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Equatorial Mountain Torques and Cold Surges in a GCM

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The dynamical relations between the equatorial atmospheric angular momentum, the equatorial mountain torque and the cold surges are analysed in a General Circultaion Model (GCM). First we show that the global equatorial atmospheric momentum budget is very well closed in the model which is a clear benefit when we compare with results from the NCEP reanalysis. We then confirm that the equatorial torques due to the Tibetan plateau, the Rockies and the Andes are well related to the cold surges developping over South Eastern China, North America, and the Southern South America respectively. For all these mountains, a peack in the Equatorial mountain torque component that points locally toward the pole preceeds by few days the development of the cold surges, yielding a predictive interest to our results.

We also analyse the contributions to the torques of the parameterized mountain stresses and find that they contribute substantially. In experiments without the parameterized stresses, we also find that the explicit terms partly compensate the parameterized contributions to the torque, and the cold surges are not much affected. This shows that the cold surges can be well captured by models, providing that the synoptic conditions prior to their onset are well represented. The compensation between torques is nevertheless not complete and some weekening of the cold surges is found when the mountain forcings are reduced. This illustrates how the exact torques are needed at a given time to produce the correct synoptic scale dynamics at a later stage.