Second review of the paper: “Influence of ENSO on entry stratospheric water vapor…” written by Chaim I Garfinkel et al.

General: The paper improved. However there is still one important point which needs clarification. See below.

Major points

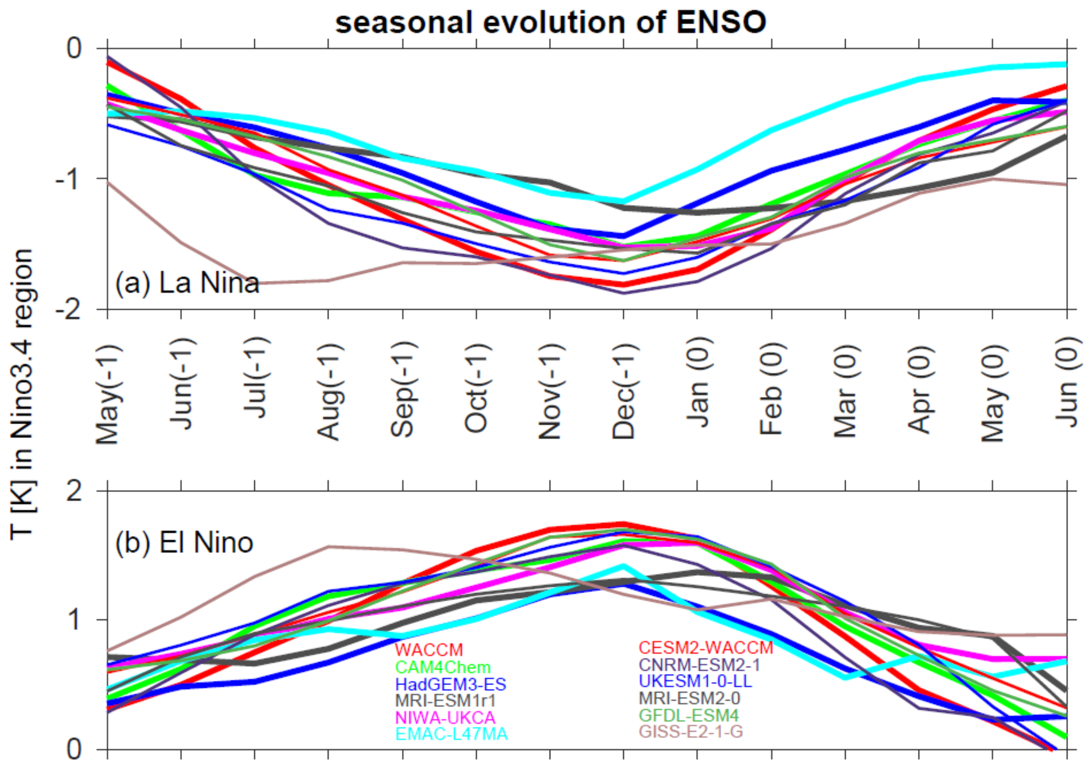
You write in your abstract: “the only aspect of the entry water vapor response with consensus is that La Nina leads to moistening in winter relative to neutral ENSO”. What you see is only a positive correlation between the moistening at 82 hPa and the La Nina index at the surface! You should take into account that the propagation of the La Nina signal (e.g. from the main convective outflow around 200 hPa) to the lower stratosphere around 80 hPa needs time of the order of few months (tape-recorder). Typically, this time is between 3 and 5 months so your interpretation that the enhanced water vapor in the lower stratosphere at the begin of the boreal winter is caused by La Nina is not correct. This error repeats many times in your paper, especially in relation to your non-linear correlation between the ENSO index and water vapor in the lower stratosphere. The correlation itself does not explain the formation of this relation!

We certainly are aware that transport to 80hPa is not immediate, and we apologize if we were not sufficiently clear and implied otherwise. Note however that the characteristic timescale of ENSO is much slower than this transport timescale. ENSO events typically develop in the preceding early fall and peak in early winter, such that La Nina conditions are present well before the January/February signal we are ascribing to La Nina. Hence the statement in the abstract, and similar statements elsewhere in the text, are actually correct.

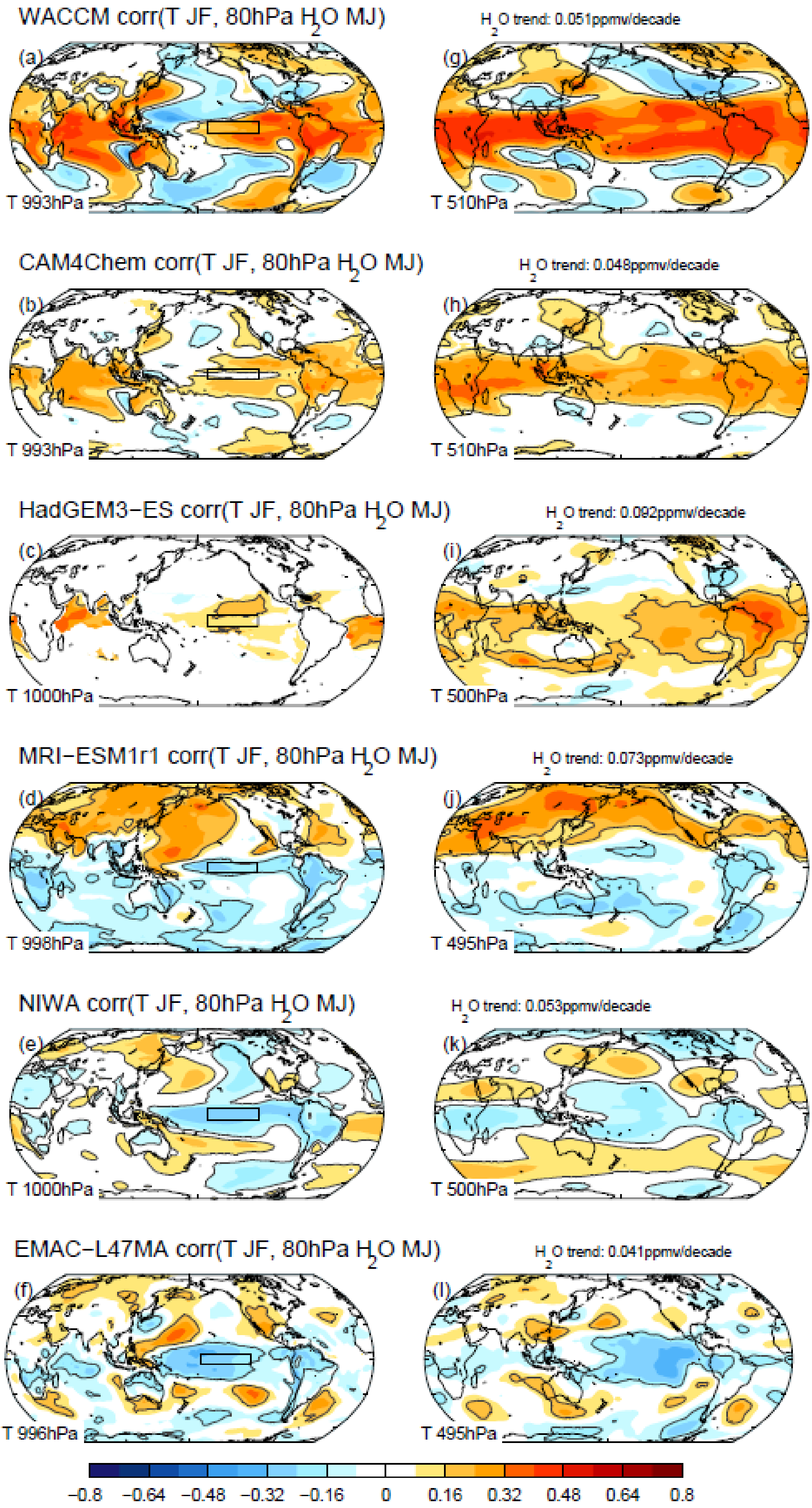
However we realize this was confusing, and we have therefore added to the methods section:

“A typical ENSO event slowly strengthens in the summer and fall, reaches its maximum strength in late fall or early winter, and then decays in the spring (Figure 1 of Wang and Fiedler, 2006). This evolution is captured in the models (Supplemental Figure 1). While the influence of ENSO on tropospheric temperatures is rapid due to convection, there is a few month lag in transport from the level with peak convective outflow to the cold point (Mote et al., 1996; Fueglistaler et al., 2004). However the sea surface temperature anomalies due to ENSO are already established by fall, and hence all of the anomalies shown here can be associated with ENSO”

This new figure is included in the supplement.



The reviewer asks about a correlation between an ENSO index and entry water vapor, but we aren't sure what figure the reviewer is referring to as we don't show any correlations between the ENSO index and water vapor in the lower stratosphere anywhere in this paper. Our guess is that the reviewer was referring to figure 4, which showed the correlation between near surface temperature and temperature at 500hPa with entry water near 80hPa. (This is the only figure based on correlations anywhere in our paper.) We used a two month lag for this figure, and it is reasonable for the reviewer to ask whether a 4 month lag is more appropriate. To that end, we show below the same figure but using a 4 month lag, that is, January and February temperature with May and June entry water. Results are the same for five of six models, and this one exception has no impact on our overall points: instead of 4 models showing one signal vs. 2 showing a different one, now 3 models show one signal and 3 show a different one. This new figure is included in the supplement


WACCM corr(T JF, 80hPa H2O MJ)
H2O trend: 0.051ppmv/decade
(a)
T 993hPa
(g)
T 510hPa
CAM4Chem corr(T JF, 80hPa H2O MJ)
H2O trend: 0.048ppmv/decade
(b)
T 993hPa
(h)
T 510hPa
HadGEM3−ES corr(T JF, 80hPa H2O MJ)
H2O trend: 0.092ppmv/decade
(c)
T 1000hPa
(i)
T 500hPa
MRI−ESM1r1 corr(T JF, 80hPa H2O MJ)
H2O trend: 0.073ppmv/decade
(d)
T 998hPa
(j)
T 495hPa
NIWA corr(T JF, 80hPa H2O MJ)
H2O trend: 0.053ppmv/decade
(e)
T 1000hPa
(k)
T 500hPa
EMAC−L47MA corr(T JF, 80hPa H2O MJ)
H2O trend: 0.041ppmv/decade
(f)
T 996hPa
(l)
T 495hPa
−0.8 −0.64 −0.48 −0.32 −0.16 0 0.16 0.32 0.48 0.64 0.8