

Comment on acp-2022-362

Anonymous Referee #2

Referee comment on "How extreme apparitions of the volcanic and anthropogenic south east Asian aerosol plume trigger and sustain: El Niño and Indian Ocean Dipole events, and drought in south eastern Australia. First attribution and mechanism" by Keith Alan Potts, Atmos. Chem. Phys. Discuss., <https://doi.org/10.5194/acp-2022-362-RC2>, 2022

Review of manuscript "How extreme apparitions of the volcanic and anthropogenic south east Asian aerosol plume trigger and sustain: El Nino and Indian Ocean Dipole events' and drought in south eastern Australia. First attribution and mechanism using Global Volcanicm Program, Last Millenium Ensemble, MERRA-2 reanalysis and NASA satellite data.

This manuscript presents an interesting analysis to explore the relationship between the strength of volcanic and anthropogenic aerosol in South East Asia, and the occurrence and magnitude of El Nino and Indian Ocean Dipole events, with a hypothesised associated influence (via these climate variations) on extreme drought events in South Australia.

I must apologise for not being able to complete this review until now (21st August), having originally accepted to review the article on 26th July. When printing out this paper to read, I noticed there was already another reviewer comment submitted on 19th July, and an author response submitted on 26th July, the same day I accepted the review, and I have referred to these reviews whilst completing my review.

I am therefore aware the other reviewer (Anonymous Reviewer 1) has asserted that many statements in the manuscript are overstated, and also that many of the manuscript's results do not have an analysis to support them, in many cases being based on correlations.

Having now read the manuscript, I can state that I agree with the overwhelming majority of the Reviewer 1's comments, in particular that the manuscript, in its current form, is not yet suitable for publication in Atmospheric Chemistry and Physics.

Review 1 identifies a number of Major Comments which require to be addressed, and I am assuming they have stated Major revisions are required, in their summary recommendation.

Whilst I agree with the majority of Reviewer 1's comments, I do not necessarily agree that ESM simulations are required within this manuscript. Exploring correlations between variables hypothesised to potentially have a causal association/relationship is a valid method, and although specific ESM simulations to quantify an effect would ideally form part of a manuscript, within an initial paper that needn't necessarily be the case.

The author correctly states in their reply, that seeking to understand the drivers of observed ENSO and IOD variability is a valid research area, and the manuscript presents a potentially valuable analysis to understand the influence from strong aerosol conditions in SE Asia (both from volcanic and anthropogenic sources).

However, although the manuscript, in exploring these associations, is potentially a valid contribution, and exploring a topic that is suitable for ACP, I agree that in its current form, the manuscript is not yet suitable for publication in ACP.

As reviewer 1 also finds in their review, the main reason is that the manuscript asserts several surprisingly overstated findings, that are not supported by a convincing analysis. I have listed below, in the Major Revisions section, several cases where this is the case.

I also found, when reviewing the manuscript, the text associated with each "stage" of the results to be insufficient, and overall the manuscript seemed to me to be only at a relatively early stage, and not yet "written up" to the required level for submitting to a peer-reviewed journal.

In summary, I concur with the majority of the comments of Reviewer 1, and my recommendation is for reconsideration after a number of major revisions have been carried out.

Major revisions

- 1) Title, line 1 -- the wording "extreme apparitions" seemed a strange and inappropriate wording for the title of Abstract. Although the word apparition can potentially simply be intended to indicate the "appearance", I have never seen the word used in atmospheric science, and the word tends only to be used in association with ghost-like visions or apparent sightings.

Also, the 2nd half of the title is simply a list of datasets, that do not need to be stated explicitly within the title.

Re: the first part of the title, my specific suggestion is to change "How extreme apparitions of the volcanic and anthropogenic south east Asian aerosol plume..." instead to "An analysis of the relationship between strong volcanic and/or anthropogenic aerosol conditions in South East Asia and modes of inter-annual climate variability in the tropical Pacific and Indian oceans" or similar.

Re: the 2nd part of the title, my suggestion is to delete the metrics, and mention only the impacts on drought conditions in South Australia", perhaps continuing the above sentence via the text "and associated drought conditions in South Australia" or similar.

2) Summary, line 14 -- the author states that "El Nino events ... are and always have been caused by volcanic aerosols in south east Asia". Whilst strong volcanic aerosol events may well influence the magnitude and progression of the El Nino Southern Oscillation (ENSO), stating ENSO is entirely caused by volcanic aerosols is clearly much too strong a statement, and not supported either by this manuscript's findings or any other study.

Whilst the apparently minor revision to change "caused by" to "influenced by" would validate this particular sentence, with this being one of the study's central stated findings, this is a major revision needed, and to change the tenor of the manuscript's Abstract and section 1 text, where this unsubstantiated statement is repeated.

3) Abstract, lines 22-25 -- As explained in the preceding comment (re: Summary, line 14), it is incorrect to state volcanic aerosols are the cause of ENSO events. This initial sentence of the Abstract therefore needs to be changed.

As with Major Revision 2), although there is a minor re-wording that will achieve the change required, since this is a repeated statement in several parts of the text, and since it relates to the manuscript's central hypothesis, although the remedy requires only a minor re-wording, this change does constitute a major revision.

The minor re-wording I suggest is to reduce the strength of the sentence from "have always been the trigger and sustaining cause of: El Nino/Southern Oscillation (ENSO) events..." instead to "are known to influence the strength and progression of El Nino Southern Oscillation (ENSO) events."

The change is needed because the wording "the trigger and sustaining cause" implies the volcanic events are the sole cause of the ENSO events, which is not the case. The re-wording also corrects the strange and incorrect placement of the colon punctuation ":" after "cause of", and also to delete the forward-slash symbol "/" from between "Nino" and "Southern", because the words "El Nino" are the name and shorthand for the overall mode of climate variability denoted by ENSO.

When written in long-hand, the term needs to be written "El Nino Southern Oscillation" not "El Nino/Southern Oscillation".

The 2nd half of the current 1st sentences of the Abstract continues on lines 24 and 25, but this re-wording also involves adding a full-stop terminating the 1st sentence after the word "events". The 2nd part of the re-wording then involves explaining about the dominant mode of variability within a new 2nd sentence, rather than the current wording that states this within an over-long and incorrectly punctuated 1st sentence of the Abstract that continues across the lines 22 to 25.

The suggested re-wording of the 2nd half of that sentence is to

"It is well-established that ENSO events have a strong influence on global climate extremes, with for example with strong associations with drought occurrences in Australia, India and Indonesia, and flooding events in North America."

Similarly, I strongly suggest also re-wording the last part of the current sentence (re: Indian Ocean Dipole events) similarly as a short 3rd explanatory sentence here.

A suggested text is:

"The Indian Ocean Dipole is also an influential mode of climate variability, affecting climate extremes in the region, and itself is modulated by the strength of ENSO."

(This is a suggested wording which seems consistent with the intention of the original text.)

4) Abstract line 25 -- please change "this natural plume" as the preceding text in the Abstract has not introduced any plume. I am wondering if maybe the handling Topical Editor requested to edit a different wording such as the "South East Asian aerosol Plume" used later in the manuscript, to instead be worded "Volcanic aerosols over south east

Asia".

This 4th Major Comment relates to the use throughout the manuscript of the acronym "SEAP" for South East Asian Aerosol Plume. When preparing the manuscript for re-submission, the authors need to avoid the SEAP acronym because it seems to be used as though it is an established acronym such as AOD or ENSO, when this manuscript is the first time I have seen this acronym used in the 25-year academic professional career and 20 years of reviewing papers in peer-reviewed journals.

Much better to simply state "volcanic aerosol in South East Asia" or "anthropogenic aerosol in South East Asia", with the extent of any particular regional aerosol plume not well defined, in relation a gradual dispersion and dilution from its localised source.

It is fine to give an acronym to a particular region, and define a particular geographical area as "the SEAP region" (as is done on line 73 of the submitted manuscript text). But this acronym should be restricted only to when referring to that particular region, and for the scientific discussion the words should be used within abbreviation, unless a very well established acronym such as AOD or ENSO.

Please change all other instances of SEAP instead to provide words that refer to "the volcanic aerosol in South-East Asia" or "anthropogenic aerosol in South-East Asia" or in some cases "the combined volcanic/anthropogenic aerosol haze in South-East Asia" or similar.

Once the South-East Asia region is established, the term "regional aerosol haze" should then be used for the remainder of the manuscript.

In this particular sentence of the Abstract, suggest to change:

"In recent decades this natural plume has been augmented by an anthropogenic plume which has intensified ENSO...."

instead to

"Since the latter decades of the 20th century, this natural aerosol influence on ENSO has been accompanied also by anthropogenic aerosol, which has led to a strengthening of the aerosol haze's modulating effect on ENSO".

Or something like this.

And then I suggest that this 2nd half of this sentence, in referring to the time-of-year when the anthropogenic aerosol influence is strongest, should be explained in an extra separate sentence after the above statement, with the full sentence providing enough space to also mention the reason for this strong seasonal effect, in relation to the South-East Asian monsoon, for example as explained in lines 109-110 of the submitted manuscript.

There is definitely the potential for the submitted manuscript to become suitable for publication, but currently there is too much change needed to achieve the level required.

To me it feels like the author has submitted the manuscript while it is only half-finished.

5) Abstract, line 27 -- the wording "to create ENSO events" is not appropriate, because ENSO events are clearly generated within unforced pre-industrial control in climate models.

It is certainly true that the regional aerosol haze will affect the strength and progression of the ENSO effect, but it is incorrect to state that volcanic or anthropogenic aerosol "triggers" or "creates" ENSO events.

6) Abstract lines 27-29 -- Again, the wording of the manuscript incorrectly states that ENSO events are caused by SE Asian aerosol. That is simply false, although it is correct to say that the SE Asian aerosol haze modulates the strength and phase of ENSO.

Also, rather than "I show that the.." (or "We show that the...") better to re-word the sentence to be clear it is the manuscript that the Abstract is explaining shows a particular effect.

Delete "under the plume", that meaning is abundantly clear from the preceding words "reducing surface radiation which cools the surface".

7) Abstract, line 31 -- I'm making a specific suggestion to re-word this latter sentence of the Abstract to explicitly state the central aim of the study.

I mean I suggest to re-word "This further weakens/reverses the Walker circulation..." instead to "The central aim of this study is to explain the mechanism by which the SE Asian aerosol haze modulates the ENSO, and demonstrate its effect is consistent with observed correlations between the corresponding observable metrics."

The Abstract needs a sentence such as this to spell out what is novel about the study, thereby also strengthening the science it is seeking to communicate to the reader.

8) Introduction, lines 46-69 -- the Introduction next is insufficient and the 1-line paras with bold-face first words, and the 10-point itemized lists, are not appropriate for an ACP article.

In addition to the above major changes to the manuscript's narrative in the Summary and Abstract, the authors also need to change the main text sections as well.

The manuscript presents results that follow a sequence of steps, that sets out the mechanism that I believe can then provide the central aim of the study (when it is then re-worded for re-submission), in demonstrating how each of these steps are evident within correlations of observed aerosol/ocean/climate metrics and indices.

However, although I understand that these steps are therefore important to be explained to the reader, the structuring of the section 1 text is not appropriate for an Introduction section within an ACP article.

The first paragraph is OK, but having strange 1-sentence paragraphs of text with the first word shown in bold-face is inconsistent with the required format for an ACP article. Similarly, whilst itemized lists can be helpful in a Summary or Conclusions, and are certainly appropriate within methods section or introducing model simulations or observational datasets, are also not appropriate within an ACP article's Introduction.

Please re-structure the text there into coherent paragraphs of text that introduce the basis of these terms within the published literature and if this sequence of steps needs to be introduced, do so within a section 2 rather than the Introduction section 1.

The Introduction can hint at these steps, but should not introduce them explicitly until section 2 or 3, after a broader context and related preceding relevant literature is set out.

9) Introduction lines 70 to 83 -- These definitions of the specific areas are out-of-place in

the Introduction, and need to be moved instead to a new Methods section 3.

This 9th and the next 6 Major Revisions (10th to 15th) explain that much of the current text within the Introduction needs to be set out within a different section of the manuscript.

The current section 1.1 "Areas used" (lines 70-83) I am specifically suggesting, within this becomes a sub-section 3.1 of a new section 3, the current section 3 results section instead becoming section 4.

10) Introduction, lines 84 to 118 -- These definitions of the specific areas are out-of-place in the Introduction, and need to be moved instead to a new section 2 that explains the ENSO, IOD and Walker circulation aspects, to the depth required for the article.

Similarly to comment 9), here I am also specifically suggesting the current sections 1.2, 1.3 and 1.4 become sub-sections of a new section 2, which introduces the specific aspects of ENSO, and the other modes of climate variability or associated circulations, to provide the reader with the background knowledge they need to understand the results (then to be presented in section 4).

Specifically, I'm suggesting section 1.2 becomes instead section 2.1, with the subsections 1.2.1 and 1.2.2 then becoming subsections 2.1.1 and 2.1.2.

The Introduction should give the breadth of introduction without going too much into detail, but the section 2 can then provide this detail after the more general introduction in section 1.

11) Introduction, lines 119 to 191 -- Move sub-sections 1.2.3, 1.2.4 and 1.2.5 also to section 3.

I think the current sections 1.2.3, 1.2.4 and 1.2.5 seem to be explaining some specific metrics associated with the methods used in the results section.

I'm suggesting then these 1.2.3, 1.2.4 and 1.2.5 become sub-sections of the new methods section 3, following after the section 3.1 definition of the areas. Specifically, I'm suggesting these 1.2.3, 1.2.4 and 1.2.5 instead becoming subsections 3.2, 3.3 and 3.4.

This re-structuring of the article will be much better for section 2 to continue from the basic ENSO sections also to similarly have some depth of explanation of the Indian dipole and the Walker circulation (see the next Major Comment 12) with section 2 then retaining the modest-depth of explanation without straying into too-deep an explanation of the methods (reserving that for section 3).

12) Introduction, lines 192 to 220 -- Similarly, re-structure sub-sections 1.3 and 1.4 to 2.3 and 2.4

As indicated above, in Major Comment 11, this moderate-depth explanation of the Walker Circulation (section 1.3) and the Indian Ocean Dipole's relationship to ENSO (section 1.4) should be the latter part of this new section 2, this then explaining the specifics required to understand the science behind the methods and results sections 3 and 4.

13) Introduction, lines 221 to 263 -- Similarly, re-structure sub-sections 1.5 and 1.6 to 2.5 and 2.6,

14) Current methods section, line 266 onwards -- Change the current "Method and Data" sections 2.1 and 2.2 instead to be sections 3.5 and 3.6

15) Results section, line 358 onwards -- Change the current "RESULTS" section 3, and the associated sub-sections 3.1, 3.2, 3.3 and 3.4 to instead be sub-sections 4.1, 4.2, 4.3 and 4.4.

16) Results section, line 358 onwards -- these results sub-sections need to explain the results shown in the corresponding Figures, but currently the text is much too brief and does not sufficiently explain the results to the reader.

Minor revisions

1) Summary, line 15 -- change "Recently, " to "Since the latter decades of the 20th century" or similar, to be clear what is meant here. The Abstract (line 25) has similar sentence, stating "In recent decades" rather than "Recently" and whilst it is clear this multi-decadal timescale was the intention in this summary, "recent decades" might be inferred to mean only

2) Section 1.2, lines 89-90 -- and section 1.2.1 line 97

The author has not understood the use of the keywords /cite and /citet within LaTeX. If the author is more familiar with Microsoft Word, he could consider potentially using the Word template rather than the LaTeX template, and transition the text across to Word.

lines 89-90 -- This long list of citations have a mish-mash of citation styles. If they all need to be cited in this way, they should all be within parentheses, separated by semi-colons, i.e. "(Enfield, 1989; McPhaden et al., 1998; Brown and Fedorov, 2010; Cai et al., 2015; Wang and An, 2002)." This is best achieved using square brackets and reference-labels in the .bib file.

line 97 -- The sentence currently says "Since (Bjerknes, 1969) first described...."

but this needs to instead be worded as "Since Bjerknes (1969) first described.....",

and then the /cite is the correct keyword here, whereas the author seems to have used /citet.

Alternatively please ensure the citation is correct here in the LaTeX style file.

3) Section 1.2.1, line 103 -- change "with this paper which shows the atmospheric transients..." because although correlations are shown that are consistent with this, the word "shows" is too strong.

Please change "shows" instead to "analyses" and delete the word "are" before "created by". Also delete "of course," -- it is unscientific language, and the sentence stands OK without that.

4) Section 1.2.1, line 109 -- change "This paper demonstrates that the" instead to "This paper explores, via correlation between key metrics, the"

There will likely also be other sentences that need similarly to be re-phrased to be stating that the paper "will analyse the co-variation of several key metrics to explore....: or similar rather than having the text state with certainty that the effect will be shown.