

Responses to Referee 1

We highly appreciate the referee's evaluation and thoughtful comments for improving our manuscript. Our responses are presented below. The revised parts are in red color.

Comment 1: Perhaps fewer abbreviations would be helpful; DOM, for example, is typically dissolved organic matter, so readers might benefit from simply using the entire phrase of “dead organic matter” rather than try to follow acronyms. Paragraph 2.2.1 is also full of acronyms that make it difficult to understand the pools and fluxes that are being described.

Response: The abbreviation “DOM” was substituted by “**dead organic matter**”. In addition, we decided not to use abbreviations for the names of carbon pools throughout the manuscript. However, in the caption of Figure 1, the abbreviations would be helpful to understand the structure of the KFSC model.

Comment 2: Line 18 – delete “respectively” as the sentence structure is already clear.

Response: The word “respectively” was deleted.

Comment 3: Pg. 5033 Line 8: might be useful to stress that 1.3 Tg C for dead matter compares with 7.0 Tg for live biomass (if I have the numbers correct) – do failure to account for dead matter would result in an error of -20% in estimating live+dead C. Ah, I see Figure 6 does this.

Response: We revised the sentence on Page 5033 Lines 6–7 to stress the contribution of dead organic matter to the annual C balance as follows: “The C balance of dead organic matter during 1954–2012 was 1.3 Tg C yr⁻¹, **which was approximately 20% of that of the biomass (7.0 Tg C yr⁻¹).**”

Comment 4: Pg. 5033 Line 20, Jeju Andisols. It's true that andic soils accumulate large stores of C, but the presence of a very old, recalcitrant pool of C should not be confused with a low rate of decomposition (or high rate of humification) for modern C substrates. These two are likely to be completely unrelated. I may not follow how the Andisols are filled up with C during the spin up of the model, so this might be an artifact. And as noted in the manuscript, Jeju is a small part of the area of Korea, so this is not a major point.

Response: As the low decay rate of soil organic matter is insufficient to explain the presence of very old and recalcitrant C in Andisol, the presence of charred plant materials was specified as the major reason for the high C content. Andisol soils have high C content compared to other soil groups for two major reasons. One reason is the properties of soil organic matter derived from charred plant materials by volcanic activities (Shindo et al., 2004), and the other reason is the low decay rates of the soil organic matter caused by the strong combination with allophane (Calabi-Floody et al., 2011; Theng and Yuan, 2008). Considering these reasons, we revised the sentences on Page 5033 Lines 21–24 as follows: “**Andisol soils have more C stocks than other soil types for two reasons: the properties of soil organic matter derived from charred plant materials (Shindo et al., 2004) and low decay rates of soil**

organic matter caused by the strong combination with allophane (Calabi-Floody et al., 2011; Theng and Yuan, 2008). As the input of these materials by volcanic activities and the low decay rates were not considered in the KFSC model, the dead organic matter C stocks in Jeju province may be underestimated.”

Added reference to the manuscript

Shindo, H., Yoshida, M., Yamamoto, A., Honma, H., and Hiradate, S.: $\delta^{13}\text{C}$ values of organic constituents and possible source of humic substances in Japanese volcanic ash soils, *Soil Sci.*, 17, 175–182, 2004.