Hydrol. Earth Syst. Sci. Discuss., 9, C3681–C3684, 2012
www.hydrol-earth-syst-sci-discuss.net/9/C3681/2012/

Hydrology and Earth System Sciences Discussions

Interactive comment on "Water discharge estimates from large radar altimetry datasets in the Amazon basin" *by* A. C. V. Getirana and C. Peters-Lidard

Anonymous Referee #3

Received and published: 9 August 2012

This paper proposes a methodology for estimating instantaneous discharge using observations of water surface elevation from radar altimeters and a rating curve. This aim should be of interest to readers of HESS and is accomplished by the methods proposed in the paper. The paper also finds that the method can be used to monitor discharge in ungauged regions. However, in ungauged regions the method essentially depends on simulated discharge from a hydrological model, which often results in large errors in the discharges estimated from the altimetry. In fact, the NS for experiment 1 (ungauged case) appears to get worse when using the altimetry data relative to the hydrological model on its own.

A number of specific points can be found below:

P7593 L15: "...have combined virtual swath altimetric measurements with hydrodynamic models using data assimilation methods in order to improve modeled depth and discharge on river reaches (e.g., Andreadis et al., 2007).These studies show the potential of upcoming altimetrc measurements, but the application of the proposed techniques implies that bathymetry must be known."

I found this sentence was quite confusing. Assimilation methods are introduced as a way to estimate bathymetry and discharge, before you state how the techniques imply bathymetry is known. The key difference with a swath altimeter is that by providing information on dh/dx, in addition to the dh/dt information provided by current altimeters, it may be possible to estimate bathymetry and discharge (and maybe even friction) from the data. The altimeter based method used in this paper requires observations of either bathymetry or discharge to create the rating, so to work in an ungauged site you need to either know the bathymetry or simulate the discharge. Furthermore, depth was not estimated by Andreadis et al., (2007) so it would be better to add some of the papers that do such as those by Durand et al.

P7594 L4: Are the altimeter measurements being used to forecast or just make instantaneous estimates of discharge? Given an estimate of discharge it probably would be possible to forecast into the near future but I don't think this was done here unless I have missed something? If this is the case, describing the estimated of discharge as forecasts should be changed throughout the paper.

L25: Could you provide a reference here for the interpretation of a and b.

P7595 L5: The slope of the water surface may also change leading to hysteresis in the stage-discharge relationship. This can be particularly important in areas of diffusive flow where backwater effects are significant. Given the river slopes in this region I suspect much of the Amazon is diffusive and that at least some of the rating used by gauges will include slope components.

L15-20: My main concern with the method in ungauged catchments is that it offers no real improvement over existing data. When a gauging station is not available the method depends on an estimate of discharge from a hydrological model (in which case why not just use the hydrological model). No attempt is made to take advantage of correlations in space or time between observations of discharge and altimetry heights in order to improve the discharge estimate or make a forecast (e.g. you could probably forecast discharge at a gauge downstream of a virtual station using a transfer function that relates altimeter level to observed discharge x days ahead). So while it is possible to create a rating between altimeter level and discharge this tells you nothing about discharge in ungauged basins because simulated discharge is needed, on top of which deviations in level could be due to changes in slope rather than discharge.

P7596 L21: As a kinematic model I'd be surprised if this routing scheme is able to simulate flow velocity in the Amazon with much skill. When evaluating the discharge estimates from the altimetry against gauge data it would be worth including a more detailed evaluation of the equivalent hydrological model discharge estimates, particularly in respect to timing of flow peaks.

P7597 L3-4: "Altimetric data was combined..." I didn't understand what was done here.

L7-11: What data assimilation method was used? It reads as if the model discharge at the gauge locations were simply set using the gauge data and then allowed to flow downstream. If this is the case then I'm not sure this is really data assimilation, which implies some combination of model and observation to create an analysis of the state variables. It might be more accurate to say that gauge data were used to set an upstream boundary for the routing model where available. Then remove all reference to data assimilation from the paper.

P7600 L23-27: Is there any information on the typical errors introduced by using a single rating rather than a slope dependent rating at gauges? It would be nice to include this in the discussion.

P7602 L20: "Overall, discharge forecasts provided by both experiments had good performance." This could be more precise and I'm not sure how negative NS efficiency could ever be good performance because it is worse than using the mean of the observations.

L22 "Results can be considered as optimistic if compared to previous related studies and are as acceptable for most hydrological applications." What is meant by optimistic and as the results in ungauged basins are strongly dependent on hydrological model estimates of discharge how can the result be acceptable for hydrological applications where data is typically needed to evaluate hydrological simulations?

P7603 L1: "The use of rating curves derived from this experiment at these locations should be more adequate to estimate monthly or annual discharges rather than daily." To support this you could show improvement in monthly and annual discharge estimates from the altimeter relative to the hydrological model when compared to some of the gauges. This would be a good test because you could then show that the infrequent sampling by the altimeter and need to interpolate discharge between overpasses doesn't reduce the accuracy (both in terms of the annual volume of flow (m3) and mean monthly discharge (m3s-1)) relative to just using the hydrological model which presumably provides daily or sub-daily discharge.

Interactive comment on Hydrol. Earth Syst. Sci. Discuss., 9, 7591, 2012.