An attempt to reduce errors in InSAR deduced DEM of a glacier by applying atmospheric phase correction

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We present work in progress to construct a DEM for year 1995 of the Hofsjökull ice cap (850 km^2), central Iceland, from InSAR data of the ERS1/2 tandem mission. The data include 15 InSAR pairs acquired during the winter 1995-1996 from various tracks, which were topographically corrected with existing DEM's from 1986 and 2008. We developed a data fusion method to extract the topographic residual signal in the interferograms and obtain a DEM corresponding to the autumn 1995. Our first attempt to obtain a new DEM, indicated an unrealistic elevation decrease (~10 m) in the upper part of the ice cap from 1986 to 1995, while direct mass balance observation from this period showed slightly positive average net balance for the ice cap. On the other hand, an elevation rise of similar magnitude was derived for the period from 1995 to 2008 further supporting that the derived elevation change in the upper part of the glacier was indeed artificial due to erroneous data. It is well known that temporal changes of atmospheric conditions between two SAR observations, forming an interferogram may produce significant phase variations in InSAR data. Hence, prior to a second attempt to obtain a DEM for 1995 we use a high-resolution atmospheric data based on the AR-WRF mesoscale model to estimate these phase signals. The ECMWF analysis is dynamically downscaled to 3 km x 3 km horizontal resolution and 55 layers from the surface to 20 km height, with a 3 hour temporal resolution. In our presentation we demonstrate the characteristics of the atmospheric phase signals calculated from atmospheric data and how to include this atmospheric correction in the InSAR processing in order to improve the quality of the final DEM.