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Detection and Attribution of the surface air temperature during last millennium

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An optimal detection method was employed to compare the reconstructed and model-simulated changes of surface air temperature during last millennium. Model simulations are from CESM1-CAM5, which include 28-member ensembles in total, i.e. 5-member ensembles volcanic forcing runs, 4-member ensembles solar forcing runs, 3-member ensembles forcing runs for land use, orbital, greenhouse gases, and 10-member ensembles runs from combined 5 individual external forcing. Analyses were conducted from hemispherical to continental scale. Results show that combined effect of all the external forcings can be detected for both Northern and Southern Hemisphere, and for the continent of Europe, Arctic and Antarctic. The influence of volcanic eruption and solar activity can be detected for all the hemispheres and nearly all the continents of North Hemisphere. Land use forcing can be detected for all the continents of Northern Hemisphere, but only detected for one continent of Southern Hemisphere, i.e. South America. The orbital forcing is detected for all the continents of Northern Hemisphere, but not detected for the Northern Hemisphere as whole. Influence of greenhouse gases can rarely be detected from hemispherical to continental scale.