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Inter-annual variability of the surface ozone concentration at European mountain stations: main patterns and driving mechanisms

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The long-term measurements (1990-2006) of the surface ozone concentration at Kislovodsk High Mountain Station (KHMS) in Caucasus, Russia (43.7^{0}N, 42.7^{0}E, 2070m a.s.l.) and Jungfraujoch (JFJ) in the Alps, Switzerland (46.5^{0}N, 7.9^{0}E, 3580m a.s.l.) are studied. We focus on analysis of the inter-annual variability of the surface ozone, its main patterns and causes. Wavelet analysis of the ozone concentration series shows the presence of a quasi-periodic variability in the data (around 2-3 years). This variability is detectable since 1997/1998 while in the beginning of the time series it is likely to be masked by strong concentration trends. Inter-annual variability can be seen through the change (shift) of the month of seasonal ozone maxima from year to year. For the interpretation of the observed inter-annual variability a set of diagnostic local, regional and global parameters is considered. To attribute the ozone concentration variability to the air transport changes the LAGRANTO trajectories are used. In particular the impact of the changes in the frequency of the contact with the stratosphere and the planetary boundary layer on the ozone variability is analyzed. Different trajectory lengths are selected to investigate different "impacting" areas. Changes in horizontal advection patterns are taken into consideration by accounting for the changes in the advection clusters frequency and the role of local factors is considered through local meteorological conditions variability. Impact of the global atmosphere dynamics variability on the surface ozone inter-annual changes is assessed by correlation analysis of ozone datasets with global teleconnections and El Niño indices. Contributions of mentioned above factors into total variability of the surface ozone concentration at two locations are discussed.