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TITLE: CLIMATE CHANGE IN THE RUSSIAN ALTAI MOUNTAINS AND ITS INFLUENCE ON TREE LINE AND GLACIER DYNAMICS

PRESENTATION TYPE: Assigned by Committee (Oral or Poster)

CURRENT SECTION/FOCUS GROUP: Global Environmental Change (GC)

CURRENT SESSION: GC16. Regional Climate Impacts 7. Environmental, Socio-economic and Climatic Changes in Northern Eurasia and their Feedbacks to the Global Earth System: The Role of Remote Sensing and Integrative Studies

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ABSTRACT BODY: The mountain ecosystems are highly sensitive to climate changes. The Russian Altai Mountains are located in the Inner Asia on the border of Russia, Mongolia, China and Kazakhstan. The Department of Geography and Geoecology of SPbSU has been organizing annual field expeditions to this region during the last 20 yrs. The uniqueness of the Altai landscapes lies in its great variety as these mountains are higher than 4 km and located on the zonal border between steppes and semi-deserts and between continental and sharply continental climates. This research deals with space-time features of regional climate changes and the dynamics of high-altitude landscapes.
The 1940-2004 time series of seasonal air temperature and precipitation from 14 weather stations from 300 to 2600 m a.s.l. were statistically analyzed applying regression, correlation, spectral and cluster analyses. To extend time series over the past 350-400 yrs, mean summer temperature and precipitation were reconstructed applying dendroclimatological methods and using the WSL Dendro data base.
Comparing to the Northern Hemisphere tendency of temperature increase in the second half of the 20th century over the Altai has been observed generally earlier, since 1950s. Maximum warming rate in the last quarter of the 20th century is typical to winter in the Altai (0,85°/10 yrs) as well as the entire Northern Hemisphere. Synchronous changes in the Altai and the Northern Hemisphere are observed in all seasons only in 1975-2004. At the turn of the XX-XXI centuries warming rates slow down in the region while temperature level is still high. These changes are partly associated with circulation epochs. Spectral analysis revealed important role of natural cyclical recurrence in climate changes, for example quasi-biennial, solar and Brückner cycles.
According to dendrochronological reconstruction mean summer temperature increased from the end of the Little Ice Age (LIA) to its maximum in the 1990s by approximately 2°C, to the average for the period 1986-2004 – about 1,3°C. As tree line against the other belt borders strongly limited by summer temperature its eventual dynamics since the end of the LIA over the Altai were estimated and tree line position at different stages of modern regional warming was reconstructed. Theoretical evaluation shows that mean summer temperature increase of 1.3°C from the end of the LIA causes tree line to rise maximum by 180-280 m in different localities of the Altai.
Glacial complexes of mountain massifs Mongun-Taiga, Tavan-Boghd-Ola, Turgeni-Nuru and Harhira-Nuru located in the South-Eastern Altai are represented by small glaciers mostly on northern and eastern leeward slopes. Being situated in region with dry climatic conditions (250-400 mm/year) glaciers survive only in negative forms of relief with high concentration of snow. Accumulation coefficient is mainly from 2 to 3, and on cirque glaciers is from 6 to 8. Now glaciers retreat rapidly (17% of area loss for the period of

1995-2010 for Mongun-Taiga, 12% in 2002-2009 for Tavan-Boghd-Ola), especially valley glaciers (2-10 m/yr), the number of glaciers increase due to disintegration of larger glaciers. Small forms of glaciation disappear or transform into snow patches and rock glaciers.

(No Image Selected)

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INDEX TERMS: [1637] GLOBAL CHANGE / Regional climate change, [0439] BIOGEOSCIENCES / Ecosystems, structure and dynamics, [0720] CRYOSPHERE / Glaciers.
