

Review of os-2018-89 (Li et al.)

The authors have provided two important components for the use of eight halogenated compounds as tracers of ocean circulation. They have reconstructed the atmospheric source functions and estimated their solubilities in water and seawater. These two items should enable reconstructions of the surface seawater concentrations of these compounds as a function of time. However the utility of these compounds as transient tracers depends more strongly on whether they are conservative in seawater, and whether they can be precisely and accurately measured on relatively small volumes of seawater in a timely fashion. A cautionary tale can be found in the use of CFC-113 as a tracer in the ocean. A great deal of time and effort went into developing the analytical method and determining its solubility. However CFC-113 exhibits non-conservative behavior in seawater. This paper needs to be revised before publication. There are a few scientific issues to be addressed and numerous grammatical corrections.

Scientific Issues:

Why not direct the reader to the AGAGE website (<https://agage.mit.edu/data/agage-data>) for the recent atmospheric measurements? Why were these eight compounds chosen out of the many compounds measured by AGAGE?

The authors provide late winter atmospheric concentrations for these compounds. Are these values much different than a linear interpolation between the mid-year values? Is there a systematic offset that makes it important to include the NH Feb and SH Aug concentrations?

Most of the use of transient tracers is to study the ventilation of waters colder than 10 C. However the measured freshwater solubilities presented in this manuscript do not constrain the solubility curves at temperatures colder than 298 K where the temperature dependence of the solubility becomes significant.

Editorial Comments:

P2,L10 – CFC concentrations are not “variables”

P2,L41 – Define MOZART

P3,L29 – Is it important that HFC-125 is the 5<sup>th</sup> most abundant HFC? It makes me wonder why the 2<sup>nd</sup> through 4<sup>th</sup> most abundant HFCs are not considered by the authors.

P4,L31 – The atmospheric growth rate can be reversed – not the concentrations

P4,L40 – intercalibrated rather than consistent?

P6,L10 – “see studies”?

P6,L18 – be more specific than America

P6,L21 – all data for HFC134a are first reported for HFC134a?

P7,L34 – “by in”

P9, EQN1 – csapsGCV not defined

P10, EQN8 – D,E,F not defined

P10,L14 – “some properties”?

P10,L25 – There is no  $V_c$  in the equations

P11, L13 – Use approximately when dropping significant figures

P11,L16 – “so as to”?

P11,L30 – Note that CGW model method does not provide a method for estimating  $L_0$

P12,L2 – Methods do not think

P12,L18 – A better description of the ventilation process is needed (e.g. the mixed layer deepens...)

P13,L4 – Curves and symbols in the upper panels of many figures are difficult to distinguish.

P13,L14 – “stable” is not the correct word

P13,L36 – As written “they “ refers to the interhemispheric gradients

P14,L13 – Bimodal has a specific meaning, choose a more appropriate word for describing this curve.

P14,L15 – ‘other one’ implies a second plateau.

P14,L17 – verb missing

P14,L21 – “rapid” instead of “raid”

P14,L31 – “are” not “were”

P15,L8 – How do the authors distinguish “exponential” from “quadratic” from ‘linear’?

P15,L10 – larger instead of “large”

P15,L13 – missing verb

P15,L35 – “reduced”

P16,L12-13 – sentence needs rewritten

P16,L22 – What does “annual growth rates exhibit a normal distribution” mean?

P17,L10 – “accelerated phase out” not correct

P17,L11 – “bank of HCFC-22 exist” ?

P17,L29 – “even out” is not a noun

P18,L18 – Warner and Weiss did use a salting out coefficient as defined in Eqn 6

P18,L24 – Fitting the solubility at temperatures between 25-65 C is not an important finding

P18,L29 and L31 – What happened to the factor of  $10^{15}$ ?

P21,L2 – the Cl radical is the culprit, not the prime suspect

P21,L10 – Use e.g. before presenting a subset of the manuscripts that use the CFCs as ocean tracers