DETERMINATION OF 20TH CENTURY SEA LEVEL RISE

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Sea level rise has been widely recognized as a measurable signal of global climate change and may be influenced by anthropogenic (human-induced) processes. The small rate of sea level rise, at 1-2 mm/yr during the last century [IPCC, Church et al., 2001], could only be partially explained by a number of competing geophysical processes, each of which is a complex process within the Earth-atmosphere-ocean-cryosphere-hydrosphere system. Recent determination of the 20th Century sea level rise rate of 1.84 +/- 0.35 mm/yr [Douglas, 2001; Peltier, 2001] cannot fully explain 0.2-1.2 mm/yr of the estimated sea level signal [IPCC, Church et al., 2001]. Recent studies [Cabanes et al., 2001; Miller and Douglas, 2004] have competing characterizations of sea level in attributing thermal expansion and melt water as the respective dominant causes of 20th Century sea level rise. Significant geographical variations in both the thermal expansion [Antonov et al., 2001] and self-gravitational redistribution of melt-water as a result of present-day ice melt [Mitrovica et al., 2001] appear to limit the determination of sea level rise using tide gauges. This paper provides an updated quantification and characterization of the 20th century sea level rise using data from a) multiple satellite altimetry missions (GEOSAT, ERS-1, ERS-2, T/P) spanning ~18 years, b) ~800 long-term tide gauges, and c) assimilated ocean model results [Schroeter et al., 2003]. Further, we study effects such as thermal expansion and steric contraction employing the Levitus data [WOA, 1998, 2001], melt-water self-gravitational effect [Mitrovica et al., 2001, Tamisiea et al., 2002] and GIA affecting tide gauge benchmarks (Peltier, 1995, Milne et al., 2001).