Reviewer 1

The discussion in the paper is clear and well-organized, and the results should be of good practical use to other researchers using CTD data to estimate mixing. However, given the emphasis on validating the Thorpe scale, it seems a bit narrow in scope to limit the discussion only to one method. It would be useful to know how the Gargett and Garner validation method performs compared to the van Haren and Gostiaux (2014) criterion of the z/d ratio. Also, since temperature CTD data tend to be considerably less noisy than density, if good results could be achieved by identifying overturns in the temperature profiles rather than the density profiles, or if salinity compensation made such an approach impractical.

Thank you for letting us know the interesting new method of van Haren and Gostiaux (2014). In the revised version we have inserted a new subsection 5.1 where we compare the performance of this method in comparison with our approach. We have emphasized there that temperature profiles cannot be used in our case of the upper layer of the Antarctic zone where the temperature is unstably distributed due to the presence of the subsurface Tmin at about 200 m and Tmax at about 700 m.
Lines 343-381.

Some minor technical edits:
Pg. 12143, Line 15: need the "The" in front of Gargett and Garner or the "'s" after, but not both.

Yes, corrected as “The Gargett and Garner method”. Thank you.
Line 180.

Pg. 12144, Lines 20-25: I found the wording here confusing. The text speaks of suspect overturns "passing" the R_0=0.2 and/or 0.25 criteria, which sounds as if the overturns were validated, when they were actually flagged as false. I’d say an overturn with R_0 < threshold value fails the validation, not passes it.

We agree with you that the phrases we made are quite ambiguous. In the revision we have restated the phrases.
Lines 212-218.

Pg. 12146, Line 14: no need for "the" in front of "unity". Line 17: should be "prevents detection of". Line 26: should be "much more reasonable agreement". Line 27: again, no "the" in front of "unity".

Done. Many thanks for your corrections.

Reviewer 2

Specific comments

1) Additional references:
- In section 2, page 12141 line 5: For the thermal mass correction, ’typical’ values of alpha and beta are used as ’recommended’. Can you please provide a reference or some details as to where those correction values come from?

In order to be clearer for everybody (although it was evident for us), we have added a phrase "in the above software" at the end of the sentence, such as:
"… we used typical values (a = 0.03; 1/b = 7.0) recommended for SBE 9*plus* in the above software."
Lines 116-117.

- Section 4, page 12147 line 10: When describing the diffusivity distribution, can you please provide some references of previous estimates of mixing in the Kerguelen Plateau area or southern Ocean for comparison. Eg Waterman et al 2014, Wu et al, 2011, Thompson et al 2007, St Laurent et al 2012...

Yes, these references have been cited and commented.
Lines 294-303.

- Section 4, page 12147 line 20: When talking about strong mixing found over the Plateau and close to the Polar front, can you refer recent work on mixing showing similar results or providing discussions on the matter? Eg Waterman et al 2014, Wu et al, 2011, Thompson et al 2007, Whalen et al 2012, Waterhous et al 2014, Sloyan 2005...

Yes, similar results in recent work have been acknowledged.
Lines 311-314.

- Section 4, page 12148, line 3-4: You mention that the diffusion rate is quite 'low' throughout the upper 400 m and talk about a background level. The way it is written, one might think the background level is your mean mixing estimate. Some details and maybe reference about what you mean by background level, if not mentioned earlier, would be fitting here.

In responding to your above comment (Section 4, page 12147 line 10), we have mentioned the area-mean mixing rate in our KEOPS2 area (Lines 294-295) and implicitly related it to a background level (Lines 302-303).

2) Additional discussion:

- Section 4, page 12147 line 25: When you mention that the diffusivity estimates this time are less intense than those from the 2005 campaign, it would be nice to add a couple of sentences with some ideas about why that is.

Potential factors underlying the observed difference are given.
Lines 320-331.

- Section 4, page 12147 line 25: You mention an exception at TNS 5 where a local minimum in chlorophyll is observed in conjuncture with elevated diffusivities. Are you able to provide any comments or theories on why that is?

We have no clear idea on this feature. We have added "for unknown reasons" at the end of the phrase.
L316

3) Page 12145, line 8: what is the minimum value of the TurboMAp derived diffusivities?

We have added a value of 1.024 x 10^{-5} m^2 s^{-1} in the corresponding phrase.
Line 231.

4) Page 12147, line 2: You have not shown that this last sentence applies to any study or data set. Maybe add that 'is highly desirable in the estimation of vertical diffusivities for this data set'.

Indeed, you are right. We have added "for our study area, which is also worthy of testing its broad applicability in the other sectors of the Southern Ocean."
Lines 278-279.

Technical corrections
Below corrections are suggestions only.

1) Page 12138, line 6: Change to 'These diffusivities are validated' for clarity.
Done.

2) Throughout the paper, change numerals between 1-10 to the written form (one to ten).
Yes, corrected.

3) Page 12138, line 17-18: Clarify what is attached, the polar front or the acc surface water? The text as is is not clear.
"that is" is added after "the Polar Front"

4) Page 12139 line 23-24: Re phrase to 'Shih et al recently proposed a new param for the energetic turbulent regime based on the lab and numerical experiments as...' for clarity.
Done. Thank you.

5) Page 12140, line 6: add 'a total of four kinds of K estimates at ...' to help the reader follow the story.
Done. Also "(ε_Osborn, ε_Shih, Thorpe_Osborn, Thorpe_Shih)" has been added after " K estimates".

6) Page 12140, line 23: rephrase to 'while the TurboMAP measurements from the surface to about 400 m...' for consistency.
Done.

7) Page 12140, line 24: Change 'top' to 'upper'.
Done.

8) Page 12141, line 12: change to 'there was' for tense consistency.
Done.

9) Recurring use of 'On the other hand': Either just remove or use something else. It is quite an outdated English expression in this setting.
Yes, it is removed. Thank you.

10) Page 12142, line 21: Change 'as' to 'that' for clarity.
Done.

11) Page 12143, line 27: Replace 'Shortly speaking' with 'In short'.
Done.

12) Page 12144, line 21 and after: Change 'most apparent' to 'clear'.
Done.

13) Page 12145, line 3: For ease of reading, rephrase to 'from the Osborn parameterizations and from the Shih parameterizations...' otherwise, it sounds like you are talking about an Osborn & Shih parameterization.
Done. Indeed, it is clearer. Thank you.

14) Page 12145, line 24: add 'appears to be a tendency...'
Done.

15) Page 12148, line 17: Change to 'of the Kerguelen Islands using more direct estimates...'
Done.

16) Page 12149, line 3: remove 'still' as it makes it sound like the Thorpe scale method was considered at some point as a non useful tool. If that is the case, explain this in the introduction somewhere with references.
Indeed, you are right. We have added a phrase like "This is in stark contrast to Frants et al. (2013) who claimed the real limitations of the CTD-based fine structure methods in Drake Passage and the eastern Pacific sector of the Southern Ocean." (Lines 407-409). A similar phrase has previously been mentioned in the introduction (Lines 62-65).

17) Throughout the paper, there is the use of 'We make here' or 'We do here'... This could be changed to 'Here we make' for reading fluidity.
Thank for your suggestion of fluid English.

18) Title: I m not sure that the 'the' is needed before 'Thorpe scale-derived vertical diffusivities'. Maybe worse checking with an English grammar specialist...
We have removed "the".

Figures:
1) Page 12152 Fig 1: Provide source for the chlorophyll satellite image. Also, explain where the location of the PF comes from... your data, previous papers...?
To be clear, we have added: "This figure has been adapted from Park et al. (2014)."

2) Page 12153 Fig 2: Add 'density noise (0,0007) used is...'
Yes, done.

3) Page 12154 fig 3 and other figures: Add 'depth' on the y-axis or explain in caption that z is depth.
We have added "Depth z (m)" on the y-axis of Fig. 2 only because it is so evident that z in following figures is same as that in Fig. 2.

4) Page 12156 Fig 5: In caption add 'but for the mean (in black) and standard deviation (in grey) ratios of all stations.'
Done. Thank you.

5) Page 12157 Fig 6: What data is used for the seabed profiles? Add source or ref please.
In the figure caption we have made it clear that the seabed profiles were drawn from in situ station depths measured during the KEOPS2 cruise.

Many thanks for your meticulous corrections and valuable suggestions. The revised manuscript reads well.