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The global warming-induced South Asian High change and its uncertainty

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Based on Coupled Model Intercomparison Project phase 5 (CMIP5) models, the present study investigates the South Asian High (SAH) change in response to global warming. Under global warming, at 100 hPa, the selected 16 coupled general circulation models all feature an elevation of geopotential height to the south of the SAH climatological position; an easterly response is found over the northern Indian Ocean in all the models, while a westerly response is found over subtropical Asia. The ridges of the SAH shift equatorward in 75% of models. Using the linear baroclinic model, it is found that the co-effects of latent heating and the mean advection of stratification change (MASC) are mainly responsible for those responses. The MASC mainly leads to the forementioned easterly and westerly responses; the latent heating contributes to the geopotential height response and the easterly response over the northern Indian Ocean.

The most important inter-model diversity found in the 100 hPa circulation change under global warming, and accounts for more than half of the total inter-model variance. The inter-model spread of latent heating and the MASC are important factors in driving the 100 hPa circulation diversity. Furthermore, analysis shows that the projected uncertainty in humidity, vertical velocity and global mean temperature change are the three most important sources of inter-model diversity for the 100 hPa circulation change.