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Evidence of subglacial drainage expansion during the 2012 Greenland Ice Sheet melt event.

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Extreme melt events of the Greenland Ice Sheet are increasing with multiple occurrences since 2000. The most extensive melt recorded was in July/August 2012 when ∼98% of the Ice Sheet surface showed evidence of liquid water. These extreme events influence Ice Sheet dynamics and the surrounding environments but are not well documented. This study fills in some gaps by measuring discharge and chemistry in one of Greenland's largest rivers, the Watson River, during the July 2012 peak melt event. Two distinct peak discharge events were recorded: The first discharge peak was followed by high solute concentration with peak-to-peak lag time of 54 hours between both. Lag time and high ion concentration give evidence for release of multi seasonal water from a subglacial system indicating a shift in the Greenland Ice Sheet basal hydrology towards an expansion of the area affected by seasonal velocity fluctuations which could increase ice mass loss. Lower solute concentrations during the second discharge peak may indicate development of a channelized system with short water residence time. The total water, solute and nutrient flux in 2012 is about 2 times of average of 2007 to 2010. Measured nutrient fluxes such as bioavailable iron and dissolved silica further demonstrate that extension of subglacial drainage area during extreme flood events can potentially have an important effect on the receiving fjords and oceans.