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On the stratospheric forcing of the North Atlantic climate variability

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Previuos studies have pointed out how stratospheric anomalies precede tropospheric mean-flow anomalies. Hence, coupling between stratospheric and tropospheric circulation is starting to be considered as a new tool for predicting possible anomalous surface conditions, especially because of the slow propagation downwards of these stratospheric anomalies.

In order to improve our knowledge of the dynamic mechanisms involved in stratosphere-troposphere interaction, we have examined the state of the atmospheric column (1000 hPa -1 hPa) prior to high/low atmospheric index conditions. For that, we have used daily data from the ERA-40 reanalysis (1957-2001) and the three main principal components of geopotential at 1000 hPa as atmospheric indices.

Among other, the results show that large anomalies formed in the polar stratosphere (north 70žN) a few days before the occurrence of NAO extreme events propagate downwards and produce anomalies in the troposphere mean. These significant stratospheric anomalies appear above 5 hPa around 8 days before low NAO events occur. However, strong stratospheric anomalies prior to high NAO episodes appear earlier and lower (10 hPa), about 15 days before the positive NAO extreme events.