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Estimating peak water in glaciated basins: the importance of scale, process, and terminology

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Peak water is a concept that is increasingly used to describe a tipping point in time for glaciated drainage basins, where annual discharge reaches a maximum and thereafter is in continual decline. Millions of people across the globe depend on glacial meltwater, especially in regions such as the Himalayas and the Andes, and therefore current and future changes in meltwater generated flow and downstream water availability are important for society and ecosystem services. Due to the long-term negative consequence of glacier retreat on freshwater resources, peak water in glaciated basins has received more attention in recent years. Using an example case study from the Peruvian Andes, we highlight crucial considerations around scale, process, and terminology when measuring, modelling, and communicating peak water in glaciated basins. Through the application of commonly used peak water calculation methods, we explore the influence of these considerations on the estimation of peak water timing. One such consideration is the processes affecting discharge aside from direct glacial melt, such as catchment storage (aquifers, wetlands, lakes), precipitation, and human activities. In our example case study of the Rio Santa basin in Peru, we find that these factors may all play a much larger role than originally assumed. Subsequently, some peak water estimates may not isolate glacial melt peak water, but instead represent “basin peak water”. Depending on the basin of interest, these aspects can play a significant role in water availability, and thus in peak water estimates. We believe that these nuisances are important for ensuring that the peak water concept is appropriately communicated to end-users, and to inform suitable water management. As a scientific community, we now have an opportunity to assess and find ways to move forward with a unified approach to the terminology and communication of peak water.