Response to Anonymous Referee #1

I appreciated that the authors took into account all the issues that I remarked, but unfortunately I think that the paper is still not suitable for publication. A great effort has been done to try to improve the paper but it is still lacking in sharpness particularly in the algorithm description

1. English should be improved
Author Comment (A.C.): English has been revised.

2. Introduction.

This section was improved by focusing the bibliographic review on geostationary and particularly on SEVIRI applications in the field of rain rate retrieval. Nevertheless the authors still omitted to highlight the strengths of their methodology with respect to other similar products. It is not clear which gaps are filled by the presented technique. If a key-point of this algorithm is that it does not need any real-time ancillary data, while this is not true for other similar products, the authors must specify this concept clearly in the Introduction. The authors also indicate the use of WV channel brightness temperatures in "temporal differences" as another key factor of their algorithm (this concept is also cited in the Conclusions), but in this case the benefits produced by this channel has to be demonstrated.
A.C.: The RainCEIV key-points are

- the inclusion of the WV "temporal differences" in the feature vector;
- the training dataset built by double-matching SEVIRI pixels with the radar-derived rain rate values and the Passive MicroWave-derived rain rate values from AMSU-B/MHS radiometers at a better spatial resolutions than the other PMW sensors.

The fact that RainCEIV does not use ancillary data is a characteristic of the algorithm but it is not a strength when compared with the other techniques. The Abstract and Conclusion have been modified in order to better clarify the RainCEIV strengths.

As for the benefits produced by the WV brightness temperature temporal differences, they can be noted by considering the results shown in Tables 2, 3 and 4. In fact, the WV temporal differences are included in the d=16 features of the feature vector, but they are not included in the d=10 features. It is also important to note that when considered alone the WV temporal differences are not useful for RainCEIV purpose, but they gain usefulness when considered with the other features.

3. Instruments and data description. Page 5 – line 2.
From EUMETSAT Image newsletter MSG-4 launch is scheduled for February 2015, not 2014.
A.C.: Thank you for spotting this typo.

4. Instruments and data description. Page 6 – lines 4-21.
The references cited to describe Italian Weather Radar Network data (Vulpiani et al., 2008, 2008a, 2012; Rinollo et al., 2013; Puca et al., 2013) were not included in the bibliography.A.C.: The reference list has been updated and it includes the above-mentioned references. Thank you for the advice.

5. Cloud classification algorithm description. Page 7-9

The authors improved the description of C_MACSP module, by including a citation of the paper Ricciardelli et al., 2008 for the description of the previous version of the module, a very brief (completely non-exhaustive) presentation of the 6.2 – 10.8 BTD test used to identify the presence of thick clouds with high tops, and the description of the training dataset arrangement (see also Appendix 1). Nevertheless at the end of this section readers do not yet know which threshold tests are exploited within the C_MACSP module. Moreover it is not clear to me in which way the C_MACSP module associates to each SEVIRI pixel a cloud class among the five available classes. Does it use the k-NN method?

A.C.: In order to better clarify how C_MACSP classifies each SEVIRI pixel as belonging to one of the five cloud classes, Section 3.2 has been updated as follows:

"The C_MACSP statistical (temporal) algorithm considers in input the same spectral and textural features described and listed in section 3.2.1 (section 3.4) and Table 4 (Table 7), respectively, of Ricciardelli et al. (2008), but the training dataset has been updated in order to build the training samples for the *convective cloud* class."

and:

"The C_MACSP statistical and physical algorithms are applied separately to each SEVIRI pixel, and the results are compared. If they agree, the SEVIRI pixel is classified consequently, otherwise the temporal algorithm is applied in order to remove the ambiguity and classify the SEVIRI pixel definitively."

Moreover, a new reference (Di Paola et al, 2014), where the initial updates of MACSP to provide cloud classification are described, has been added.

6. Features selection and description. Page 10 – line 26.
I think that it is more appropriate to replace "cloud drop distribution" with "cloud effective radius", which is the parameter that can be retrieved together with cloud phase from SEVIRI channels centred at 1.6 and 3.9 µm.

A.C.: Ok, done. Thank you for the advice.

7. Training procedure
In my opinion the comprehension of this section is still difficult despite of the revised text, in particular the bootstrap sample construction.
A.C.: The paragraph has been revised in order to make it clearer.

8. RainCEIV validation results.
Table 8 with the list of the case studies for the validation was never cited in the text. There are two Table 10, the first one is the contingency table (rain/no-rain) for night-time pixels, the second one summarizes the statistical scores for the C1 and C2 classes and it was never cited in the text.
A.C.: Table 8 is now cited in Section 4.2. Table 9 and Table 11 were erroneously named Table 10 and because of this three Tables 10 were present in the paper. Thanks for the advice. Tables 9, 10 and 11 are cited in the paper.

9.Conclusions

The exploitation of VIIRS data is identified as a method to individuate very localized (size smaller than the SEVIRI pixel) extreme rainy events. The authors could add further details about this topic.
A.C.: Further detail has been added at the end of the Conclusion paragraph:

"The purpose is the integration of the SEVIRI and VIIRS observations in order to determine the cloud classification and the rainfall occurrence probability at a better spatial resolution (from 3 km for SEVIRI to 0.375 km/0.750 km for VIIRS at the sub-satellite point)."

Response to Anonymous Referee #3

Second review of the paper "A statistical approach for rain class evaluation using Meteosat Second Generation-Spinning Enhanced Visible and InfraRed Imager observations" by Ricciardelli and coworkers.

The authors revised the paper following the reviewers' suggestions; however, I feel there are few minor issue to be fixed before the publication of the manuscript.

1)The reference list seems to be not up to date. New references have been added in the text (e.g. Vulpiani et al, Puca et al., Capacci et al.) and are not present in the list, while some others have been removed from the manuscript but still appear in the list (e.g. Adler and Mack)
Author Comment (A.C.): Thanks for the advice, now the reference list is updated.

2)Line 18 on page 6: the correct citation is Puca et al., 2014;
A.C.: Ok, the citation has been corrected.

3)On section 3.2.1:

a)line 26 on page 10. Cloud Drop Size Distribution cannot be inferred by any SEVIRI wavelength: it is possible to estimate effective radius, which is the ratio between two moments of the DSD, but not the DSD itself (see Chen at al., JAS 2007);
A.C.: Thank you for the correction. "cloud drop distribution" has been replaced with "cloud effective radius".

b)line 4 on page 11. The WV channels have weighting function peaked at around 400 and 600 hPa at mid-latitude, and I do not think it is correct to say the radiances "are indicative of the water vapour content in the troposphere at levels lower than 350hPa and 500hPa" because the lower level moisture is not sensed by these channels.
A.C.: I agree with you, in fact the "lower levels" means "lower pressure levels", in order to avoid confusion the text has been modified as follows:
"are indicative of the water vapour content in the troposphere at pressure levels lower than 400 hPa and 600 hPa"