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Impact of the QBO on trace gas distributions in a chemistry-climate model

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The impact of the QBO on the transport, dynamics and chemistry of trace gases can be analyzed using general circulation models that include a chemistry parameterization, so-called Chemistry Climate Models (CCMs). On this poster, a set of four experiments with the CCM MAECHAM4-CHEM is evaluated and compared to observations. Experiments differ by including or not including the QBO and running in recent past or near future, covering 20 years respectively. Comparison of the experiments with and without QBO shows the QBO's effects on dynamic fields and trace gas transport and distribution. Focus here is on temperature (T), humidity (q), methane (CH_4) and ozone (O_3) fields, for which some prominent findings are presented. Temperature fields follow the wind fields as is expected from thermal wind balance, in agreement with recent reanalysis results. At the tropopause, however, the field is no longer zonally uniform and shows some QBO effect on seasonal variation. Further, QBO effects on humidity mainly occur just at the tropopause, they are linked to the temperature signal. A reversal of the sign of the effect is observed higher up in the stratosphere, as it is the case for ozone. The methane QBO signal is evident in most of the tropical and subtropical stratosphere and relates to the humidity field because H_2O from methane oxidation is an important contributor to humidity in the upper stratosphere. Overall, a fair representation of the QBO is detected in all analyzed quantities, similar to observations and in general agreement with present understanding of stratospheric dynamics and chemistry.