

***Interactive comment on* “Estimation of subsurface soil moisture from surface soil moisture in cold mountainous areas” by Jie Tian et al.**

Anonymous Referee #1

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The paper explores methods to estimate subsurface soil moisture from surface soil moisture based on an in-situ observations in cold mountainous areas since 2013. This variable is important for different scientific and applied topics. Authors explored the availability of three methods and applied the exponential filter method to the SMAP product. Research showed the improvement of profile soil moisture estimations in the mountainous. Many useful data, figures, and results were shown in the manuscript. I recommend a minor revision.

General comments: The paper is well written and the results are well presented. Bibliography very exhaustive. The analyzed dataset is interesting and the results can be useful to improve the estimation of subsurface soil moisture and could be potentially useful for hydrological modelling. The results show that the combination of exponen-

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tial filter method and satellite surface product can improve the estimation of profile soil moisture, and the availability of the area-generalized T_{opt} in the cold mountainous areas. Related researches in high mountain ranges are limited around the world. Therefore, the presented results add new knowledge on those relevant hydrologic topics. 1. Line 111, The half-hourly measurements were averaged to obtain daily SM values that will be used for the estimation of subsurface SM, which cover up the response of soil moisture to precipitation in a day if it's a rainstorm in where are a big soil porosity. 2. Figure 12, please explain this figure in detail about the temporal variation of soil moisture. It's obvious that SM increased in August. You can link the impact of climate change to moisture source and so on.

Specific comments: Line number are related to the authors' line numbers. 3. Line 14, 'statistical' replace with 'multiple'. 4. Line 15, 'an' replace with 'its'. 5. Line 15, '15' and '25' replace with '10-20' and '20-30', respectively. 6. Line 25, 'with' replace with 'by'. 7. Line 26, please rewrite this sentence. I would prefer to 'the ExpF method was applied to estimate profile soil moisture using the satellite soil moisture product'. 8. Line 27, the first 'to' replace with 'with'. 9. Line 33, please insert 'as' before 'an'. 10. Line 36, 'included' replace with 'include'. 11. Line 41, 'provide' replace with 'provides'. 12. Line 48, 'from 0 to 60 cm depth' replace with '(from 0 to 60 cm depth)'. 13. Line 56, please delete 'that'. 14. Line 59, 'are' replace with 'is'. 15. Line 60, 'have' replace with 'has'. 16. Line 61, 'on' replace with 'about'. 17. Line 73-74, please re-write this sentence 'In the absence of large scale networks of in situ SM observations in mountainous areas'. 18. Line 84, delete 'which is'. 19. Line 106, please put the reference 'Zhang et al., 2017b' at the end of the sentence. 20. Line 107, '(González-Zamora et al., 2016)' replace with 'González-Zamora et al. (2016)'. 21. Line 109, 'data set' replace with 'dataset'. 22. Line 118, delete the 'and' after 'bulk density'. 23. Line 123, I think you use the SMAP products of 2015-2017 in your research, not only 2015-2016. 24. Line 118, delete 'and' after 'bulk density'. 25. Line 155, 'tn-1' replace with 'tn-1'. 26. Line 166, delete ',' before 'The ANN'. 27. Line 167, delete 'of' after 'training'. 28. Line 177, I think the equation (6) is incorrect, please correct it. 29. Line 190, please unify the 'lag

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time' and 'Lag time', I think it's better to use the term 'Lag time'. 30. Line 193, 'from 0-70 cm' replace with '(from 0-70 cm)'. 31. Line 204, add ', respectively at the end. 32. Line 211, I think you mean that 'no significant linear correlations' rather than 'no linear correlations'. 33. Line 216, delete 'have' after 'may'. 34. Line 250, 'season' replace with 'seasons'. 35. Line 270, insert 'ranging' before 'from'. 36. Line 280, please insert 'layer' before both the '3' and '4'. 37. Line 285, 'Topt' replace with 'Topt'. 38. Line 300, 'suggest' replace with 'suggests'. 39. Line 310, I think it is negative correlations from Fig. 8. 40. Line 356, 'Topt' replace with 'Topt'. 41. Line 380, insert 'were shown' before both 'in supplementary' and 'in Fig.11'. 42. Line 380, 'researches' replace with 'research'. 43. Line 420, 'Topt' replace with 'Topt'. 44. Line 421, insert 'profile SWI' before 'estimation'. 45. Line 430, 'season' replace with 'seasons'. 46. Line 444, 'soil profile moisture' replace with 'profile soil moisture'. 47. Line 447, 'SMAP-L4' replace with 'SMAP_L4'. 48. Line 485, insert 'The' before 'main findings'.

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