

Water vapour is an important climate system feedback but difficult to monitor because of its high spatial and temporal variability. Global Positioning System (GPS) satellites emit microwave signals which are delayed by water vapour as they pass through the troposphere, allowing the calculation of Integrated Water Vapour (IWV) from fixed GPS receivers. A dense network of 31 GPS receivers in Switzerland, located at altitudes between 330 and 3584 m, delivers hourly IWV estimates. Taking the example of a series of frontal systems in January 2004, we show that the GPS system contains information on altitudinal and latitudinal variations in water vapour.

Figure 1 shows a time series of IWV observed by GPS at Bern, Saanen, Andermatt and Jungfraujoch between 11<sup>th</sup> and 15<sup>th</sup> January 2004. The IWV peaks at all altitudes on the afternoons of the 11<sup>th</sup>, 12<sup>th</sup> and 13<sup>th</sup> due to the passage of a series of frontal systems. We see the expected decrease in IWV with altitude. The GPS agrees well with IWV measured by the TROWARA microwave radiometer (MR) at Bern.

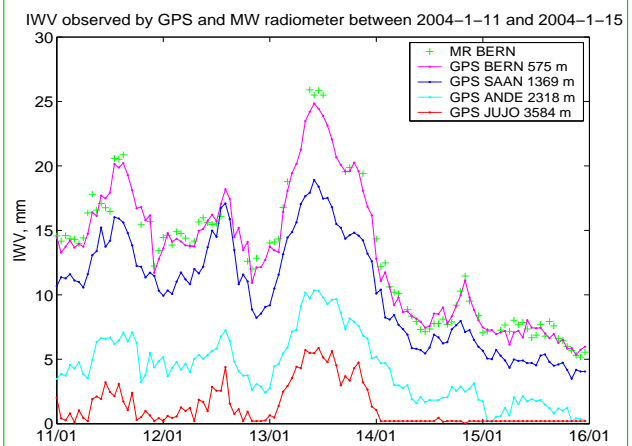


Figure 1 – IWV time series from GPS at Bern, Saanen, Andermatt and Jungfraujoch and microwave radiometer at Bern.

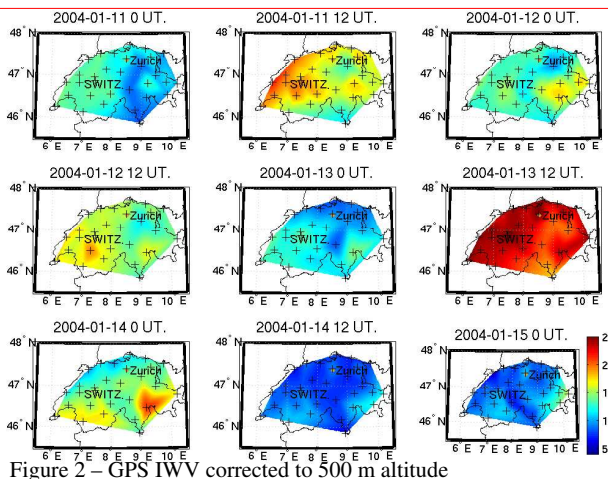


Figure 2 – GPS IWV corrected to 500 m altitude

We modelled the decrease in GPS IWV with increasing altitude and used our model to produce an IWV product which is corrected to 500 m altitude. In Figure 2 this plotted at 12 hourly intervals over the period of interest in January 2004. We clearly see the increased IWV at 12 UT on the 12<sup>th</sup>, 13<sup>th</sup> and 14<sup>th</sup> January 2004.

We averaged the GPS data over 6 hourly intervals and over 11 altitude ranges to produce the IWV profiles shown in Figure 3. Water vapour profiles from the radiosonde and the ASMUWARA MR at Payerne were integrated from selected altitudes to produce IWV profiles for comparison. The GPS profile clearly captures the increase in IWV on the 13<sup>th</sup> Jan 2004 and the decrease afterwards. It is often higher than the sonde profile between 1500 and 1700 m because of spatial inhomogeneities in the IWV which persist over 6 hours or longer.

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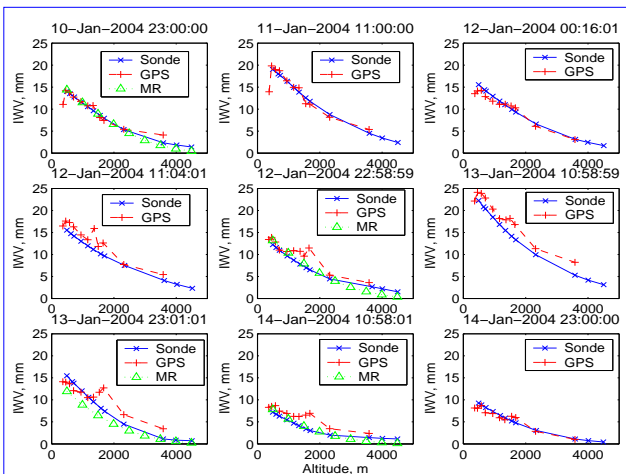


Figure 3 – GPS IWV profiles compared with sonde and MR