Hydrol. Earth Syst. Sci. Discuss., 12, C1844–C1847, 2015
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Hydrology and Earth System Sciences
Discussions

Interactive comment on "A review of applications of satellite SAR, optical, altimetry and DEM data for surface water modelling, mapping and parameter estimation" *by* Z. N. Musa et al.

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Received and published: 28 May 2015

General comments.

This review tries to cover a broad area of applications of satellite SAR, optical, altimetry and DEM data for surface water modelling, mapping and parameter estimation in both rivers and coastal zones. As a result, some focus and detail is lost. The review has also been written at the time of a step-change in the capabilities of remotely sensed data for improving surface water monitoring and modelling, yet there is little about future directions, and it is an ill-balanced review that does not mention the future as well as the past.

Probably the section most lacking in detail is section 2.1 on SAR data applications, which is also one of the most important. There don't appear to be any references after 2010, but the area has had a substantial number of new references since then. Unfortunately there has just been a review of this topic published (Yan et al., 2015), which goes into much more detail than is presented here, and is not referenced here. The review of Yan was written specifically to cover a perceived gap, since the review before that was published five years earlier. Some of the topics covered in the Yan review that are not mentioned here are:

(1) the use of the new high resolution SARs for flood detection (e.g. CSK, TerraSAR-X, RADARSAT-2, PALSAR), including mapping of flooding in urban as well as rural areas. The CSK constellation satellites can have a revisit interval of 12 hours for a flood, which is sufficiently frequent to capture floods in medium-sized catchments. Also, there is no mention here of the Sentinel-1 constellation (the first of which is already working), which will give high resolution images in near real-time (making them suitable for flood forecasting operations), on an almost daily basis in Europe. The methods used to derive flood extent data from SAR images are also not considered e.g. Martinis et al., 2009, 2011). (2) despite the fact that the words "parameter estimation" are included in the title, there is no discussion of assimilation of observations (e.g. SAR-derived water levels) into hydraulic models, which has been a big trend over recent years (e.g. Matgen et al, 2010, Garcia-Pintado et al. 2015). However, it is possible to estimate a number of model parameters using these observations, including channel friction and river bathymetries, as well as river inflows. (3) the future SWOT satellite, which will produce global surface water maps every 11 days or so, from which surface water slope and river discharge will be estimated, which will be a substantial advance on current-day satellite data acquisition capabilities.

Section 2.2 on altimetry applications is more complete. Again SWOT needs to be mentioned in this section for its altimetric as opposed to its flood extent measurements.

In section 2.4 (Satellite derived DEM applications) no mention is made of the global

TanDEM-X WorldDEM, which should be available at the end of this year, and should allow better hydraulic modelling of remote rivers than has been possible to date with the SRTM DEM. There are also a number of flood modelling studies using SRTM that have not been mentioned (see Yan et al., 2015).

Sorry to be so negative, but I don't recommend publication of this review in its present form.

Specific comments.

P4859 l9: The optical satellites are in near earth orbit. . .. . . Not solely, they can be in geostationary orbit (e.g. SEVIRI on the Geostationary Ocean Colour Imager). P4859 l23: . . ..very low radar return. . .. Say this is because SAR is a side-looking instrument in order to get range resolution. P4860 l6: . . . review excludes certain applications. . .. Should mention that satellite measurement of soil moisture is excluded also. P4862 l20: . . ..two clusters of roughness values are enough. . . Enough for what? P4862 p17: it would be worth giving the typical altimeter footprint at this point, to show how wide the rivers detected must be. P4866 l8: This work of Cretaux et al 2011 has already been mentioned in the previous section. P4868 l4: In this first sentence of section 2.4, mention SAR interferometry was used to produce SRTM. Give the resolution of SRTM in this paragraph. Why does the accuracy of SRTM given not tie up with that quoted in Yan et al. (2015)?– the figures given here seem too accurate. P4868 l17: how were the brightness temperatures of the floodplain used? P4869 l21: mention CSK, RADARSAT-2 and PALSAR as well as TerrSAR-X. P4871 l15: mention that the great advantage of satellite DEMs is that they are global or near-global, unlike airborne measurements of surface height. P4871 l 18: . . . satellite based DEMs are those generated from radar echoes of spot heights. . .. This misses out satellite interferometry completely! P4872 l 3: how about mentioning the advantages of SWOT in this paragraph?

Technical corrections.

P4858 l18: none -> non- P4860 l5: channels coastal areas -> channels and coastal areas P4861 l7: extend -> extent P4863 l10: sum of for -> sum of corrections for P4865 l2: With model calibration and validation results showing -> Model calibration and validation results showed P4865 l7: few kilometre widths -> a few kilometres width P4865 17: long - > poor P4867 l27: few weeks -> a few weeks P4867 l27: barrier beaches and lagoons recovery -> recovery of barrier beaches and lagoons P4868 l16 measure by-> measured by the P4868 l21: in delineated -> is delineated P4869 l16: the best -> better P4870 l13:large temporal -> poor temporal

Reference. Yan, K., Di Baldassarre, G., Solomatine, D.P. & Schumann, G.J-P. (2015). A review of low-cost space-borne data for flood modelling: topography, flood extent and water level. Hydrological Processes, DOI: 10.1002/hyp.10449.

Interactive comment on Hydrol. Earth Syst. Sci. Discuss., 12, 4857, 2015.