Closure of the budget of global sea level rise in the GRACE era: The importance and magnitudes of the corrections required to account for ice-age influence

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The budget of global sea level rise includes contributions from several distinct factors, including thermosteric effects, the wasting of small ice-sheets and glaciers, and the loss of mass by the great polar ice-sheets and by the continents due to desiccation. Since the former contribution may be estimated on the basis of both hydrographic survey data and more recently using Argus float data, the second may be estimated on the basis of mass balance measurements on existing ice-fields, and the latter on the basis of modern GRACE-based time dependent gravity field measurements, the inputs to the globally averaged rate of sea level rise are well constrained. The net rate of global sea-level rise is also measured directly by the TOPEX/POSEIDON and Jason-1 altimetric satellites. Since GRACE also provides a measurement of the rate at which mass is being added to the oceans, we are now in a position to ask whether this rate of mass addition to the oceans matches the rate at which mass is being removed from the continents. He answer to this question depends critically upon the accuracy with which we are able to eliminate the contamination of both the measured rates of mass loss from the land and mass gain by the oceans due to the influence of the ongoing process of glacial isostatic adjustment. This issue is addressed in detail.