Satellite and reanalysis data can substitute field observations over Asian water tower

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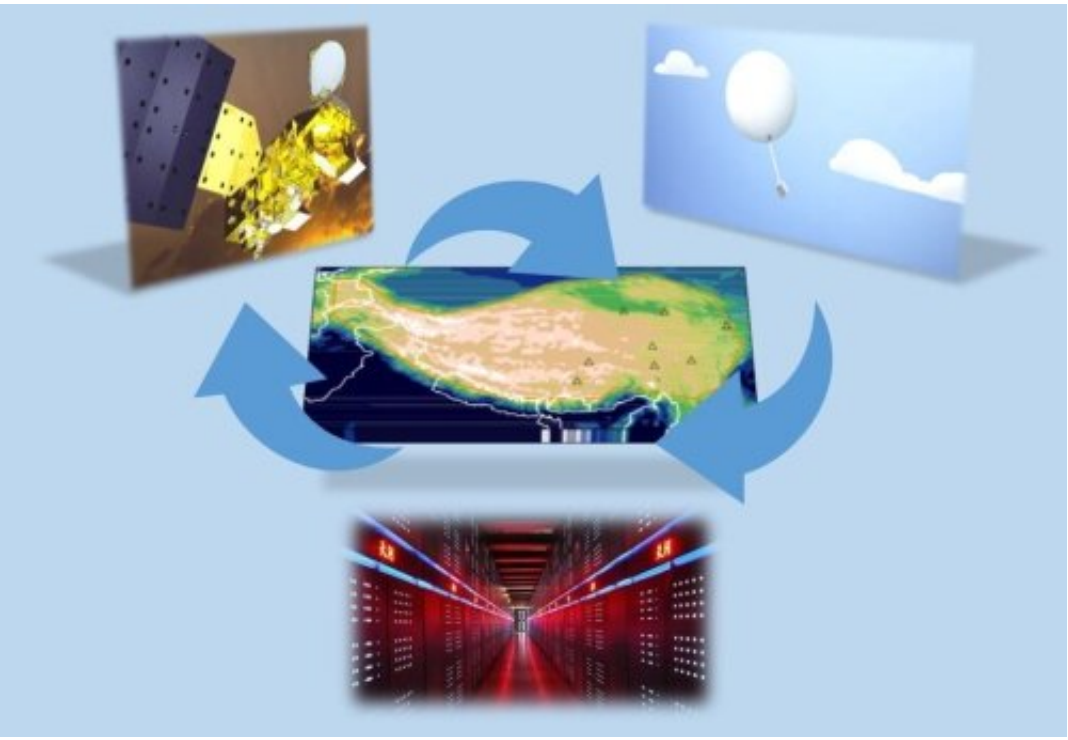

Use satellite and reanalysis data sets as the substitutes to the in situ observations over the Tibetan Plateau. Credit: Zhao Yin

The Tibetan Plateau (TP), known as the "Asian water tower" because of its huge storage capacity in glaciers, has a profound impact on local and downstream ecosystems. However, it is a challenge to establish and maintain in situ observations there due to the complex terrain. Scientists have found substitutes, thanks to satellite technology.

"Both satellite and reanalysis data sets are reliable to be substitutes to reproduce the water vapor features over TP, but the time scale should be considered," said Yin Zhao, a doctoral student from the Institute of Atmospheric Physics, Chinese Academy of Sciences. Zhao is the lead author of a recently published study in *Climate Dynamics*, along with her mentor Prof. Tianjun Zhou.

In sharp contrast with the importance of the giant water tower, sufficient in situ observations in the TP have been lacking due to the complex terrain. So satellite and reanalysis data sets become substitutes.

"In recent years, new versions of satellite data have been released and more reanalysis data sets have been updated. However, their quality needs to be evaluated, in particular, the reliability of existing satellite and reanalysis data products in capturing features of water vapor over the TP," said Zhao.

After evaluating two NASA satellite data sets and seven widely used reanalysis data sets, they found both satellite data sets are reliable to reproduce the total column water vapor characteristics over TP and the difference between them is negligible, but the quality of reanalysis data sets varies with time scales considered.

"There is larger uncertainty among reanalysis data sets than that in satellite data sets because of the climate models, observations assimilated, and the assimilation process. So the quality of reanalysis data varies with the time scale considered and there is no perfect reanalysis data set." Prof. Zhou suggested using reanalysis data with caution.

The team therefore constructed a skill weighted ensemble mean of reanalysis data sets. Using the spatially gridded data AIRS-only as reference, greater weights are given to the higher quality reanalysis data

set. This quality weighted ensemble data performs better than unweighted ensemble data and most of the single reanalysis data.

"Our analysis provides essential information about both the strengths and weakness of the current existing substitutes for the observational data, including the satellite products and reanalysis data. We recommend the application of the skill weighted ensemble mean of reanalysis data in future studies of water cycle over the TP, as it takes different time scale into account," said Zhao.

More information: Yin Zhao et al, Asian water tower evinced in total column water vapor: a comparison among multiple satellite and reanalysis data sets, *Climate Dynamics* (2019). DOI: 10.1007/s00382-019-04999-4

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