

## ***Interactive comment on “Circulation timescales of Atlantic Waters in the Arctic Ocean determined from anthropogenic radionuclides” by Anne-Marie Wefing et al.***

### **Anonymous Referee #1**

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This manuscript uses measurements of two long-lived artificial radionuclides ( $^{129}\text{I}$  and  $^{236}\text{U}$ ) together with idealized transport models to analyze the tracer transport in the surface and in the mid-depth Atlantic water in the Arctic Ocean. It is shown that analysis of the pair of radionuclides enables the time scales and pathways of the transport, and role of lateral mixing, to be constrained. The paper is well written, contains interesting new results, and I think is suitable for publication in Ocean Science after only a few relatively-minor revisions (see below).

### Specific Comments

1. Why are different models used for surface and mid-depth waters? The manuscript

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just states that different models are used, but there needs to be a discussion of why the same model can't be used for both and/or why one model works for one layer and not the other.

2. A related issue is the relationship between the different "ages" reported. Can the tracer ages from the binary model be compared with the mean age (or modal age) from the TTDs? These ages are both shown in summary figure 7, but it needs to be clearer if the difference between the ages reflects real differences in transport times or if some of the differences could be due to the age definition.

3. In the discussion of uncertainties (e.g. appendix A) there should be some mention of the uncertainty in the TTD method due to the choice of  $G(t)$ . All the analysis assumes the  $G(t)$  is an inverse Gaussian, but different mean, and especially mode, ages would be obtained if  $G$  had a different functional form. I acknowledge that this uncertainty can't be quantified as easily as some of the other factors, but it should at least be mentioned.

4. The Introduction is very long, with multiple subsections, and it is not until page 5 that what is examined in this paper is discussed. As a reader I greatly prefer papers with more concise Introductions that quickly gets to the outstanding questions and what is examined in the paper. Would it be possible to have a more concise Introduction, with some of the subsection in a second section that provides the background on the radionuclides in the Arctic.

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