Dear William,

technical correction to “Comparative study between ground-based observations and NAVGEM-HA analysis data in the MLT region”

In your decision statement you raised a new concern about the terminology that is used in the manuscript. The suggestion was to replace holographic analysis by hodogram or hodographic.

When the manuscript was written, we searched in the literature to find an appropriate terminology of what is done. A simple look to Wikipedia provides already a short summary on the terms hologram and hodograph and its main features.

The definition of a hologram that is currently available in Englich Wiki shows the classical laser hologram. However, a hologram is mathematically a superposition of a coherent wave with an imaging wave that is diffracted or interfered with an object. Storing the information of the phase differences into an image matrix allows to reconstruct the 3D structure of that object from this 2D image. This can be done in transmission, reflection as phase-only or mixed type of holograms.

Our reference wave is the excitation of tides at the troposphere/stratosphere with the solar orbit precision. This excitation is highly coherent. Atmospheric tides then propagate vertically through the atmosphere. The meteor radar just takes picture of the transmitted wave field, or the through the atmosphere transmitted tide. All interactions with the mean wind, planetary waves, gravity causes lead to small changes of the phase and amplitude. Thus, we infer these tiny changes in phase of the coherently excited wave by the holographic analysis. Mathematically, this is done as outlined in the manuscript. We truncated the Taylor expansion already after the first term, however, if we include the second order term, we obtain the Fresnel transform or 1D-holography introduced by Elford (2004).

A hodogram or hodograph is essentially different in that respect as the phase plays a minor role. It is the vector length (magnitude) that is added and there is a clear dependency from the starting point. A hodograph is basically a dead reckoning navigation or ray-tracing of information. In this case our analysis would dependent on the starting point. So the hodograph just containing the January and February would look different from the one that started in December. This sensitivity of the hodograph analysis is well-know from gravity wave analysis. It can be very challenging to derive the gravity wave properties from a hodograph analysis, as small changes in the starting point already lead to quite some changes in the final result. This is not the case in our analysis. The results do not depend on whether we just look at the January or at the complete winter season.

$x(i+1)=x(i)+f'(x)$

Further, the holographic analysis is phase only and does not depend on the amplitude of the tidal wave.

Thus, we suggest keeping the terminology as it is. However, we added some sentence to the paragraph to point out that we used a more abstract definition of the holography. The added sentence is labelled in bold. The text basically explain of what we wrote in this report.

In the following, we investigate the phase variability of the semidiurnal tide introducing a holographic analysis for the SSW 2012/13 and discuss a potential connection to the Pekeris resonance \citep{Zhang_Forbes_2014_lunar_tide_Pekeris}. **Similar to other holographic analysis, we use the phase differences between a coherent reference wave and the observed wave field to infer small deviations in frequency that are not resolvable by standard Fourier techniques.** The day-to-day variability, obtained from the ASF, indicates that the tidal phase are not stable with time and show significant interday variability, which appears to be related to changes in the zonal wind in the middle atmosphere driven by the polar vortex and planetary waves. Considering that a time dependent phase corresponds to a frequency shift, it is possible to convert this temporal phase variability into a period change and, hence, to estimate the spectral line shape of the tide or to derive a holographic representation of the temporal evolution on a day to day basis.

Please let us know, whether these explanations are satisfying the concerns that were raised.

Best regards,

Gunter