

Response to referees' comments.

*We would like to thank both referees for the comments and respond as follows.*

Anonymous Referee #2

Scientific comments: P 2973: As mentioned by Johnson, the 24 hour filtering should be described in more detail.

*This is discussed in the response to Johnson.*

One goal of the filtering would be to average down to temporally varying contribution to delay that are not salinity related.

*This is correct, we expect salinity to be the most slowly varying of all the variables considered.*

As the salinity contribution on the order of 10's of nanoseconds, an account for all potential measurement errors should be made (transmission time error, TOA measurement error due to noise, skywave, etc.).

*The error budget is described in our response to the review by Johnson.*

Similar filtering should be performed to the data used to derive SST and PF delay to have a fair comparison.

*The data used is already at 24h resolution and this is why a 24h running mean was chosen, rather than any other time period.*

P2974: Reference where you get the 1 K increase in SST causing a 1 ns/100 km decrease in Loran delay.

*This was inferred from Johler et al (1956), who give extensive graphs and tables of the 'Secondary Factor' based on distance, frequency and conductivity. This is also based on the effect of SST on conductivity.*

*Johler, J. R., Kellar, W.J. and Walters, L.C.: Phase of the low radiofrequency ground wave, National Bureau of Standards Circular 573, 1956*

I noticed this is roughly on the same order in the temperature relationship of the PF term. Is it possible that the SST variation is already accounted for?

*This hasn't been doubly accounted for. However, the SST and 2m atmospheric temperatures do have similar effects, though the SST effect is slightly larger and peaks later in the year due to the inertia of the ocean.*

Please detail how the SSS is calculated. I assume it is an integrated sum along. Also, is the sea salinity data averaged and if so how does the averaging affect the analysis.

*The SSS SMOS data came from the 1° by 1° SMOS product from the Integrated Climate Data Center (ICDC, <http://icdc.zmaw.de>), University of Hamburg, Hamburg, Germany and was averaged along the path. Given the resolution of the data this is likely to have little effect compared to taking the data value closest to the centre of the path, but is consistent with average nature of Loran data.*

Technical Comments: P2974: The definition of PF shown is fine. It should be made clear that this PF is actually the full propagation time for the Loran signal along an all air path rather than a delay from the “ideal” speed of light propagation time.

*This is now clarified, the PF refers to the entire path rather than the excess delay.*

P2974/Figure 3: Please spell out the acronym PSS either in the text or the figure (in Figure 3).

*This is done in the figure caption.*