

## ***Interactive comment on “Atmospheric Fe supply has a negligible role in promoting marine productivity in the Glacial North Pacific Ocean” by Francois Burgay et al.***

### **Anonymous Referee #1**

Received and published: 20 August 2020

General Comments: This is a concise paper providing some useful insight into linkages between iron fluxes derived from the NEEM ice core in Greenland with past marine primary production in the north Pacific Ocean. This is a nice contribution to the literature where data is sparse. However, I believe some further clarification is needed in the paper to make the results more easily understandable and convincing to a broader audience. I provide some recommendations for the authors' consideration below.

Specific Comments: L22: Specify what you mean by “our data” .. NEEM ice core? L23: The phrase “marine productivity”.. how is this being defined? What proxies were used? Do you mean marine primary productivity? L25: are you referring to upwelling

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of major nutrients here when you say “absence of upwelling nutrient supply?” L25: “Fe-fertilization” when? During the LGM? L26: “the transition zone of the North Pacific” .. unclear what you mean here.. do you mean the transition zone between and HNLC region and region that is not an HNLC region?

L37: Suggest adding in “Regardless of the source” before the sentence beginning with “The higher atmospheric dust..” L39-40: Can you expand on the implications of the effect you describe on the Earth energy budget? L43-45: Unclear what is meant by “artificial and natural” Fe-fertilization processes. Can you expand? L50 Ref for 8-20 ppmv figure? L51: What do the authors mean by “leachable Fe” ... this can mean different things depending on the fraction of Fe studied or leach used. Ultimately how bioavailable is this leachable Fe – this seems to be the key question. Did the studies cited define leachable Fe in the same way? If not, how are they comparable? L57: Seems to imply the LD site is the central plateau.. is this true? L59: What are possible sources for a homogenous load over the entire continent during the LGM.. can you expand? L65: It would be good define earlier on in the paper (such as here) what you mean by “leachable Fe” and how bioavailable or not this fraction might be?

L87-88: Were the samples filtered prior to analysis? If not, maybe consider adding “total” to the description of leachable Fe. Are you using the 30-day acidification as your definition of leachable Fe? Please state this explicitly. How representative is this of bioavailable fraction (soluble in seawater)? The authors discuss this later in the paper but this is really a central point to their linkages to impact on marine microbial production, so I think the paper’s conclusions could be served by being explicit about the definition of “leachable Fe” and using previous studies to back-up why this leach choice was made. L99: Phrase “Its quantification was performed” is repetitive and unclear what it’s referring to.

L137: I think it’s problematic that the term “leachable Fe” has not be explicitly defined, described, or justified yet.

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L144: Phrase “activation of dust deflation area” is unclear. Provide more detail? L146: Is this paragraph referencing Fig 2 still? L158: Yes, as the authors point out here “the biological relevance of Fe” is the motivation for this study so I think the biological relevance (or not) of these Fe concentrations needs to be made sooner in the paper than it currently is. L161-163: Can you expand on why this is an upper limit (given leaching conditions), why this choice of a leach was made, and what other studies have used a similar leach. Line 164-170: It’s unclear to me what time period you are referring to – the past (when?) or present. Please clarify. Line 171: Are you referring to present day Fe-fertilization experiments? L164-170, 184-186: Is there a lag in time between when the E. Asian dust source influences the N. Pacific HNLC region vs Greenland that needs to be accounted for when considering primary productivity patterns? What about the influence of dust from the Sahara on Greenland? L190: Can you expand on what types of marine production these proxies estimate? L199: Expand on potential mechanisms to increase water stratification during cold period when you might expect a deeper mixed layer L220: When are you referring to when you say the region “was not characterized by stratified waters” L233: Expand on reasons for enhanced water stratification during the coldest periods? L229-240: Are you referencing Fig 2 here? Clarify? L260: I agree – and would just expand and address this a bit earlier as suggested above.

Technical Corrections L85: Two % signs typo L110: State units for C and A in ()’s. Replace “whose” with “with” L120: Add “Coincidentally” before “The recorded average Fe fluxes. . .” L123: Replace sentence starting with “A” with “However,” L160: Would be good to have a reference at the end referencing HNLC region of the North Pacific. In the map I suggest for Fig 1, it would be helpful to clearly show not only the location of all cores (analyzed in this study and used for comparative purposes) but also the location of North Pacific HNLC and transition zone. L164: Replace with “Previous geochemical evidence shows” L173: Replace “is rather” with “maybe” L184: Is “This location” referring to the S-2 sediment core? Unclear. L201: Phrase “determined an increase .. “ is awkwardly phrased. The enhanced Fe supply determined an increase? Con-

sider re-wording. L207: Replace “on seawater” with “on the seawater surface” L228: Clarify what you are referring to when you say “western and eastern sides”. L232: Replace “similar” with “same” L235: Replace “additional effect on they phytoplankton” with “stimulation of phytoplankton production”? L239: Replace “players” with “physical processes”? L257: Replace “This indicates” with “This may indicate”

Figures It would be helpful if the first figure was a map of the different sites where the data was collected and being compared too.

Figure 2: Does the axis on the 3rd panel have a typo .. should it be EDC? Or maybe just be consistent with calling it EPICA Dome C (DC) as you do in text? Can you highlight the time periods you are discussing in text on figure?

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Interactive comment on Clim. Past Discuss., <https://doi.org/10.5194/cp-2020-77>, 2020.

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