

## ***Interactive comment on “Synchronicity of the East Asian Summer Monsoon variability and Northern Hemisphere climate change since the last deglaciation” by T. Shinozaki et al.***

**Anonymous Referee #2**

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General comments:

This paper presents a well dated stable carbon isotope record derived from peat deposit in Japan. The record covers the whole time span from the last deglaciation to modern time and is used as a proxy for hydrological and climatic changes. During last decades, isotope studies based on peat cellulose have mainly been published from Europe and Northern America, but here the authors present novel high resolution data from East Asia and make an ambitious attempt to make a model of East Asian summer Monsoon variability and periodicity based on their record as well as other studies. Climate mechanisms and links between climate systems are also discussed in the paper,

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and a synthesis of conclusions is nicely illustrated in a sketch map (Fig, 6).

The paper is well structured and the authors own contribution contra other publications is clearly described, but the title does not indicate the author's labor for the reconstruction of environmental changes and the use of stable isotopes from a peat archive. Chapter 4 Results is very short and a paragraph about stable carbon isotope results is missing. The tables and figures support the text and are easy to overview, figures are of good quality. The long record presented here for the first time has high potential for climate studies. Still, the authors should discuss the limitations of methods a bit more thoroughly, such as the use of bulk material that may be preferred of practical reasons. Furthermore, the authors assume that accumulation rates are solely a proxy for temperature variation while carbon isotope variation in fig. 4 is regarded to reflect dry/wet shifts exclusively. This point of view needs to be clarified in more convincing way. Besides the Referee #1's comments that I have considered there are additional revisions listed below:

Technical corrections and Specific comments:

2160 Abstract and throughout the entire paper - “peat sediment” is a confusing term, as bog and fen peat is formed in situ (peat deposits are mostly autochthonous, sedentary soils) although the archive may also include sediment from an ancient lake in the bottom of the core (allochthonous, sedimentary soils). There is a need to check the terminology.

2161, line 27 “vascular plants” – are peat samples used in this study only formed by vascular plants? Is it really so that all environments where peat forms (bogs, poor fens - rich fens) encourage growth of vascular plants? Which plants are best preserved and contribute to the accumulation of peat, vascular or non-vascular plants (mosses)?

2162, lines 1-4 “The balance between precipitation and evapotranspiration controls. . .” - it is true that it is a very important factor but the kind and abundance of bog plants also depends on several other circumstances that should be considered (temperature,

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nutrient status, pH, light availability, competitive advantages, etc.).

2163, line 2 – Geographical, remove “y”

2163, line 9 – There is bit abrupt start of the description of vegetation in the study area, what are the plants that grow and die?

2163, line 11 “lower” – than what?

2163, line 12 “more intact” – than what?

2163, line 12-14 – here it is stated that Tashiro Bog is a raised bog by hydrology, the “swamp water” originates from precipitation and the peat layer was not disturbed. Has it been so through the whole peat sequence or is it possible that in earlier stages there has been also ground water input? This could be seen e.g. in changes in stratigraphy and/or plant assemblages. What about other causes for disturbance in peat accumulation, such as hiatuses caused by dry periods/erosion?

2163, line 24 “samples were left at least two months for drying” – why were they dried slowly? Is there not a risk for fungal growth and/or contamination during that time if the sample cubes were uncovered to let samples dry?

2164, lines 9-10 “a mixture consisting of . . .” - only tree species of “different species of C3 plants” are exemplified here. Even though there can be remains of trees in peat, the major constituent of peat in a 880 long sequence ought to be mosses (Bryophytes, non-vascular C3 plants) together with herbs/sedges/shrubs (other vascular C3 plants than trees)? The primary productivity of peatlands is commonly dominated by bryophytes.

2164, lines 10-13 - because (Sphagnum) mosses do not possess stomata, a discussion about different pathways for the mixed bulk samples could be relevant.

2164, lines 20-21 “the smaller the water reservoir surrounding the chloroplast, the lower the  $\delta^{13}\text{C}$  cellulose”. How does this statement match with the one in p. 2162 lines 14-16: “the amount of rainfall is negatively correlated to plant  $\delta^{13}\text{C}$  value; the larger the

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amount of rainfall, the smaller the value”?

2465, lines 1-2 “the standard method is not used for peat sediments but for tree-rings” – the standard method by Green (1963) has been modified slightly in some studies (Daley et al., 2010; Kaislahti Tillman et al., 2010) to suit small moss samples but it is still used.

2165, line 5 “Acid-Alkali-Acid procedure” – are the parameters concentration, temperature and time “respectively” used for both acid and alkali solutions? Which solutions were they? How were reagents removed? Was cellulose homogenized before freeze-drying?

2165, line 14 “the overall precision was estimated” - estimated or calculated?

2165, line 18 “bulk sediment” – once more, do the authors mean bulk peat? If the samples include roots, is there not a risk for too young ages? Why was not any plant macrofossils selected? It could be worth to discuss somewhere the choice of bulk samples for isotope analyses and radiocarbon dates.

2166, lines 8-14 - are the tephra layers used in age models? Without geochemical analysis, tephra layer ages are assumed from radiocarbon dates. Are there any other possible volcanic eruptions during the time span?

2166, line 19 “DBD” – explain! Dry bulk density is mentioned in Fig. 2 but not in the text here.

2166, lines 21-22 “sand and/or mud layers” – what is the possible origin of these layers, wind or water deposited? These sediments may tell something about altered hydrology, precipitation was not the only source of water then? See p. 2163 lines 12-14 comment.

2167, lines 3-8 “peat accumulation fluxes” – is it meant to be carbon accumulation fluxes according to the unit? The flux unit does not match with the given partial units that are used in the calculation.

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2167, lines 8-14 “the influence of atmospheric  $\delta^{13}\text{C}$  variability. . .” – It is of interest that authors have investigated a possible effect of variability to the whole long record since peat started to accumulate in the Tashiro Bog. Could that effect be illustrated in the Fig. 3 showing the heavy stable carbon isotope record? There could be both  $\delta^{13}\text{C}$  and  $\delta^{13}\text{C}'$  records for comparison. From around AD 1850 until today the depletion is about 2‰ adding of differences during the industrial time to recorded values is appropriate (e.g. McCarroll and Loader, *Quaternary Science Reviews* (2004) 23, 771-801; Leuenberger, *Terrestrial Ecology* (2007) 1, 211-233).

2168, line 3-4 “accumulation rates are high only during warm periods” – if there is a dry and warm period, are accumulation rates due to photosynthesis/decay always higher than in cooler and moisture periods? Is the statement valid for all plant communities (vascular and non-vascular plants)? Compare also with p. 2162 lines 1-3 where the authors discuss the importance of moisture conditions.

2170, lines 12-15 – “the influence of an increased relative contribution of Sphagnum species in peat sediments in Hani Bog on peat cellulose  $\delta^{13}\text{C}$  seems to be negligible. . .” – it is difficult to draw conclusions about the relative contribution in Tashiro Bog in comparison with results from Hani Bog, because the authors do not include a macrofossil analysis in their study. According to several other studies (e.g. Loader et al., 2007; Loisel et al., 2009; Moschen et al., 2009) there are differences in isotope values between species and between plant fractions, which also may have different decay rates in peat and therefore risk to bias the bulk peat record.

2176, line 4 “Bond, G., . . . muscheler, R. . . .” change m to a capital letter M.

2182, line 17 “in Pleurozium and Sphagnum” – missing space before “and”.

2191, Fig. 6 - abbreviations should be explained

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