We thank reviewer #3 for his/her valuable comments. We have implemented the recommended suggestions. Doing so the quality of the paper has greatly improved. Point-to-point answers to the comments are given here below.

Comment 1 :
Good progress in flood modeling in wetlands has been achieved in the recent past and I believe this needs to be acknowledged and built upon. There is no need to going back and taking other routes that may not add more value to the effort. The labour of writing new source codes may not necessarily add much to science especially if we cannot clearly indicate the contribution of such an effort. Generally, in flood modeling, we need a flood generation model (hydrological) and a flood routing model (hydraulic). These two need to be coupled; with validation being done at all stages i.e hydrological and hydraulic. Thus, I challenge the authors to clearly indicate their contribution in science and literature on flood mapping/modeling in wetlands.

Answer 1:
We agree with reviewer #3 that good progress has been made in recent years in flood modelling. Spatially distributed hydrologic models are now widely used (e.g. MIKE SHE, or MIKE Flood) to characterize flooding events. However, their use is sometimes challenging. As reviewer #3 has pointed out numerously, they often require topographical and hydrological data. It is therefore challenging to use these type of models in many basins where data are scarce and data collection difficult. Reduced complexity hydrological models have been recommended as an alternative to distributed numerical models (Hunter, 2007). Furthermore, local features (data availability, dominant processes…) call for the use of site-specific and tailor made hydrologic models (Savenije, 2009). This study falls within this context. We have developed a hydrologic model adapted to the Tana River Delta to characterize the main flooding characteristics in its poorly gauged wetlands. Our contribution mainly resides in the combination of a set of methodologies from the hydrologic and remote-sensing fields to assess hydrologic fluxes. Indeed, the use of MODIS images enables to measure flood extents in a coastal delta where cloud cover limits the use of many satellite products. These flood extents are then used to calibrate and validate a water-balance model. The latter is obviously constrained by data availability but can be used to quantify flood extent and duration and determine the main fluxes of the water balance within the delta. Lastly, the MODIS images also provide relevant information about the spatial characteristics of the floods. In this way, we believe that this study largely contributes to the topic of Predictions in Ungauged Basins (Sivapalan et al., 2003).
We developed these ideas in the new version of the paper, in particular in the introduction.

Comment 2:
I don't agree with the authors that Tana Inundation Model (TIM) is the first hydrological model for Tana. There have been several efforts including by the Kenya Generating Company, local universities etc to use various hydrological tools e.g SWAT model, to understand the impact of land use changes on the hydrological regimes of the Tana. May be the authors need to clarify their understanding of hydraulic and hydrological modelling and how these two have been applied in this study. I tend to think that more of the efforts and relevancy in this study have been on hydraulic than hydrological modelling. Modelling floods is a hydraulic effort (flood routing) and hence the attributes that define the flood event e.g flood extent, duration, timing, frequency etc are important. I believe this was the primary focus of this paper including the validation approach using MODIS images and hence the inclusion of "Remote sensing. . .." in the title of the paper. Otherwise the relevancy of the title and abstract will not stand if we lose focus on flood modeling (routing) as presented in this paper. This needs to be made clear.

Answer 2:
As one of the largest and most populated basins in Kenya, we have no doubt that many efforts have focused on understanding the hydrology of the Tana River basin. We are in particular aware of the study of Maingi and Stuart (2002), and of modelling efforts by the Kenyan Meteorological Department and some private companies. However, all the models we are aware of deal with the upper and mid parts of the Tana River. No studies have, up to now, looked specifically at the flooding characteristics in the Tana River Delta. That is why we included the sentence “The Tana Inundation Model (TIM) presented here is the first known hydrological model of the TRD” in the abstract.
If Reviewer #3 is aware of hydrologic models concerning the Tana River Delta, we would be pleased to include the references in this paper.
We believe that both hydraulics and hydrology bring answers to the study and modelling of floods. Savenije (2009) pointed out that “Hydraulics takes place within clear, often imposed, boundaries. […] The special character of hydrology is that it describes the movement of water through an ill-defined, often unknown or un-observable medium”. Our study is therefore more of a hydrologic than hydraulic study.
As Reviewer #3 has pointed out, the focus of our study was to characterize the flood extent, duration and timing of the floods within the TRD and to validate the model using remotely sensed data. The paper has been restructured so that these objectives are clearer. In particular, the objectives have been re-phrased: “The objective of this study was to quantify the main water fluxes and flooding characteristics in a poorly-gauged East African wetland: the Tana River Delta. To do so, we constructed a lumped hydrological model (the Tana Inundation Model, TIM), that allowed to determine the role of river fluxes in flooding events and the number of flood events from 2002 to 2011, and to characterize the extent and duration of the floods. In parallel, the analysis of satellite data provided distributed inundation maps.”

Comment 3:
One of the tools for modeling floods in river systems is HEC-RAS, of which is in the public domain. Did the authors think of the possibility of constraining this tool to fit their challenge? RAS has been applied with great success in many countries including Tanzania. The main input is DEM (TIN form) of which can be created from contours e.g 1m interval. A high-res DEM is a pre-requisite for good results e.g flood extent, depth etc. At least ASTER 30m could be much better than validation with a 500m MODIS image. Any comment on this?

Answer 3:
HEC RAS is indeed a very useful tool within the public domain that can perform one-dimensional hydraulic calculations for natural channels. The model also allows the calculation of sediment transport or water quality analysis, even though these are not the objectives of the study. As Reviewer # 3 pointed out, high resolution DEM and numerous hydrologic data are necessary to obtain good results with this model. Concerning the Tana River Delta, these data were not available, hence our decision not to use such a tool. Furthermore, hydro-dynamic modelling of river-floodplain systems needs to be done with precaution in large and flat floodplains, where small uncertainties in water height can generate large errors in the prediction of flood extents. This last sentence has been added in the new version of the paper to clarify our position on this matter.
Concerning the satellite data, we agree that the Aster data can provide useful information to monitor hydrologic variables. For example, flood inundation maps generated using ASTER products have already been used to calibrate a distributed hydrologic model within the Lake Victoria basin (Khan, 2011). However, one specificity of the Tana River Delta is that a high cloud cover (coastal zone of Kenya) limits the use of many products from optical sensors. An interesting feature of the MODIS products is that they provide 8 day-composite products, where each pixel of the image is the best-observed pixels within

an 8-day window. Thus cloud cover is reduced. For this reason, we used the MODIS product instead of other optical products (Landsat, ASTER, SPOT etc.).
This explanation is included in the paper as: "MYD09A1 is a level-3 high-quality composite product, at a 500 m resolution. Each pixel contains the best possible observation during an 8-day period, corrected for atmospheric gases and aerosols, and is hence useful in zones subject to high cloud cover. Furthermore, two bands describe the quality of each pixel regarding aerosols and presence of clouds or cloud shadow, so that masking poor quality pixels is possible. Despite the moderate resolution, their long-term data and frequent overpass make them a good candidate to monitor large to medium size wetland complexes."

Comment 4:
Page 11270, paragraph 5 The authors need to be explicit on their statement objective (i) construct a parsimonious hydrological model using satellite imagery. . ..". Were the MODIS images used as an input into the TIM model or used merely for validating flood extents? If the latter is true then this objective need to be revised. How is the satellite imagery reflected/factored in the TIM model structure?

Answer 4:
The objectives have been re-phrased to better translate the work undertaken in this study (see Answer 2). Indeed, the MODIS images were used for the calibration and validation of the TIM model, and are not input variables. This has been clarified within the new version of the paper, especially in Figures 3 (presentation of TIM) and 4 (workflow diagram), where the analysis of the satellite images and the hydrologic modelling are separated.

Comment 5:
Page 11271, paragraph 1 It would be nice if the authors could discuss the challenges of applying RS in hydrological studies while noting that RS and hydrological models are two different scientific platforms.

Answer 5:
The new version of the paper better reflects the interest and challenges of using remotely-sensed data in hydrological models. In the introduction, a large section deals with subject, of which we present here the main ideas:
"A vast majority of wetlands worldwide lack long-term and reliable hydrological and climatic data. Different remote sensing data can be used to detect water bodies and their characteristics (water extent, height, variability, vegetation cover, sediment load, etc) for calibration and validation of hydrological models. However, there are no standard methods to do so. Synthetic Aperture Radar imagery is very popular […] the radar signals are sensitive to wind induced-waves, […] are limited by their low orbital repeat cycles, cost and limited archives. Passive microwave data […] but are limited by low spatial resolution. Thermal satellite data have been used to map inundated areas (Leblanc et al., 2011) but to our knowledge at an inadequate monthly time-scale to characterize rapidly changing inundation extents. […] The MODIS instruments […] have been used to characterize water levels […] Despite the moderate resolution, their long-term data and frequent overpass make them a good candidate to monitor large to medium size wetland complexes".

Comment 6:
Page 11272, Paragraph 5 It would be nice to highlight the spatial & temporal resolution of the SAR images
Paragraph 15 Which of the spectral ranges are useful in mapping floods/water?

Answer 6:
This information has been included in the new version of the paper (introduction).

Comment 7:
Page 11273 Paragraph 5 The authors need to justify the use of an 8-day, 500m

resolution MYDO9A product to map a flood. Can a 1m flood in the Tana be captured by such an image?
Paragraph 20 It would be nice to write the formula for NDWI. Not all hydrologists understand remote sensing jargon.

Answer 7:
The use of the MYD09A1 product has been justified (cf Answers 3 and 5). The Tana River Delta floodplains are large and flat. As such, a 1 m flood will cover a couple of hundred square kilometers and are visible using this product.
The formula of NDWI has been included in the paper as suggested by the reviewer.

Comment 8:
Section 4 (page 11276) Paragraph 20 There are established ways of filling missing data. Any discussion about some of these methods?

Answer 8:
We agree that different methods are available for filling missing data (linear or spline interpolation, the flood routing model used in this study (Lamagat 1991), etc.). The discharge data at Garissa presented two large gaps for which interpolation was difficult and thus excluded from the study. The other missing data were limited to short time-spans. After a visual inspection, we concluded that a linear interpolation was an appropriate method to fill in the data as discharge data for large rivers usually don't present large and rapid variations (continuous data), compared for example to rainfall data. Another interpolation method (such as the spline method) would not have induced a large difference in transiting water volume. Hence, the interpolation method does not have a large influence on the final results of this study.

Comment 9:
Section 4.2 (page 11278) Paragraph 15 Any reason for using a 10-day moving average for the Garissa discharge? Is there a logical framework for choosing this time lag?

Answer 9:
10-day moving averages are commonly used as input data for the flood-routing model that we used in this study (personal communication with Lamagat).
Furthermore, the use of 10-day moving averages is reasonable when we consider the other data used in this study (the MODIS images, which are 8 day composite products) and the time-step at which we analyze the results of the TIM model.

Comment 10:
Page 11279 Paragraph 20 Was there an effort to seek local knowledge on flood dynamics in the area?

Answer 10:
Local knowledge can indeed provide essential information of a studied system. In our case, regular visits to the delta and collaboration with the national water management authorities (WRMA) gave us the opportunity to corroborate our results. We changed the corresponding sentence in the new version to reflect this.

Comment 11:
Section 5.1 (Page 11281) Paragraph 20 What were the assumptions in construction of the TIM model?

Answer 11:
Hypotheses were made on the way to express the water fluxes within the water-balance model and the water level-flood extent relationship. They are expressed in the equations

(8) to (13), and follow classical assumptions made in hydrology (e.g. evaporative outflow depending on the potential evapotranspiration). In the absence of topographical data, a logistic curve was used to express the Z-S relationship. The latter reflects the flooding process within a large and flat floodplain: at low water levels, flooding does not occur, then flood extent increases rapidly once overflow into the floodplain occurs, then flood extent finally reaches a plateau when all the floodplain is flooded (see Fig. 3 in the new version).

Comment 12:
Section 5.3.2 Page 11285 It would be interesting to read more on the downscaling of monthly potential evapotranspiration to hourly time step. How was this achieved?
Are the equations mentioned in this section new or have been documented somewhere else? However, it is important to note that these equations define unique processes that have been documented over decades. How are these equations in this section related to the documented work in literature?

Answer 12:
Downscaling of monthly values to daily values is justified in our case by the fact that no daily or decadal evaporation or rainfall (at Garissa) data were available. The downscaling of evapotranspiration and rainfall at Garissa is also justified a posteriori by the fact that their contribution to the water-balance is minor. Hence, even if the temporal distribution within the month had been slightly different, this would not affect the end results of the study.
We want to stress the fact that the time-step at which the results were analyzed is different from the time-step at which Equation 5 was solved. On one hand, Eq. 5 was solved at an hourly basis, so that the numerical resolution of this differential equation (by RK4) was stable. On the other, the time-step at which the model's results can be analyzed is constrained by the time-step of the input variables. In our study, the main variables (e.g. MODIS) are approximately on a 10-day time-step basis. Therefore, the results are averaged over this time-step. Hence, the equation was solved at an hourly basis, but the model is run on a 10-day basis. This has been clarified in the new version of the paper.

We agree with Reviewer #3 that the equations describing the hydrological variables (evaporation, infiltration, surface flow) are classical and have been already used in the past for water-balance models. We have therefore added some references to previous literature.

Comment 13:
Section 6.1 Paragraph 1-5 Any possibility of groundthruthing this information with local knowledge?

Answer 13:
Indeed, the results concerning the spatial flooding characteristics can be compared with local knowledge. For this study, we did not undertake interviews to directly compare these two. However, we have had numerous exchanges with the local populations (e.g. Leauthaud et al. 2013 in Global Environmental Change, study in which we describe semi-directive interviews). This has given us the opportunity to corroborate our knowledge of the zone with local knowledge.

Comment 14:
Section 6.3 Paragraph 15-25 The authors are honest enough to explain the weak-nesses of their model/approach. These weaknesses are expected in such a flood modeling framework where a high-res DEM is not used. Logically, it may be wrong to start something that one has a 100% assurance of failure. How can the authors defend

their thesis in this paper - of their effort to model floods with “weak” tools, starting from the scratch, while there are available tools in the shelves that can do a much better job than their approach? Are the authors testing their model? Against what? If this is the case, then the paper could have taken the shape of an inter-comparative study.
The last sentence of paragraph 20 reads:” The model should therefore.....flooded areas”. What is a large and small flood?
Section 7 Paragraph 25 (page 11294) I don’t foresee any improvement of TIM or other sequel of models unless the concept of flood modeling is applied in the right way with the right tools. Flood routing need to be taken into consideration (a hydraulic approach).
In page 11295, paragraph 1, the authors are categorical that there is a need of using a DEM. Of course there is no doubt about this!
In page 11295, paragraph 15, the authors highlight the importance of being cautions when using results from this study. This is a self acknowledgement that what is presented in this study is not so good for “consumption”. Now, what are the authors telling us? Do we discard the work and take a break from reading their work?

Answer 14:
We believe that Answer 1 to Reviewer #3 brings the necessary answers to the first section of this comment.
We agree with Reviewer # 3 that a DEM is required to undertake hydraulic modelling within the floodplains of the Tana River Delta. This study shows, however, that a first characterization of the floods can already be achieved using a lumped water-balance model.
Concerning the importance of being cautious with the results presented in this, our aim in the discussion section was to define the limits of the study. It indeed seems important to us to stress that, like all models, TIM was constructed and validated using data that had specific temporal and spatial resolutions. It was also calibrated for 2002-2011. Therefore, the results can only be used at these scales, and extrapolation to different periods is erroneous. The discussion section has been re-structured and these points clarified.