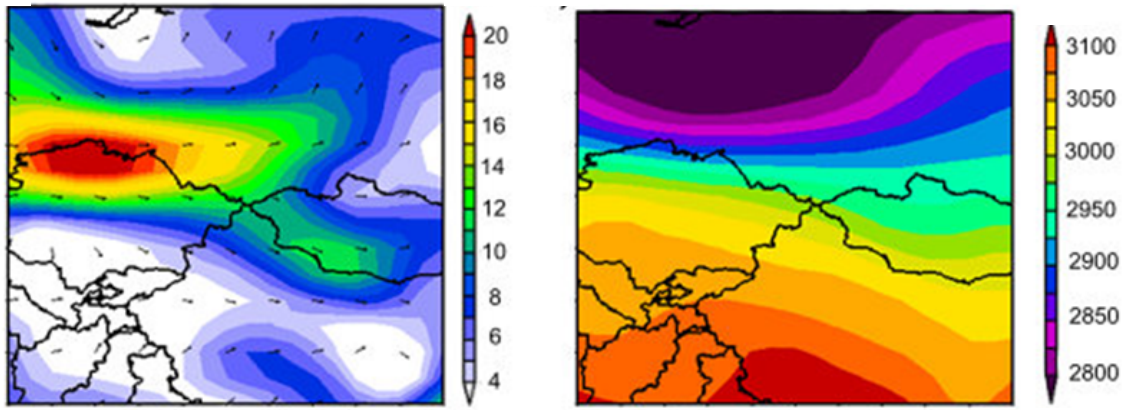
Precipitation for the winter season of 1960-2010 and 2014-2015 in the transition zone of Altai



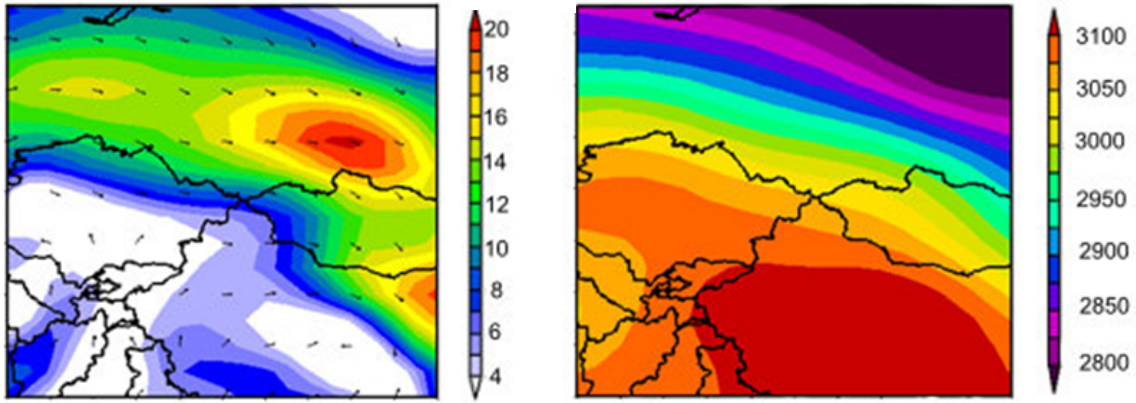
Average wind speed and vector, geopotential height of 700 mb for winter seasons

[http://www.esrl.noaa.gov/]

1960-2010



2014-2015



Thus, with the correct interpretation of the results, the data of the isotopic composition of precipitation and snow cover in the transition zone of the Altai can be used as the alternative data sources instead of the GNIP data

The reported study was funded by RFBR according to the research project № 16-35-00188 мол_а