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Interactive comment on "Imprint of external climate forcing on coastal upwelling in past and future climate" *by* N. Tim et al.

Anonymous Referee #3

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[a4paper,10pt]article [utf8]inputenc amsmath

General Comments

As a phD student, coming from a related field in oceanography, this is my first review. This makes it difficult to evaluate the significance of the paper in comparison to other works. But I hope that my comments might still be helpful.

It is general praxis in climate science to try to find certain changes of external parameters to explain changes in the climate system. This paper uses the upwelling index to

quantify the impact of a bunch of parameters on 4 local upwelling systems and compares these to the effect of natural variability in the system aka changing the initial conditions in a coupled global circulation model. It concludes that the atmospheric forcing has no statistically significant effect on the upwelling systems.
It is interesting to look specifically at upwelling systems because global models still tend to behave rather poorly in these areas, compared to observed data. But doing such an ensemble analysis with 3 members for one forcing is, even though right now state of the art, just not enough to conclude anything substantial. Nevertheless this paper explains its idea very well and is overall quite enjoyable to read. If the author can give some answer to the below questions it is valuable due to the idea of using the upwelling index for testing the effectiveness of Bakuns hypothesis in an ensemble setting. And I would therefore recommend a major revision.

Specific Comments

As far as I can see it, the main methode hinges on splitting up a certain solution quantity in a part caused by initial conditions and a part caused by the forcing (eq.(1),(2)). The underlying assumption beeing that the part of forcing for a certain quantity doesn't change when only the initial conditions are changed. And that the time scale of the internal variability of the system is much smaller than the variability due to forcing. Making it possible to set variance terms of the form $\left(y^i, y^f\right)$ to zero. Is this really the case here? In particular regarding the upwelling index. On what time scales does the forcing change? Maybe some kind of plot showing the overall forcing and not just the radiative one would be good.
On another note.These two equations are never mentioned later on. Even though it is clear after a second read through, what was calculated with them. The paper might benefit from mentioning these quantities just after the equations thus removing any possible confusion later on.

OSD
12, C1377–C1379, 2016

Other stuff:
Could you elaborate more on the setting of the initial conditions. What was randomly changed?
2904 line 24: As there seem to be other definitions of the upwelling index, could you please write out the formula for yours.
2903 line 14 The width of the probability distribution (volcanic ash) is mentioned. How big were the differences between the models?
2903 line 10: Information in what order the simulations were started is not really useful.
2909 line 15: ' areas most closely correlated': So the area, where the upwelling index was calculated differs from the area, where the SLP gradient was calculated (ocean)? Why would one do that?
2922: Figure 1 really doesn't tell me much. Except that that these kind of rcp scenarios exist.

Technical Corrections

There are a couple of small things. I couldn't find information about the physics of the CESM-CAM5 version. In particular the ocean model. A reference in the text, when mentioned first, would help very much.
2905 line 8: no 'the' in 'the initial conditions'
2909 line 2: found instead of find
2919 line 9: 'to be kept in' instead of 'to kept in'

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12, C1377–C1379, 2016