We present results from future sea-level change experiments with the Earth system model of intermediate complexity LOVECLIM. The model includes fully coupled three-dimensional thermomechanical models of the Greenland and Antarctic ice sheets, a global glacier melt algorithm, and a diagnostic for oceanic thermal expansion. In the present study a large range of the model's sensitivity to greenhouse warming was sampled by systematic parameter variations. This led to an ensemble of model versions that simulate the present-day climate consistent with observations, while producing contrasted results for the future period. We discuss results for the entire ensemble of model versions under three different SRES forcing scenarios (B1, A1B and A2) extended over the third millennium. Mountain glaciers are the fastest to disappear in all scenarios, followed by small ice caps. Initially the strongest contribution, thermal expansion of the world oceans decelerates on multi-centennial time scales and is outpaced by Greenland melting, the largest contribution to sea level rise at the end of the third millennium in all scenarios. The Antarctic contribution remains negative for scenario B1, due to increasing accumulation but is positive for the two other scenarios. By 3000 AD, the Greenland contribution to sea-level rise is at least one meter for the lowest scenario but increases by more than one meter per degree of warming above 2°C limited by the total amount of ice. The sea-level contribution from Antarctica is small for a warming less than 5 °C but increases rapidly for an average warming above 8 °C.