**Earth System
Dynamics**
Discussions

Interactive comment on "Impact of the Atlantic Multidecadal Oscillation (AMO) on deriving anthropogenic warming rates from the instrumental temperature record" *by* G. R. van der Werf and A. J. Dolman

Anonymous Referee #2

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Review of

Impact of the Atlantic Multidecadal Oscillation (AMO) on deriving anthropogenic warming rates from the instrumental temperature record

from G. R. van der Werf and A. J. Dolman

The authors investigate the sensitivity of estimating recent warming trends by regression techniques on the definition of the Atlantic Multidecadal Oscillation Given the large discrepancy between the published studies regarding the influence of the anthro-

pogenic warming, I welcome this contribution and suggest that it should be published in ESD after incooperating the revisions noted below.

I had some troubles understanding the method and results:

In 533:L20, the authors find that the regression coefficients for the anthropogenic factor varied little and conclude that the role of the anthropogenic forcing is robust between the MLR's. If the forcing dataset and the linear model would be good (and the authors suggest this by estimating the transient climate sensitivity this way) an estimate of the anthropogenic temperature trend of any time-period could be derived by multiplying the forcing with the regression coefficient and calculating the trend on this time-series (lets call this estimate A).

On the other hand, the main conclusion of the study is that the "anthropogenic temperature trend" of the last decades is strongly sensitive on the MLR (e.g. Fig. 2i). This is in a first sight counterintuitive; why does the role of the anthropogenic forcing not determine the anthropogenic temperature trend.

My confusion might come from the fact that I could not find a definition of the "anthropogenic temperature trend" in the methods. From reading the other papers I guess that the authors "anthropogenic temperature trend" (lets call this estimate B) is defined as using the observed temperature time-series, removing everything natural and anthropogenic) and adding back in the anthropogenic parts.

If this is right, the difference between both estimates of the "anthropogenic temperature trend" (A and B) equals the trend in the residuals of the full regression. It follows that if all regression coefficients (except the AMO one) do not depend on the AMO definition and if the AMO definitions have a similar trend in the time period analyzed, that the trend estimate B will by definition be linearly related to the regression coefficient of the AMO.

What is unclear to me and what could be clarified is whether estimate A or B are better

estimates of the anthropogenic trend. At least the trend for the past 30 years estimated from the anthropogenic forcing times the regression coefficient should be presented and discussed.

Detailed comments:

Introduction:

A complementary way of estimating the transient climate response are attribution studies which use the temporal structure as well as the spatial pattern of the response to the forcing. e.g. Stott, Peter A., John FB Mitchell, Myles R. Allen, Thomas L. Delworth, Jonathan M. Gregory, Gerald A. Meehl, und Benjamin D. Santer. "Observational constraints on past attributable warming and predictions of future global warming". Journal of Climate 19, Nr. 13 (2006): 3055–69. They are likely more robust as they use more information. I propose to add at least a reference to these techniques in the introduction.

Data and methods:

-The method description should be more precise to be understandable and replicable. Is the regression done on an annual basis? I guess no time-lags are allowed (e.g. Foster and Rahmstorf use monthly data and allow for a timelag); what is the noise model (e.g. Zhou et al., use an AR-p process).

-Please define what the "anthropogenic temperature trend" is (see my comment in the beginning)

-It could be formulated clearer in the method section that the regression is always done on the 1900-2011 period but different time-periods are analyzed for the "anthropogenic temperature trend".

- Why are the regression coefficients unitless? The anthropogenic forcing,solar and volcanic forcing in the GISS dataset is in W/m2, the temperature in degree celcius.

532:L25: Unclear; You also run 5 sets with a linear trend; thus this is no key difference to your study.

533:L14 Unclear sentence: Do you want to say that you ignored the covariations?

535:L14 the greenhouse gas forcing is well known but the aerosol forcing and the translation from the emissions to the forcing are not.

536:L15: Doesn't that assume that the AMO as defined in the different methods is a purely natural mode?

537:L23: This is too speculative and I would propose to weaken or remove it. 1.) The AMO is not a purely periodic and thus predictable phenomena 2.) the warming rate if proportional to the forcing rate is not constant.

Figures

-It would be useful for the reader if the explanatory variables (including their units) would be shown in a figure.

-Figure 2: Unclear what dotted black line in the caption refers to? To the dashed line in panel i? One could add here the estimates from multiplying the forcing times the regression coefficient.

Interactive comment on Earth Syst. Dynam. Discuss., 5, 529, 2014.