

Biogeosciences Discuss., referee comment RC1
<https://doi.org/10.5194/bg-2021-348-RC1>, 2022
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Comment on bg-2021-348

Anonymous Referee #1

Referee comment on "A convolutional neural network for spatial downscaling of satellite-based solar-induced chlorophyll fluorescence (SIFnet)" by Johannes Gensheimer et al., Biogeosciences Discuss., <https://doi.org/10.5194/bg-2021-348-RC1>, 2022

The manuscript "A Convolutional Neural Network for Spatial Downscaling of Satellite-Based Solar-Induced Chlorophyll Fluorescence (SIFnet)" describes a new, downscaled SIF data set based on TROPOMI data. The downscaling is done with a Convolution Neural Network utilising a large number of variables in its feature space, including the coarse resolution SIF data itself. I am broadly familiar with the Machine Learning techniques in this paper, but I am certainly not an expert, so there could be issues that I am unaware of. However, to the extent of my knowledge everything appears to be rigorously constructed. Overall, the manuscript is well written and I only have some relatively minor comments.

Minor comments and typos:

Paragraph starting L40 - I am not in complete agreement that making the spatial resolution of an instrument finer is the same thing as "improving" it. I appreciate many applications do benefit from finer resolutions than that of OCO2 SIF, but some applications benefit from coarse spatial resolutions (and there can be instrumental advantages to this too). I also note that the spatial sampling of the two instruments is overlooked here, and that is arguably an even bigger challenge for integrating OCO SIF into ecological measurements.

At several points the phrase "ground truth" is used, but I think this is misleading as there is no actual "ground truth" in this paper. For example on Line 135, I would use the phrase "target variable" rather than ground truth.

L36 the Sellers reference here should come after the statement about VIs representing photosynthetic capacity, not at the end of the sentence. (Because that paper doesn't mention SIF).

L44 improves->improved

L67 trains -> trained

L67 CNN, should be defined here as it's the first usage in the main text.

L68 uses -> used

L107 photosynthetic -> photosynthetically

L111 "channel" is the wrong word here. Maybe "band"?

L128 the information about PCA presented here is repeated further down. I suggest deleting it here.

L136 being -> begin

L136 used -> used it

L147 repeats information about PCA. It is probably better HERE.

L165 During training -> During training,

Eqn 5 The MSE part needs a square (or it is just mean error, not mean squared error) and the DSSIM part has unbalanced parentheses.

L199 did yielded -> yielded

L224 "found SIF to perform poorly in the western US drylands" - I think some context is needed to make the meaning clear - how did SIF perform poorly? As a proxy for GPP? Or was the SNR bad?

Eqn 6 - presumably the τ on the top of the fraction should not have a superscript "s" i.e. $SZA(\tau, x, y)$, because the intention is to integrate across the day?

L271 L_1 is written differently in the main text and the figure caption. They should be consistent (but either is OK in my view).

L278 notbale -> notable

L320 I suggest deleting the two sentences about urban areas here. The first sentence appears to contradict what was written in the previous paragraph. If the points about GPP are something the authors want to retain, they could be moved up into the earlier paragraph.