

Treeline dynamics under the climate changes in the Russian Altai



Mountains



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OUTLINE

Project: The Northern Eurasia mountain geosystems under the global climate changes and the transformation of the nature management regimes

Purpose: Revealing the space-time features of regional climate changes and the reaction of different mountain landscape elements

1. **Background**

2. **Excursion over the region**

3. **Data and methods**

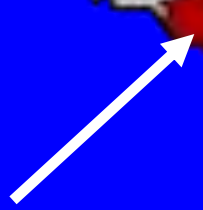
4. **Results**

a) Spatial-Temporal Climate Changes

b) Climatic conditionality of the treeline position



The Altai Republic



The Tuva Republic



Kuragino

RUSSIA

**ХАКАСИЯ
(KHAKASSIA)**

Kyzyl

RUSSIA

**TUVA
(TYVA)**

Altai

**Mongun-Taiga
(3970 m)**

KAZAKHSTAN

**Ukok
Plateau**

MONGOLIA

MONGOLIA

CHINA

**Tavan
Bogd**





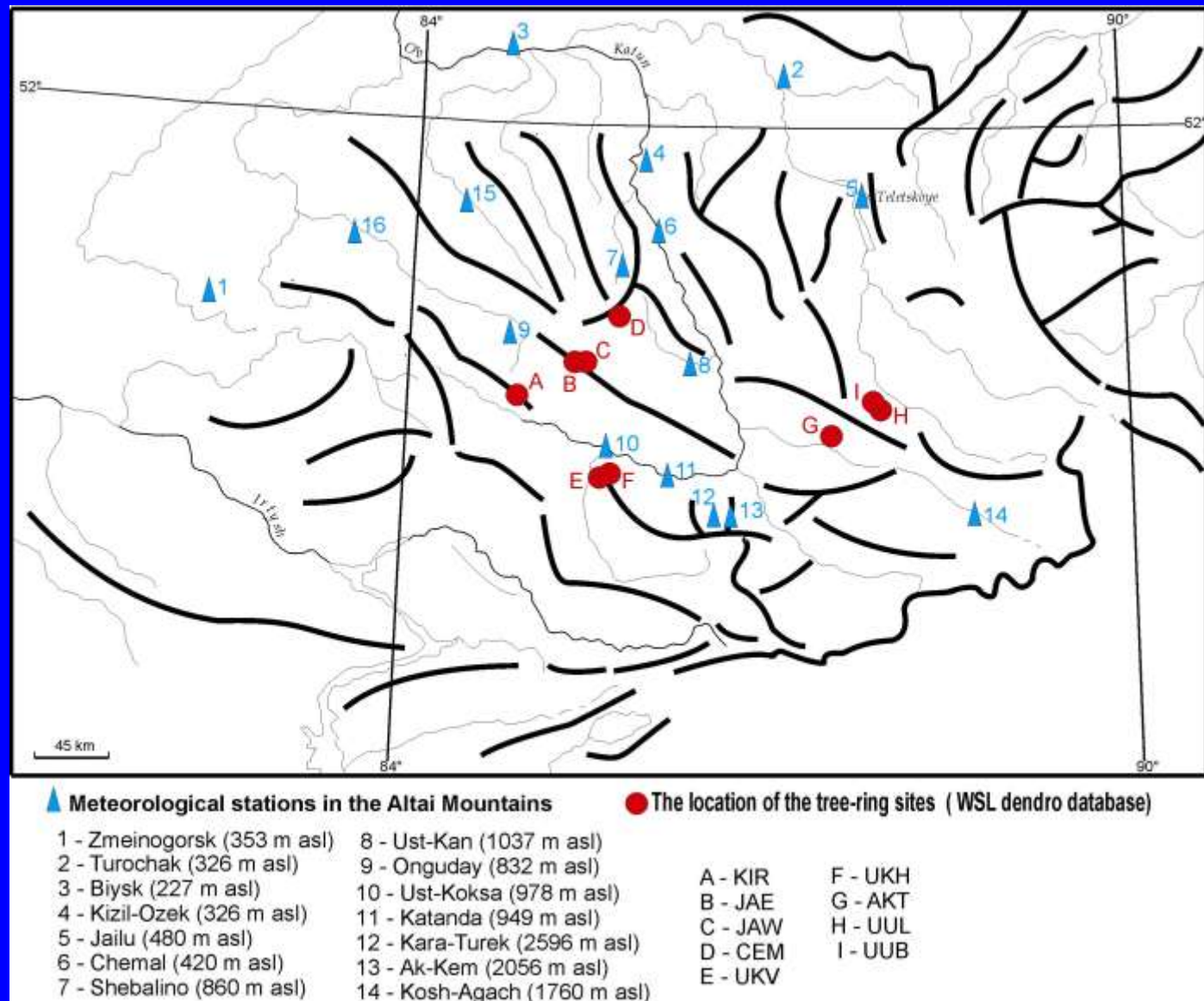
Mound composite

Kurgan Stelae





DATA and METHODS



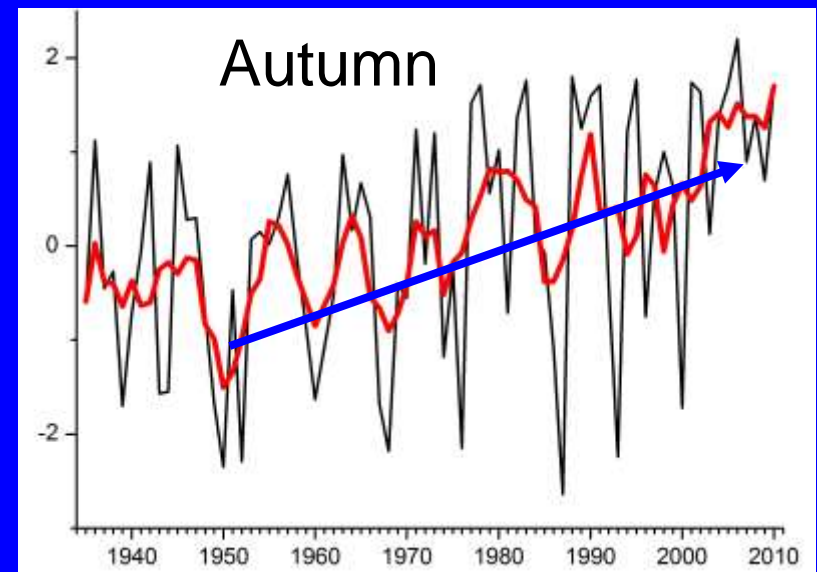
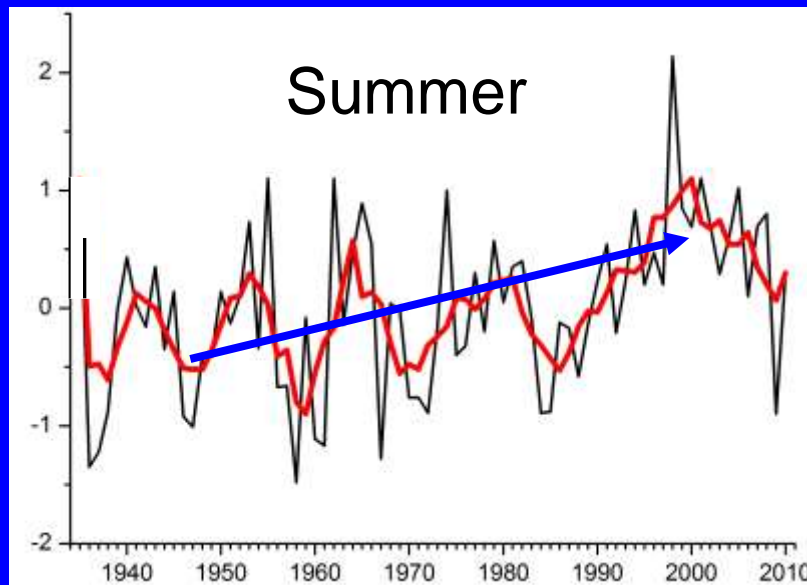
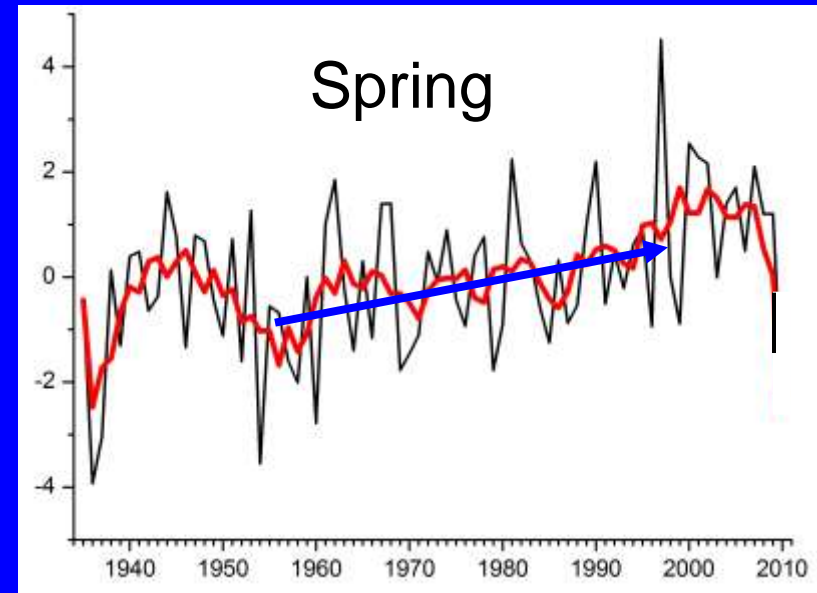
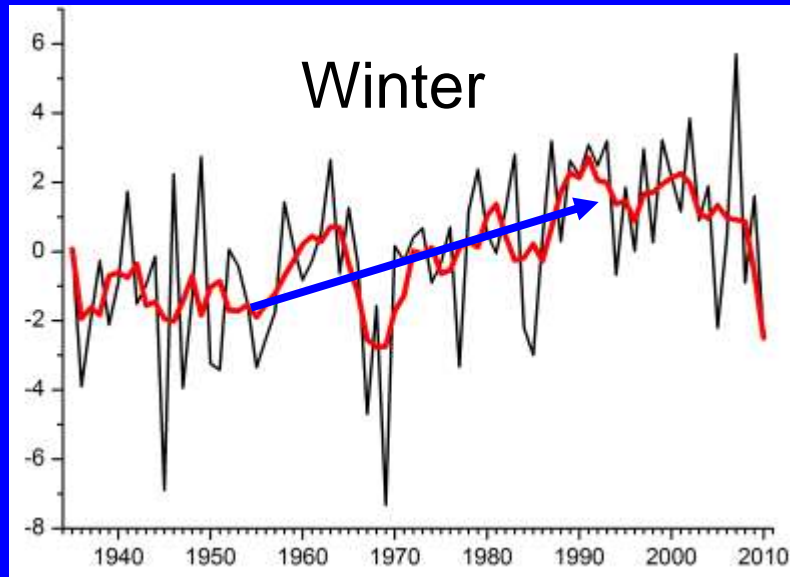
Instrumental data from
14 meteorological stations
(1935-2010)

WSL dendro database,
Switzerland

Upper treeline position
estimation

Anomalies of the seasonal air temperature (w.r.t. 1940-2010)

— 5-year running mean



Comparison

Temperature trends °C/10 years for the last 40-50 years

Season	Altai	Tyan-Shan
Winter	1.3	0.7
Spring	0.6	0.2
Summer	0.3 (0.8)	0.2
Autumn	0.4	0.5

Baityk (1580 m)

Bishkek (759 m)

Cholpon Ata (1645 m)

Dzhalal-Abad (769 m)

Balykchi (1660 m)

Narin (2039 m)

Sari Tash (3155 m)

Sysamir (2061 m)

Talas (1217 m)

Tien Shan (3614 m)

Novorossiika (1524 m)

Tuya Ashu (3225 m)

Chon Kizilsu (2555 m)

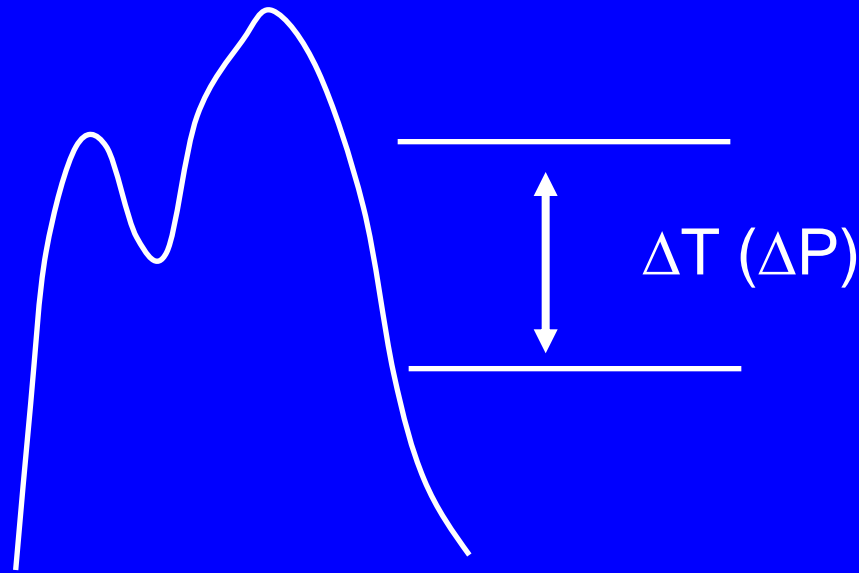
Alpine landscape response

- The uniqueness of the Altai landscapes lies in their 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
- In the Altai almost the full range of the temperate zone altitudinal belts is presented - from desert steppe to glacial-nival.

	<i>Steppe belt</i>
	<i>Forest-steppe belt</i>
	<i>Dark-taiga subbelt</i>
	<i>Mountain taiga subbelt</i>
	<i>Subalpine belt</i>
	<i>Alpine-tundra belt</i>



Altitudinal hydrothermal gradients

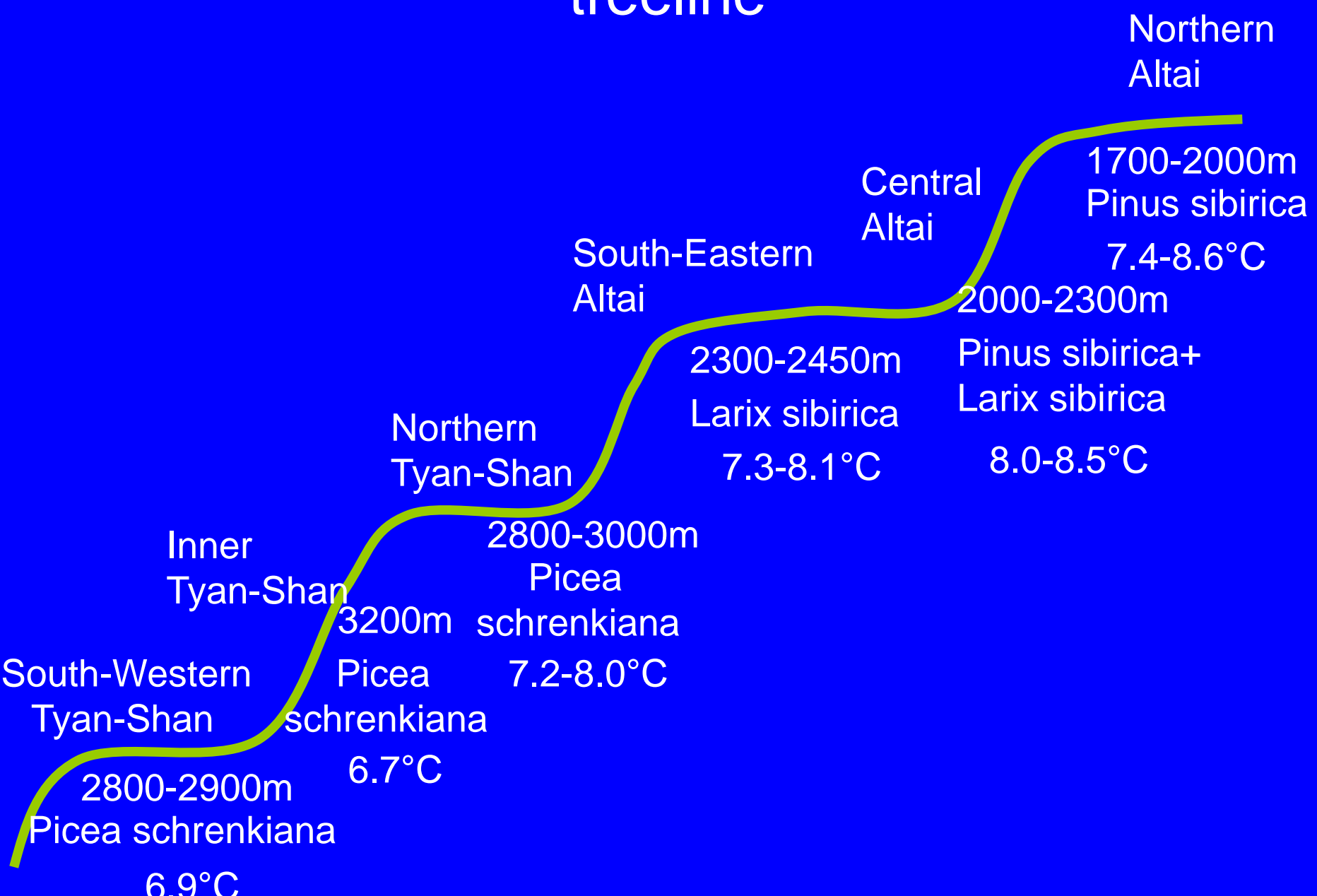


Mean summer air temperature
vertical gradients:

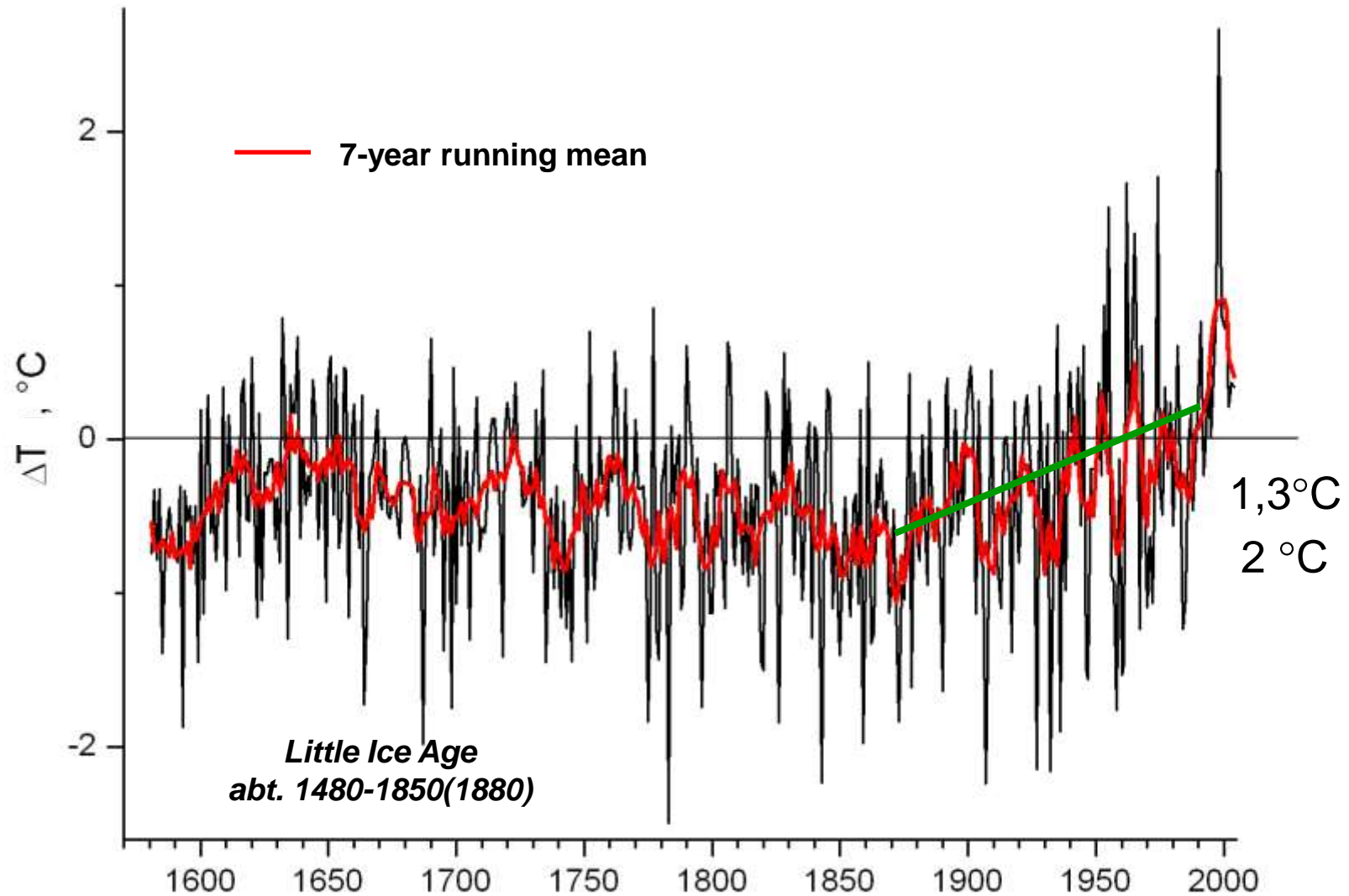
Central Altai	0,5 - 0,6°C/100m
Northern Altai	0,6°C/100m
South-Eastern Altai	0,80-0,82°C/100m

Northern Tyan-Shan	0,71°C/100m
Inner Tyan-Shan	0,81°C/100m
South-Western Tyan-Shan	0,67°C/100m

Mean summer temperature on the upper treeline



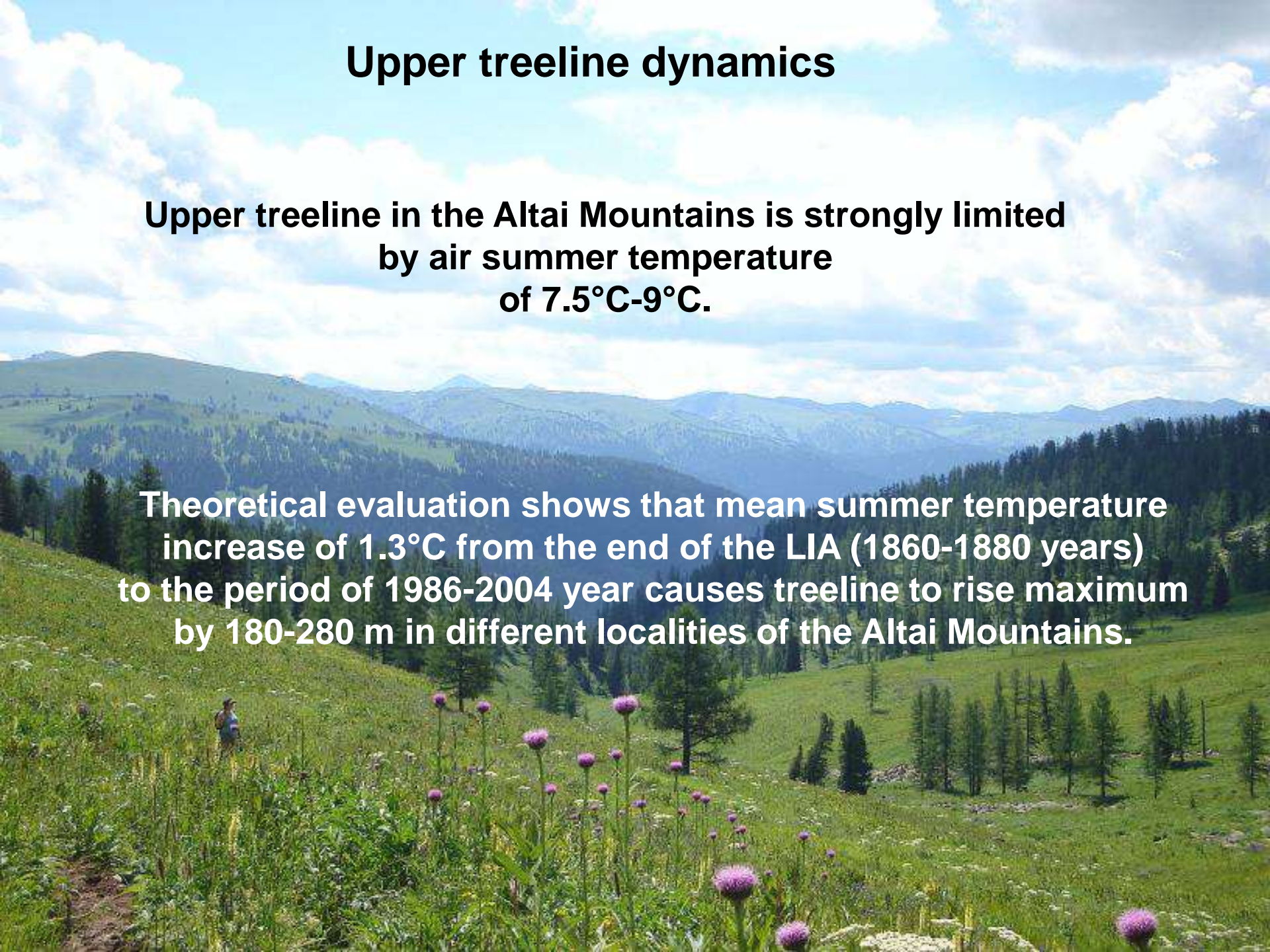
Dendrochronological reconstruction of the mean summer temperature



Upper treeline dynamics

Upper treeline in the Altai Mountains is strongly limited by air summer temperature of 7.5°C-9°C.

Theoretical evaluation shows that mean summer temperature increase of 1.3°C from the end of the LIA (1860-1880 years) to the period of 1986-2004 year causes treeline to rise maximum by 180-280 m in different localities of the Altai Mountains.



Thank you for your attention!



2011 field expedition group