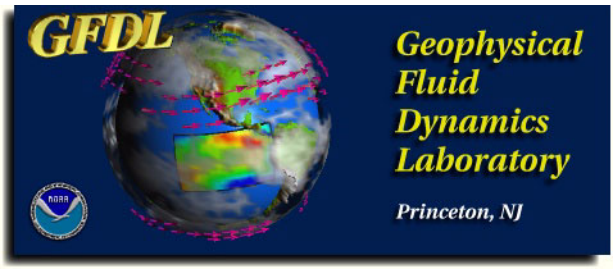
Computer Model Projections of 21st Century Sea Level Change



Sea level change projections produced by several computer models of the Earth's climate system suggest that the rate of sea level rise will accelerate in response to increasing atmospheric greenhouse gas (GHG) concentrations. The models project that thermal expansion (ocean waters expanding as they warm) could lead to an average sea level increase of 0.20 to 0.37 meters (8 to 15 inches) for the period 1990 to 2090.

In a paper published in the journal *Climate Dynamics*, lead author Jonathan Gregory of the United Kingdom's Hadley Centre and nine international colleagues (including Ronald Stouffer, Keith Dixon, and Michael Winton of NOAA/GFDL) report on the implications that changing atmospheric GHG levels may have on future sea level. All the model experiments examined assume that GHGs and sulfate aerosols will vary in the 21st century following a scenario of moderate economic growth but no measures to reduce GHG emissions.

While all the models project that warming ocean waters will cause global sea level to rise markedly during the 21st century, the model results differ by almost a factor of two, largely because of uncertainties in how the ocean will take up heat from an atmosphere that is warming, as well as the sensitivity of the atmosphere to increasing GHG levels.

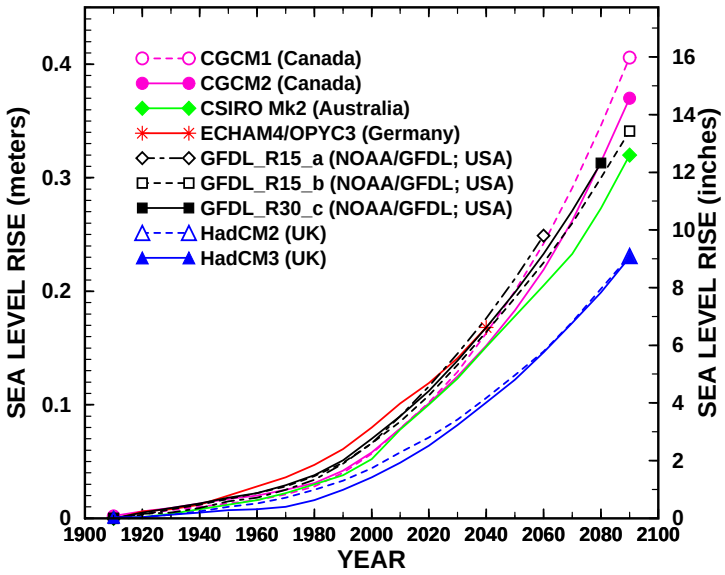
The model intercomparison reveals that wide variations in regional sea level change can be expected as patterns of winds and ocean circulation change Some areas are projected to experience twice the global average rate of sea level rise. However, the models do not agree regarding the details of the geographic distribution of future sea level change. Most of the computer models do suggest that larger than average sea level rise may occur in the Arctic and that smaller than average changes may occur in the Southern Ocean that surrounds Antarctica.

The scientists note that many factors need to be better understood to further refine these estimates. One limitation involves uncertainties in how levels of GHGs and other atmospheric constituents will vary in the future. Also, other studies have suggested that the melting of glaciers (a factor not considered in this study) could lead to an additional 0 to 0.23 meters (0 to 9 inches) of sea level rise during the 21st century. Even if GHG levels are stabilized in the coming decades, sea level would continue to rise for centuries due to the ocean's long response time.

REFERENCE: Gregory, J.M, J.A. Church, G.J. Boer, K.W. Dixon, G.M. Flato, D.R. Jackett, J.A. Lowe, S.P. O'Farrell, E. Roeckner, G.L. Russell, R.J. Stouffer, M. Winton, 2001: Comparison of results from several AOGCMs for global and regional sea-level change: 1900-2100. *Climate Dynamics*, vol 18, pp. 225-240..

TAKE HOME POINTS

- ☛ Global mean sea level rose in the 20th century and the rate of increase is projected to accelerate during the 21st century
- ☛ The thermal expansion of sea water is expected to be the leading contributor to global sea level rise, accounting for 0.20 to 0.37m (8 to 15 inches) from 1990 to 2090
- ☛ Some areas may experience twice the global average sea level change, but large uncertainties remain regarding the regional details of future sea level change
- ☛ Even if atmospheric GHG levels were to be stabilized in the coming decades, global mean sea level would continue to rise for centuries as the ocean slowly responds



Global average sea level rise due to the thermal expansion of ocean waters as projected by several coupled atmosphere-ocean climate models. Model names and the country in which the experiments were conducted are indicated in the key. The curves have been offset on the y-axis so that they all have a mean of zero for 1910.

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