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Sensitivity of water vapour in lower stratospheric monsoon anticyclones to different processes

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Lower stratospheric water vapour is affected by a number of processes from ice formation and removal to methane oxidation. It is therefore necessary to develop model parametrizations covering these processes. Although they can reproduce the general picture of stratospheric water vapour variability, current model simulations still show significant differences to observations, particularly in monsoon regions. For instance, satellite observations from the most recent version of the Microwave Limb Sounder experiment (MLS) show climatologically similar water vapour maxima at 100 hPa in the Asian (AM) and North American (NA) monsoon regions. On the contrary, Lagrangian models driven by different reanalyses show a much stronger water vapour signal in the Asian monsoon at that pressure. Therefore, it is crucial to study if these differences arise from the effect of the parametrizations included in the model.

We use the modular structure of the Lagrangian atmospheric model CLaMS in its diabatic version to perform several runs, disabling parametrizations included in the model. Thus we have covered a wide range of configurations: from simple trajectory runs to full chemistry-transport model runs. The three dimensional structure and relative strength of the AM and NA monsoon water vapour signals are analysed and compared between the different simulations. This procedure gives us clues about the effect of the applied parametrizations on the main sources of water vapour during boreal summer in the LS. Besides it helps to identify which parametrization is behind the differences between CLaMS and MLS.