Reconstructions of climatic changes in the Holocene will allow us to find paleo-analogues for possible landscape dynamics at the regional level of the south of Valdai Hills (Central European Russia). The Central Forest State Natural Biosphere Reserve (CFSNBR) has been chosen as a key region for this study.
Holocene climatic reconstructions based on pollen, plant macrofossil and radiocarbon data from several mires in the CFSNBR have shown a very high sensitivity of vegetation cover to changes of climate conditions. The relatively short-term (with duration less, than 1000 years) and sharp (with amplitude about 10°) temperature fluctuation in the Late Glacial and the early Holocene led to significant vegetation changes.
Bearing in mind the environmental condition of the Holocene optimum as a model of vegetation changes for the middle of XXI century (Velichko, 1991), one can expect changes in the internal structure of plant communities, such as increase in abundance of broad-leaved trees in forest stands and in the understorey. Spruce forests are reduced and their areas will be, obviously, replaced by secondary stands of birch and aspen.
Obtained data of climatic fluctuations in the second half of the Holocene suggested a rather well determined response of vegetation to both climate warming and cooling. Thus, increase of the January and July temperatures by 1-2° and 1° respectively, in some periods of the Late Holocene resulted in reduction of areas occupied by south taiga communities and expansion of coniferous broad-leaved forests. The main phases of the last millennium are well pronounced in the paleogeographical data of the CFSNBR. The decrease of winter temperature by 7° during the Little Ice Age in comparison with the Medieval Climatic Optimum lead to a decay of the broad-leaved communities in the CFSNBR and gave an impulse to active processes of wetland development.

CONTINENTAL-SCALE GLACIER VARIATIONS IN EUROPE (ALPS, SCANDINAVIA) AND THEIR CONNECTION TO CLIMATE OVER THE LAST CENTURIES

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There exists unique historical evidence for European glacier dynamics over the past centuries. Evaluation of this information allows reconstructing glacier length variations from the Little Ice Age (LIA) until the present. For several glaciers, reconstructions with decadal or nearly annual resolution can be achieved. Here, we present newly established length change records for eight glaciers in the western and central Alps (back to the 16th century), and eight glaciers in southern Norway (back to the 17th century). The longest available records are from the French Mont Blanc area (Mer de Glace back to AD 1570 and Glacier des Bossons back to AD 1580) and the central Swiss Alps (Unterer Grindelwaldgletscher back to AD 1535). Those reconstructions are based on historical documents and reveal dramatic glacier advances starting by the end of the 16th century and culminating in about 1600 and 1640. There is a striking asynchrony between Alpine and Scandinavian glaciers during the LIA and in the 20th century with the LIA maximum length peaking around 1600/1640 and 1820/1850 in the Alps, and around 1750 at Jostedalsbreen (1870–1890 at Folgefonna) in southern Norway. In the second half of the 20th century, southern Norwegian glaciers showed a major advance while a general retreat is observed in the Alps. Interpreting glacier fluctuations in terms of climate variations – mainly temperature and precipitation – yields valuable insights into the driving forces behind glacier changes. For this purpose, we compared the glacier records with independently derived reconstructions of temperature and precipitation. The influence of distinct large-scale atmospheric circulation patterns on glacier mass balances is presented for the studied areas. For instance, the major glacier advances in the Alps from 1820 to 1850 coincide with predominant north-westerly and northerly air flow.

ALPINE CLIMATE DURING THE HOLOCENE: A COMPARISON BETWEEN RECORDS OF GLACIERS, LAKE SEDIMENTS AND SOLAR ACTIVITY

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The understanding of the climate history of the European Alps is crucial, since they are very sensitive and vulnerable to climate change. The recent improvement of Alpine glacier length records and climate reconstructions from annually laminated sediments of Alpine Lake Silvaplana gives the opportunity to investigate the relationship between those two data sets of Alpine climate. Two different time frames are considered: the last 500–1000 years as well as the last 7400 years. First, we found a good agreement between the two different climate archives during the past millennium: mass accumulation rates (MAR) and biogenic silica (bSi) concentration are largely in phase with the glacier length changes of Mer de Glace and Unterer Grindelwaldgletscher, and the records of glacier length of Grosser Aletschgletscher and Gornergletscher.
Secondly, the records are compared with temporally highly resolved data of solar activity. We find that the Sun has had a major impact on the Alpine climate variations in the long-term, i.e. several centuries to millennia. Solar activity varies with the Hallstatt periodicity of about 2000 years. Hallstatt minima are identified around 500, 2500, and 5000 cal. years BP. Around these times grand solar minima (such as the Maunder Minimum) occurred in clusters coinciding with colder Alpine climate expressed by glacier advances. During the Hallstatt maxima around 0, 2000, and 4500 cal. years BP, the Alpine glaciers generally retreated, indicating a warmer climate. This is supported by archaeological findings from Schnidejoch, a trans-alpine pass in Switzerland only accessible when glaciers were retreated. On shorter timescales, however, the influence of the Sun cannot be as easily detected in Alpine climate change, indicating that in addition to solar forcing, volcanic influence and internal climate variations have played an important role.

GENESIS OF STRATIFIED SUBGLACIAL 'TILL' (GLACITECTONITE) SEQUENCES

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Stratified diamicton assemblages are a common feature of many glacial settings and have often been interpreted as subglacial tills recording deposition beneath grounded glacier ice. Results from a number of different locations show that such sediments often contain a large amount of stratified and variably deformed material including intact sediment rafts, reflecting low strain rates and short sediment transport distances. These sequences are particularly common in late Quaternary ice marginal settings where steep topography often provided pinning points for the glacier margin to stabilise and deliver large volumes of sediment into a subaquatic setting before proglacial and subglacial reworking of the sediment pile. Stratification/lamination can be recorded by the presence of sandy or thin gravelly layers within the diamictons and some diamictons contain interbeds and lenses of sand, mud and gravel, which still preserve original stratification. Formation is a two-stage process in which initial glacially-influenced subaquatic sedimentation was followed by glacitectonic thrusting and overriding, during which the waterlain sediments were reworked and variably deformed. The final sediments constitute a continuum of glacitectonised waterlain sediments to subglacial traction tills. The sedimentology and stratigraphic architecture of such stratified sequences will be discussed in this talk, drawing on examples from a range of different locations.

ICE SHEET LIMITS AND CHRONOSTRATIGRAPHY IN THE SOUTHERN SECTOR OF THE LAST IRISH ICE SHEET

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This paper discusses the extent and associated chronology of the last glaciation of southern Ireland. Traditionally surficial glacial drifts across a broad swath of terrain in the southern half of Ireland have been subdivided on morpho-stratigraphic grounds into an 'Older Drift' and 'Younger Drift' series and large end moraine complexes bordering the zone of 'Older Drift' have long been regarded as marking the limit of the Late Midlandian (last glaciation) ice sheet. Recent advances in dating Quaternary sediments along the south coast of Ireland demonstrate that this traditional reconstruction is no longer valid. OSL dates on raised beach deposits underlying the glacigenic sequence, AMS radiocarbon dates on