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Interactive comment on "Annual South American forest loss estimates based on passive microwave remote sensing (1990–2010)" *by* M. J. E. van Marle et al.

Anonymous Referee #2

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General comments:

The method of estimating tropical forest loss on continental scale with passive microwave remote sensing data on continental scale is a new and interesting approach. The manuscript is well structured and well written. However, the authors should highlight what their new approach brings as new information with respect to existing datasets on forest loss, more specifically with respect to the Global Forest Change (GFC) dataset of Hansen et al. 2013, given that the VOD spatial resolution is much coarser than GFC's, and that a 'tuning' (calibration) of VOD data to GFC is performed (in order to produce forest loss area estimates from dimensionless VOD values). The authors must give an outlook on advantages and future potential use of this new

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method compared to existing methods. In general the authors should have put less emphasis on the detailed description of the forest loss area results per country but more on the reasons of the significant differences between the VOD-based forest loss area estimates and the corresponding PRODES and GFC estimates. In the conclusions the authors describe the three datasets (GFC, PRODES, VOD) as equally valid, each with their flaws and limitations. This view seems unfair (too positive) with regard to the VOD dataset which needs 'tuning' to another dataset (and is thus dependent on its quality), and, in addition, is missing a throughout analysis on its accuracy and on the factors that can influence the VOD signal (e.g. impact on "inter-annual scales by anomalous dry or wet conditions", volcanic eruptions, water bodies. . .).

Major comments:

Tuning: The abstract should mention the comparison between the VOD-derived estimates and the PRODES data estimates and should clearly point out that the comparison with GFC estimates has limitations due to the interdependence of the two datasets (as the VOD-derived dataset was 'tuned' to GFC). This interdependence of the two datasets should also be pointed out more clearly in the sections where forest loss area estimates derived from of VOD and GFC are compared. Early decade: The fact that after 'tuning' VOD data from 2000-2010 to GFC data the two datasets show substantial differences in forest loss area estimates (Table 2, Figure 5) is questioning the validity of VOD forest loss area estimates for the 1990-2000 period. VOD forest loss area estimates are provided for this earlier decade, but how accurate are they? Moreover the comparison with PRODES estimates for the years 1990 to 2010 shows substantial differences in yearly forest loss area estimates over the Brazilian Amazon from the two datasets (VOD and PRODES). Spatial comparison with other datasets: In addition to the comparison of forest loss area estimates derived from VOD, GFC and PRODES (Figures 4, 5 and 6) the authors should also provide a spatial comparison with the GFC and PRODES datasets to show where the areas of forest loss coincide and where and how they differ. This can be very helpful in the discussion on the quality

of the VOD-based forest loss data and on the factors that can influence VOD outlier values. Accuracy: An independent assessment of the accuracy of the VOD-based forest loss area estimates is missing. Although such accuracy assessment can represent a large amount of work, it can be very useful to build confidence in such a dataset. PRODES comparison: The comparison with the PRODES forest loss dataset is definitely an independent one, but is not discussed in depth and rather regarded as of minor significance ("apples and oranges"), because of the "differences in methodology and spatial resolution... but also potential inconsistencies...". For the Brazilian Legal Amazon region, the PRODES dataset is one of the most relevant existing datasets, and should be fully taken into consideration. While certainly some technical issues need to be taken into account for such comparison (minimum mapping unit, cloud compensation, the exclusion of forest regrowth from the forest cover), a more in-depth comparison should be carried out and could be used as partial accuracy assessment over this region. Difference in forest loss area estimates between PRODES and GFC: Part of the considerable differences of forest loss area estimates between PRODES and GFC for the year 2010 can be explained, as the authors state, by the limitation of the PRODES method which does not take into account re-clearing or forest regrowth. However, when comparing yearly estimates of gross forest loss from the two datasets, a relatively stable offset appears between the two datasets (systematic higher values in GFC data), thus leaving the GFC peak for 2010 unexplained. Usage of monthly VOD values: The authors mention that one of the advantages of the VOD is the possibility to use monthly data. However, these monthly datasets (calculated through a 19-month moving average) are used to produce the "Interyearly Difference (IYD)", of which the negative IYD values only are used for further analysis by calculating yearly and 5-year accumulation of IYD values. The monthly VOD signal as such is not used directly for analysis but only indirectly to produce yearly IYDs, and no conclusions are based directly on the monthly values. In this respect, the monthly VOD values are not used in a very different way compared to the bi-monthly image acquisitions of Landsat 7, which are mosaicked and analysed in order to produce the GFC yearly forest loss

area dataset. The potential of producing monthly VOD estimates should be described and further discussed. Forest Plantations: The authors do not mention the issue of forest plantation harvesting which has a high impact on the VOD values. In many areas (e.g. Southern and Central Brazil, Uruguay) forest cover changes in forest plantations are the main sources of (temporary) forest cover loss. The high forest losses e.g. in the Amazon (land use change) has different implications compared to the high forest losses in e.g. Southern Brazil (mainly land cover change). This should be pointed out in the manuscript. False VOD-based forest loss: The manuscript discusses in detail the forest losses in the Amazon rainforest and the Chaco forest, where the VOD approach seems to work reasonably well. However, the discussion addresses only shortly the issue that for countries like Chile, Uruguay, and Surinam the VOD approach provides very different estimates compared to GFC (the paper mentions only the different spatial resolutions of the two datasets as the probable main reason). This discussion is essential and should be held in more depth. In fact, the VOD results show relatively high forest loss values in areas where the forest cover is very small (e.g. Uruguay). This issue of overestimation of forest loss arises also within Brazil outside the Amazon and Chaco regions: e.g. high forest loss is estimated for Southern Brazil (Rio Grande do Sul, Santa Catarina and Parana States) for the period of 2000-2004 (with 5-year VOD outlier values comparable to those within the arc of deforestation) which does not seem to correspond to reality. Another example would be Southern Bahia (South of Salvador) where, according to VOD data, high forest loss occurs throughout the 20 year period – while not much evidence is found for this loss in the satellite imagery. Country level statistics: Under point 4.2 (Calibration with GFC) the authors describe the 'tuning' of the VOD outliers to the GFC forest losses and state for some years considerable differences in forest loss estimates. A throughout discussion on these differences is missing, as well as information (as mentioned before) on their spatial distribution (apart from country-specific information).

Technical corrections:

Section 11500, Line 24 (Abstract): "One of the key findings" mentioned in the abstract is the decrease of forest loss in Brazil after year 2005, but this decrease has already been reported by many sources, e.g. by FAO in the FRA 2010 report. The sentence should thus be changed in "the analysis of VOD-based forest loss estimates are in agreement with other studies that state ...", or similar. Section 11501, Line 27: Starting in 1972, Landsat MSS had a spatial resolution of 80 m (but was often resampled to 60 m), this should be added to the mentioned resolution of Landsat (E)TM spatial resolution of 30m Section 11502, Line 8: "coarser" spatial resolution instead of "courser..." Section 11502, Line 12 ff.: Achard et al. 2014 (global), Eva et al. 2012 (regional, for tropical South and Central America) and Verhegghen et al. 2012 (regional approach with MERIS and SPOT VGT data) should be added to the list of publications mentioned here. The reference "Céline et al. 2013" should be "Ernst et al. 2013", the first name and last name of the author was reversed – which is the case for all other names in this reference (Section 11519). Section 11502, Line 17 (and Section 11506, Line 2): INPE is not the Brazilian Space Agency, but the Brazilian National Institute for Space Research Section 11502, Line 18: the project called PRODES is not called the "Monitoring the Gross Deforestation in the Amazon Project", but "Program for Deforestation Assessment in the Brazilian Legal Amazon with Satellite Imagery" Section 11503, Line 27: "...to Landsat-derived datasets including..." should be "...to the Landsat-derived datasets of PRODES..." Section 11505, Line 20: "with" or "at" instead of "on a 30 m resolution, the 30 m can then be dropped in the next sentence Section 11506, Line 10: "Landsat 5/TM" should be "Landsat 5 and Landsat 7" Section 11506, Line 14: "shade-fractioned images" should be "images of soil, shade and vegetation fractions" Section 11506, Line 16: the method described does not yield 'gross forest loss', it yields 'net forest loss', for areas where the forest loss exceeds forest gain (as only negative VOD outliers were considered) Section 11510, Line 5 ff.: In Figure 3 the arc of deforestation is not a 'dominant' feature, it is rather a well-known feature which is thus recognized easily, but in all four parts of the figure it is one among various areas which show high absolute "Summed IYD values (-)". The interpretation of figure 3 is too short and too

fuzzy with respect to the importance of the figure that shows the main results (summed IYD values (-) indicating forest loss) in their spatial distribution. Section 11511, Line 5: Equation (4) is either missing or not numbered correctly. Section 11516, Line 12: 'strict regulations' is an imprecise term, it should be "strict forest law and effective forest law enforcement" or similar. Section 11518, Line 7: ". . . partly because it was related to secondary forest degradation" should be ". . .partly because of the deforestation of secondary forest" or similar. Section 11532, Figure 3: The caption of the figure is not correct, as the figure does not show forest loss extend, but the "Summed IYD values (-)".

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