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Observed variations of cloud fraction and types over Russia in last decades

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Cloudiness changes may mitigate or exacerbate global and local warming. Here, we assess changes of total and low cloud fraction and the occurrence of days with different cloud conditions and different cloud types including convective clouds over Russia from 1965 to 2011 years. Our analysis is based on visual daytime routine observations from almost 500 Russian meteorological stations for the period 1965-2011 and than 1800 stations for the period 1984-2011.

In general, cloud fraction tends to increase during the last years. A major increase of total cloud fraction and a decrease of the number of clear days are revealed in spring and autumn mostly due to an increase of the occurrence of convective and non-precipitating stratiform clouds. In contrast, the occurrence of Nimbostratus clouds tends to decrease, which lead to a general decrease of the occurrence of overcast days. In most regions, the ratio between the occurrence of Cumulonimbus and Nimbostratus clouds has increased in last decade compare to previous ones. It worth noting, that for particular stations this redistribution may be associated with observers changes. Over some regions (Ural and the Far East), a decrease of total cloud fraction and an increase of the number of clear days are noted.

In addition, we assess possible causes of cloudiness variations. In particular, sensitivity of cloudiness changes to temperature changes were evaluated. The relationship of cloud variations with cyclonic/anticyclonic activity including atmospheric centers of action (Azores and Siberian highs, Aleutian and Icelandic lows) were assessed as well.

An overall increase of convective clouds occurrence is an additional and independent evidence for the intensification of convective processes in the last decades over land in the northern midlatitudes. Alongside with an increase of heavy precipitation events, an increase of occurrence of Cumulonimbus clouds leads to lightning occurrence increase and, in turn, leads to an increase of the risk of forest fire initiation. Together with the projected increase of fire danger indices in southern regions of the European Part and Siberia, it can lead to more fire hazardous regional climate.

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