

Interactive comment on “Regime changes in global sea surface salinity trend” by A. L. Aretxabaleta et al.

Anonymous Referee #3

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This paper presents an interesting analysis of the observed global long-term surface salinity trends over the last decades using two observationally-based datasets i.e. in-situ (1950-2014) and satellite-derived (2000-2014). The statistical method used to estimate the salinity trend regimes is rigorous. The authors provide an extensive and reasonable analysis of their results and clearly demonstrate 3 regimes of salinity trends. The first two regimes A, B (1950-1990, 1990-2009) are consistent with an increase of the water cycle with an acceleration in regime B, in agreement with previous studies. However the authors should address a few points prior to publication, mainly concerning the impact of data coverage (especially in regime A) and natural variability (especially in regimes B and C) in their trend analysis:

Major comments

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- En4 dataset has large spatiotemporal gaps in sampling coverage in the 1950's and 1960's in large areas of the world ocean. In particular in the Southern hemisphere only a few salinity observations are available on seasonal or annual basis which makes it very difficult to perform any meaningful statistical analysis and it strongly affects the significance of the obtained trends over the 1950-1990 period. The authors should discuss further about caveats in their trend analysis due to insufficient observational coverage especially over earlier decades in the record.
- Salinity decadal variations over short periods (i.e. in general shorter than 30 years) are significantly affected by natural variability. Hence salinity variations in very short periods such as 1990-2008, 2009-2014 considered in this study are strongly modulated by inter-annual/decadal natural variability, mainly ENSO/PDO in the Pacific and NAO/AMO in the Atlantic. The authors should evaluate or at least discuss further the contribution of natural variability in the estimated trends at least for their last two regimes. In particular there is strong decadal variability in ENSO over this period with strong impacts on precipitation/salinity decadal variations (e.g. Skliris et al. 2014).
- Salinity trends in regime C (2009–2014) are clearly reversed in some regions e.g. N. Atlantic subtropical regions become fresher and equatorial Atlantic now become saltier indicating a decrease of Water Cycle amplitude. The authors should discuss this along with possible links to natural variability.

Minor comments: Page 992 lines 3-8. There are contradicting statements about the obtained trend in the Antarctic Circumpolar Current region: Line 3: “ . . . larger positive trend in the Antarctic Circumpolar Current region . . . ” Line 8: “ . . . predominantly negative trend . . . along the Antarctic Circumpolar Current region”

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