

Review of Sottile et al "Eastern Andean environmental and climate synthesis for the last 2000 years BP from terrestrial pollen and charcoal records of Patagonia".

Sottile and colleagues submitted a well-organized manuscript in which they present a compilation of 12 previously-published pollen records from the eastern flank of the Patagonian Andes. Since this manuscript is part of a LOTRED-SA (South America PAGES 2k) special issue, the authors focus on the last 2000 years, and they discuss how the selected records match the general PAGES 2k selection criteria. After a brief presentation of the individual records, they combine them according to latitude, to create two composite precipitation/moisture reconstructions, i.e., one for northeastern Patagonia, and one for southeastern Patagonia. These two composite records are then compared to each other and to existing reconstructions from the western side of the Andes, and interpreted in terms of variations in the strength and latitudinal position of the westerly wind belt.

The manuscript is relatively well written, it follows a clear structure and the text is supported by four mostly useful figures. The present version of the manuscript however suffers from several issues that are summarized below.

Major comments:

- (1) One of the objectives of this manuscript is apparently to improve the chronology of some of the existing pollen records. Although it is mentioned as such in the introduction, this objective is not really addressed anywhere in the manuscript. The only place where I found some (new?) chronological information is in supplementary information S1 and S2, but there is no reference to these sections in the main manuscript (except for S1 in table 1). The authors need to clarify what is really new regarding the chronologies in the main manuscript. Did they obtain new radiocarbon ages? New $^{210}\text{Pb}/^{137}\text{Cs}$ profiles? On how many cores? Which ones? If this is really one of the two main objectives of this manuscript, as stated in the introduction, it needs to be detailed in the main text, particularly in the method and results sections.
- (2) Section 2.1 contains a relatively long paragraph on ENSO variability (mostly copied from Moy et al., 2009 – see below). It is not clear why since the most important mode of variability in the region is SAM/AAO and not ENSO. The authors should focus on introducing (and interpreting their records in terms of) SAM variability. I recommend (re-)reading, for example, Garreaud et al *palaeo3* 2009, Garreaud *j of climate* 2013 and Abram *Nature Climate Change* 2014.
- (3) The authors interpret variations in moisture/precipitation on the eastern flank of the Andes as representing variations in the strength/latitudinal position of the Westerly Wind Belt. As correctly stated in the introduction, however, the eastern side of the Andes is where the correlation between westerly wind speed and precipitation transitions from positive (western Andes) to negative (eastern part of SSA). The relation between precipitation and westerly wind speed at the coring sites is therefore not as straightforward as the authors seem to assume. This should be addressed by (a) showing the location of the pollen records on a U-wind vs precipitation correlation map (e.g., fig 4 of Garreaud et al 2013), and (b) interpreting the pollen records in terms of SWW variability more carefully, i.e., only after having demonstrated that they actually represent SWW variability, i.e., after comparison with records from western Patagonia. In other words, I think the authors should first interpret their records in terms of

variations in precipitation/moisture, then compare them with records from western Patagonia, discuss the similarities and discrepancies, and finally interpret their results in terms of SWW variability. Even if the correlation between u-wind and precipitation at the study sites is currently positive (which still has to be demonstrated), it may not always have been the case in the past (the records are located in a transition zone).

- (4) I miss the scientific rationale behind using records from the eastern slope of the Andes to reconstruct SWW variability (it is much more straightforward to use records from the southwestern Andes). A much more appropriate scientific approach in my opinion would be to use these pollen records to (a) understand how precipitation varied on the eastern flank of the Andes during the last 2k, and (b) assess the origin of these variations (i.e., linked to SWW variability or not?)
- (5) A final but important issue with this manuscript is that it contains some serious examples of plagiarism. Entire sentences are literally copy-pasted from the literature. The two most obvious examples (copied from Moy et al DPER 2009 and from Bertrand et al QSR 2014) are listed below but there are more examples throughout the manuscript (I have probably missed several). This will need to be carefully evaluated by the editor.

Example 1

This manuscript: *"When averaged over the year, an ENSO warm event (positive multivariate ENSO index values) is associated with an overall decrease in the strength of the wind field and a slight reduction in precipitation in western Patagonia (Moy et al., 2009). Northern Patagonia exhibits an overall reduction in summer precipitation and warmer surface air temperature. Of particular relevance is the frequent occurrence of longlived, tropospheric deep anticyclonic anomalies west of the southern tip of South America (below 40° S and centered at 50° S, 100° W) during El Niño years (Rutllant and Fuenzalida, 1991)."*

Moy et al DPER 2009 (i.e., not the Moy et al QSR 2009 paper cited in this article): *"When averaged over the year, an ENSO warm event (positive multivariate ENSO index values) is associated with an overall decrease in the strength of the wind field and a slight reduction in precipitation in western Patagonia. Northern Patagonia exhibits an overall reduction in summer precipitation and warmer surface air temperatures. ... Of particular relevance is the frequent occurrence of long-lived, tropospheric deep anticyclonic anomalies east of the southern tip of South America (centered at 50°S, 100°W) during El Niño years."*

Example 2

This manuscript: *"The mechanism proposed above differs from the seesaw-type redistribution of heat between the hemispheres that was invoked to explain the migration of the SWWB during the last deglaciation (Anderson et al., 2009; Toggweiler, 2009)."*

Bertrand et al QSR 2014: *"The mechanism proposed above differs from the seesaw-type redistribution of heat between the hemispheres that was invoked to explain the migration of the SWWB during the last deglaciation (Anderson et al., 2009; Toggweiler, 2009)."*

A clear evidence that this was simply copy-pasted is that SWWB is not even defined in this manuscript.

Given the issues listed above, I do not recommend publication of this manuscript in Climate of the Past in its present form. I would encourage the authors to thoroughly revise their manuscript, focusing on the major comments listed above, and resubmit a new version to CP. If all the issues listed above are constructively addressed, this manuscript could become a nice contribution to this LOTRED-SA special issue. The revised version will however need to be carefully re-evaluated by the editor.

Also note that I am not a pollen specialist so I would recommend having this manuscript being also reviewed by a palynologist/paleoecologist.

Minor comments/suggestions:

- Title: delete BP
- p 2122
 - line 4: "the Southern South America" (delete "the" and do not capitalize southern)
 - line 6: delete "and" and add "lack of" before adequate
 - line 8: here, northern and southern are not capitalized. This is correct but it should be homogeneously used as such throughout the manuscript. See e.g., line 16 (Northern Patagonia and Southern Patagonia).
 - line 17: site without "s".
 - line 17: "shifts on latitudinal and strength of the SWW" – do you mean changes in the latitudinal position and strength? "Shifts" is generally used for latitudinal changes.
 - lines 23-24: what do you exactly mean by "poleward" SWW and "northward-weaker SWW"? In the main text you mention an expansion of the wind belt but here you seem to consider that the entire wind belt was located in a northward position. Please clarify what you mean.
 - line 24: delete "Little Ice Age" and indicate the age range instead. The existence of the LIA in the Southern Hemisphere is debated so it's best to simply indicate when the shift occurred.
 - line 25: replace "to" with "with" after "synchronous"
 - line 27: Southern Patagonia – see comment above regarding not capitalizing northern and southern
- p 2123
 - line 3: replace "can concluded" with "conclude"
 - line 3: rephrase "that the SWW belt were"
 - line 6: the last 2000 millennia(l) actually correspond to the last 2 Myr! Please correct
 - line 19: add "lack of" before adequate
- p 2124
 - line 6: add "the" before LIA
 - line 12: replace points with point

line 13: southern South America
line 14: replace "in" with "by"
line 15: add "with" before respect
lines 12-17: the entire sentence needs to be rephrased
line 21: at millennial timescales
line 26: replace Patagonia with Patagonian

- p 2125
line 3: bogs (use plural)
lines 9-10: you may want to use (a) and (b), or (i) and (ii) to clearly distinguish your 2 main objectives
line 26: replace "the northeastern and the southern parts of the region are" with "Eastern Patagonia is"
- p 2126
line 12: indicate that the core of the westerlies is currently located at 50-52S (in Patagonia), since this is the rationale behind grouping the pollen records located at 48-52S.
lines 12-21: this is very important. The spatial variations in the correlation between u-wind and precipitation need to be shown on a map in figure 1 (see comments regarding fig 1 below). The values of r at the pollen sites also need to be clearly indicated in the manuscript.
Lines 22-29: this is entirely copy-pasted from Moy et al DPER 2009! In addition, the reference list indicates the Moy et al QSR 2009 paper, although it's apparently the DPER book chapter that was (over-)used.
Line 22 to p 2127 line 7: why do you focus on ENSO? Most recent climatological papers show that the most important mode of climate variability in the region is SAM. See figure 6 of Garreaud et al 2009 for example.
- p 2127
line 9: northern
line 10: add "N-S oriented" before "transitions"
line 11: rephrase "more simple poor species". Also, why do you focus on transitions instead of vegetation zones here?
- p 2129
line 20: peat-bogs: hyphen may not be necessary
- p 2130
line 3: a section on how the chronologies were improved (with reference to the supplementary information if needed) is missing here. It also doesn't make sense that S3 is cited before S1 and S2.
Line 6: replace on with in
Line 11: add "index" after balance
Lines 15-16: a locally weighed scatterplot 0.2 smoothing spline. What is the unit of 0.2?
Line 21: northern and southern

- p 2131
 - Line 4: add a reference to fig 2 after seasonality
 - Lines 12-13: these precipitation values seem overly accurate. At least remove the decimal, and if possible add error range.
- p 2132
 - Why are the southern sites labeled with combinations of letters (eg PAA, PAB etc)? For the northern sites, names were used as labels.
 - Line 8: replace this with these
 - Line 9: replace on with in (before local conditions)
 - Line 10: delete reaching and replace longer with larger
 - Line 16: list the records in parenthesis after “steppe records”
 - Line 24: forest instead of Forest
 - Lines 26 and 28: same comment as above regarding the precision of these precipitation values (this comment also applies to table 1)
- p 2133
 - Lines 6-8: this is essentially copy-pasted from Bertrand et al 2014 (except for “as analogous”, which is incorrect)
 - Line 9: use datasets instead of dataset
 - Line 11: what the pollen index really shows is drier summers, which is in turn interpreted as higher seasonality. This should be clarified here.
 - Line 15: patterns instead of pattern
 - Line 20: same comment as above: wetter summers representing a decrease in precipitation seasonality
- p 2134
 - Line 3: is this really the last 200 yrs? From figure fig 4c I would say the last 80 years maybe? This could then be attributed to anthropogenic activities. Please be more precise.
 - Line 10: this interpretation in terms of SWW variability assumes a significant positive correlation between u-wind and precipitation during the last 2000 years. How valid is this assumption? In my opinion, the records should only be interpreted in terms of SWW variability after comparison with reconstructions from the western Andes, where the correlation is clearly positive. Here you should stick to what the pollen data really show: drier summers
 - Line 13: what do you really mean by “periods of winter like conditions”. This seems poorly adapted from Lamy et al 2010. Wet winters?
 - Line 28: after belt, you should indicate the reasoning behind this interpretation, i.e., because these records are located within the core of the wind belt (which is also why it is important to state the location of the core in the introduction).
 - Lines 28-29: using the modern... again the exact same sentence as on page 2133 (directly copied from the literature). It has nothing to do here.
- p 2135

Line 16: local and regional (not capitalized)
Line 19: what is an intensification pulse?
Line 20: Please correct “values decreases” and replace to with towards?

- p 2136
 - Line 6: it's only after this comparison section that your records should be interpreted in terms of SWW variability, i.e., after you demonstrate that the variations in precipitation on the eastern side of the Andes are similar in timing and direction to what is observed on the western flank
 - Lines 9-12: plagiarism: this is copy-pasted from Bertrand et al 2014
 - Line 16: why is *Nothofagus* in italics but not Poaceae?
- p 2137
 - Line 7: here you should add a statement that the similarities between your records and records from the western side of the Andes suggest that moisture balance in eastern Patagonia during the last 2k also reflects SWW variability.
- p 2138
 - Lines 2-3: what do you really mean by “southward intensified” and “northward weaker”. Please clarify.
 - Lines 15-20: plagiarism – this is integrally copy-pasted from Bertrand et al 2014
- p 2139
 - Lines 1-2: please rephrase “during LIA dominated more intense El Nino like conditions and negative SAM values”
 - Line 3: replace decreased with decrease
 - Line 4: last decades? Above you mentioned the last 200 years? Try to be consistent
 - Line 9: charcoal (not capitalized), and move “from lake and peatbog records” to the beginning of the sentence (i.e., lake and peatbog pollen and charcoal records ...).
 - Line 10: “were successfully used to reconstruct late Holocene ...” was copy-pasted from the conclusions of Bertrand et al 2014
 - Line 15: delete fossil (or move after available) and add “s” to dataset.
 - Line 22: replace “to” with “with”
 - Line 27: conclude instead of concluded
- p 2140
 - Line 6: delete (or rephrase) “supported in strongly calibrated pollen vegetation calibration”
 - Line 8: challenges
 - Line 12: correct “dendrochronological”
 - Lines 13-15: delete last sentence
- Figure 1
 - You may want to show what you call northern and southern Patagonia on fig 1a – it will make the text easier to follow

Maps b and c are nice but the summer and winter maps (in c) are of no use for this manuscript. The best evidence is that they are never referred to in the main text. These maps are also suspiciously similar to fig 1 of Bertrand et al 2014 (with no citation). I recommend deleting the summer and winter maps (only the seasonality map is really useful) and adding a U-wind vs precipitation correlation map instead (similar to fig 4 of Garreaud et al 2013). Also, the legend of the “seasonality” map is incorrect (200 is listed twice).

- Figure 2
How are the records organized? Apparently not from North to South. This needs to be indicated/clarified in the figure caption. Also, the meaning of the brown curves is not indicated (I guess they correspond to charcoal records?). What does the green area between ~1600 and 750 cal yr BP represent?
- Figure 3
Same comments as for figure 2 above
- Figure 4
Replace stalagmita with stalagmite
Why is “westerlies intense-weak”, i.e., the interpretation of the record, indicated for the Yttrium plot (d) but not for the other records? Adding the interpretation of each individual record along the respective plots would help readers follow the interpretation paragraph (e.g., SWW North-South, SWW strong-weak, SWW contraction-expansion, etc).