

## ***Interactive comment on “Lake surface water temperatures of European Alpine lakes (1989–2013) based on the Advanced Very High Resolution Radiometer (AVHRR) 1 km data set” by M. Riffler and S. Wunderle***

**Anonymous Referee #2**

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Lake surface water temperatures of European Alpine lakes (1989-2013) based on the Advanced Very High Resolution Radiometer (AVHRR) 1-km data set M. Riffler and S. Wunderle

General Comments:

This article presents a new Lake Surface Water Temperature (LSWT) retrieval system using AVHRR data from 1989 to 2013 for all major European alpine lakes, including validation with in situ data.

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The article is well presented and organized and will provide a significant contribution to the field of lake surface water temperature research once the following issues have been adequately addressed:

1) The climate justification of including smaller lakes (section 2.1) in a relatively small geographic region is not well supported. The authors need to explain how they think including more lakes will give a more stable or accurate climate trend, especially given the potential uncertainties that could arise due to pixel contamination from land effects (e.g. straylight) in small lakes with medium resolution imagery (~1km). 2) The validation results and approach are questionable considering that much of the in situ data was not provided coincidentally with the satellite overpass and also on lake shorelines that were not spatially representative of the satellite pixel. The other concern is the issue of thermal signal from land pixels ‘bleeding’ into lake water pixels for the smaller lakes. Although visible data thresholds are used to account for this, the effects of thermal infrared straylight are quite complex, and I don’t think can be completely and confidently mitigated, especially during daytime observations. I think what’s needed in the paper is a more thorough discussion of all uncertainties involved (and their estimates) with the validation effort, and possibly better ways of reducing the uncertainties. For example, a more consistent and reliable validation method would be to use the Radiance-based method (e.g. see work done by Wan et al.). 3) The authors should provide more detail on the skin effect formulation used, uncertainties involved with its application to lake data, and consider applying a more representative formulation for lakes in the future. e.g. see recent work done by: Wilson, R. C., S. J. Hook, P. Schneider, and S. G. Schladow (2013), Skin and bulk temperature difference at Lake Tahoe: A case study on lake skin effect, *J. Geophys. Res. Atmos.*, 118(18), doi:10.1002/jgrd.50786.

Specific Comments:

p314, L16-20. What emissivity information was used in the simulations? p314, L29: What time of year were the 180 days represented of? p315, L6: The parameterization for this equation should at least be shown. Also ‘mostly reduces’ is a vague statement.

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The effect should be quantitatively stated or shown in a plot. p316, L25: I would not consider this a pure validation due to the uncertainties involved with the in situ data, but rather more of an evaluation, or pseudo-validation. p317, L25: This lake is only 2-3 km wide so I'm assuming the 3x3 pixel average was not possible, and neither the spatial homogeneity test?

Technical Comments:

p306, L3: Replace 'Thus' with either 'As a result' or 'Consequently' p306, L11: '.. ten more years, offering a ...' p307, L20: Also add reference: Schneider, P., Hook, S. J., Radocinski, R. G., Corlett, G. K., Hulley, G. C., Schladow, S. G., et al. (2009). Satellite observations indicate rapid warming trend for lakes in California and Nevada. *Geophysical Research Letters*, 36 p307, L22: Remove 'be done' p311, L1: State why nighttime measurements should give better results. p312, L3: Here and elsewhere: 'Kelvin' should be 'degrees Kelvin', or simply 'degrees'. p312, L22: Replace 'has to be admitted', with 'should be noted' p312, L29: 'were corrupted' p313, L5-10: Consider showing the basic thermal infrared radiative transfer equation to better illustrate the atmospheric effects. p316, L11: replace 'prolonged atmospheric pathway' with 'longer atmospheric pathlength'. The longer pathlength increases the uncertainty due to non-linear effects of the Planck function. p317, L21: replace 'are apparent' with 'were found' p318, L10: replace 'admitted' with 'stated' p320, L16: '.. NOAA-12, which has a ...' also 'too cold' should be 'cooler' p321, L5-10: I don't think you can rule out the effects of undetected cloud as an error source as well. p321, L19: What do you define as a significant warming trend? It's not obvious from the text.

Table 3: Show the total RMSE and Bias for each method and Lake. Fig. 4: Figure is difficult to read and should be much larger. Also it appears the last panel is an average of results for different satellites, this was not made clear in the caption.

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Interactive comment on Earth Syst. Sci. Data Discuss., 7, 305, 2014.