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Adjusted radiative forcing and radiative feedbacks in the CNRM climate model

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This study provides a comprehensive analysis of the contribution of the different climate system components (temperature, water vapor, clouds, surface albedo) to the adjusted radiative forcing and to the total strength of the radiative response in the CNRM climate model using the partial radiative perturbation (PRP) method (Wetherald and Manabe, 1988). In a first step, sensitivity tests have been performed to numerical methodological choices such as the range of the simulation time, the frequency of the field substitution, the type of simulation (abrupt 4xCO_2, 1% yr-1 CO_2). Results show a slight sensitivity to these methodological features. The feedback estimations are more sensitive to the definition of the top of the climate system (top-of-the-atmosphere / tropopause) specially for the water vapour feedback. In a second step the PRP has been applied in transient regime following Colman and McAvaney (2011). This method allows to discriminate the fast and slow change of the partial radiative flux and thus the contribution of each component to the forcing adjustment and to the feedback associated with the increase of the mean surface temperature. It is shown that partial contributions are consistent with the total adjusted forcing amplitude and the total feedback magnitude. The magnitude of the different contributions is discussed.