Reply to Anonymous Referee #2

Thanks to the referee 2, we have followed his/her suggestions by taking into account the comments that have improved the quality of the manuscript.

The manuscript entitled "Paleohydrology reconstruction and Holocene climate variability in the South Adriatic Sea" by Siani et al. focus on Holocene paleoclimatic and paleohydrological reconstructions performed on sediment core MD90-917 collected in the South Adriatic sea. The investigation is based on foraminifera stable isotope analyses and sea surface temperatures. In my opinion, the manuscript contains interesting results and the discussions are generally convincing. This work includes an important data set even if some data from this core were already published. I recommend to publish it after moderate revision.

General comments:
-The organization of the manuscript is good. Nevertheless some sentences are confusing (see below).

I recommend to reorganize the paragraph 6.1.1 and 6.1.2 in order to better evidence the new contributes with respect to the previously published data from the same area (for example the comparison with Piva et al., 2008; Sangiorgi et al., 2002; 2003).

Reply 1#
We have taken into account these remarks in revised form of the manuscript.

One of the innovative features of our study is based on the very high resolution hydrological variability recorded during the Holocene period with a focus on the post sapropel phase i.e. the last 6.5 ka. Such quantification of salinity changes is for the first time reconstructed in this basin and represents an independent approach to restore the past hydrological changes in the South Adriatic Sea. Our study is a solid contribution that confirms previous micropaleontological studies based on the planktonic foraminifera peaks of the surface dwelling species *Globigerinoides sacculifer* that was considered as sensitive of the water column structure marked by low turbidity and consequently reduced river runoff (see Piva et al. 2008).
We provide a more detailed view of the surface and bottom ($\delta^{13}C$ changes on epi-benthic foraminifera *Cibicidoides pachyderma*) hydrological changes in the South Adriatic basin and to well quantify the short-term salinity variations and their link to the increased runoff from the surrounding rivers as also pointed out by the *G.bulloides* $\delta^{13}C$ values. To corroborate our interpretation we have compared our *G. sacculifer* minima with those observed in the Adriatic basin by Piva et al. (2008). Interestingly, the main frequency minima of *G.sacculifer* in the southern and central Adriatic were recorded at around 1.4, 2.2, 3.2-2.7, 3.8 and 5 ka respectively. These micropaleontological events are coeval, within chronological 1σ uncertainties, with our *G.sacculifer* minima recorded in core MD90-917. Such surficial salinity lowering could have had an important impact on the formation of deep-sea water in the South Adriatic Sea. It is also interesting to note in our study how the negative salinity anomalies match the reduction in deep water formation marked by the low concentration of oxic benthic fauna and the absence of *Cibicides pachydermus*. <u>This part has been added in the revised form of the manuscript.</u>
The hydrological variability recorded in core MD90-917 presents a different feature compared to the south Adriatic core AD91-17 as indicated by both the *Globigerina bulloides* $\delta^{18}O$

record (the $\delta^{18}O$ record displays no marked fluctuations for the Middle to Upper Holocene) and Uk37 SST reconstructions except for a short cooling event centered at 3 ka (Sangiorgi et al. 2003). Our approach based on the reconstruction of the sea water $\delta^{18}O$ permits to independently quantify the salinity changes in the South Adriatic basin. Such changes have not been clearly evidenced in the study of Sangiorgi et al. (2003) due probably to the difficulty to deconvolve the $\delta^{18}O$ signal measured on the planktonic foraminifera in term of salinity and temperature changes. It is interesting to note that the cold spell identified by Sangiorgi et al. (2003) at ~3 ka was not observed by our SST reconstructions by the modern analogue technique. However, this short-term cold spell corresponds to the $\delta^{18}Ow$/salinity and $\delta^{13}C$ minima events and the coeval *C.pachydermus* $\delta^{13}C$ decrease in core MD90-917 according to previous micropaleontological reconstructions in the Adriatic basin (see Piva et al. 2008). The discrepancy between UK37 and SST based on faunal species, as pointed out by Sangiorgi et al. (2003), could be due to difference in growing season of the calcareous nannoplankton assemblages.
Similarly, the alkenone reconstructions in core AD91-17 indicate no cooling during the sapropel interruption and between 7.3 and 6.3 ka. Some of these discrepancies, beyond the growing season of the calcareous nannoplankton assemblages, could be also due to a different approach in the established age models for the two cores. In particular, Sangiorgi et al. (2003) used tephra layers recovered along the core as supplementary tie points for the age model of the core AD91-17. However, the origin of these tephra still remains quite doubtful because the authors did not perform any chemical analysis to discriminate the origin of these volcanic products. Several eruptions closely spaced time occurred between the Early to Middle Holocene. Among them, the Gabellotto Fiumebianco eruption from Aeolian Islands was previously recovered during the first step of the sapropel S1 followed by a second spike during the S1 interruption (Siani et al., 2004). In addition, other eruptions of vesuvian origin i.e. Mercato was recovered during and after the sapropel deposit in deep-sea cores as recently suggested by Caron et al. (2012).
As above this part of discussion will be added in the revised form of the manuscript.

Regarding the short-term hydrological changes I suggest to consider non only the influence of Po river but also the contribute of the other river as discussed in Frignani et al. (2005) and in Palinkas and Nittrouer (2006).

Reply 2#
We have taken into account these remarks in the introduction and in the section 6.1.2 of the revised form of the manuscript.

General language:
In my opinion the English is generally good even if there are some spelling mistakes (but I am not English-mother tongue).
- please adopt the same word "planktic" or "planktonic" in the text
- I suggest to change "tephra markers" with "tephra layers"

Reply 3#
We have taken into account these remarks in the revised version of the manuscript.

Minor comments:
Title - I suggest: Holocene hydrological changes and climatic variability in the South Adriatic sea

Reply 4#
We have taken into account these remarks by changing the title in the revised version of the manuscript.

Abstract
There are several repetition through the text, I would suggest to shorten the abstract
Line 1: adopt the same word "planktic" or "planktonic" in the text Line6:I suggest to change "tephra markers" with "tephra layers"

Reply 5#
We have taken into account these remarks in the revised version of the manuscript.

Introduction
Line 24: The sentence "However, comparison between land and marine proxies: : :" is not clear

Reply 6#
We changed the sentence in the revised version of the manuscript.

4359 Line 5: many informations are provided also by Sangiorgi et al., 2002
4359 Line 20: .. tephra markers: : :.. : tephra layers

Reply 7#
We have taken into account these remarks in the revised version of the manuscript.

Matherial and methods
Line 5 : : :double deposits sapropel S1: : :: I do not understand double deposits , may be "two sub-unit "

Reply 8#
We agree with the Referee #2, we change double deposits sapropel S1 with two sub-unit.

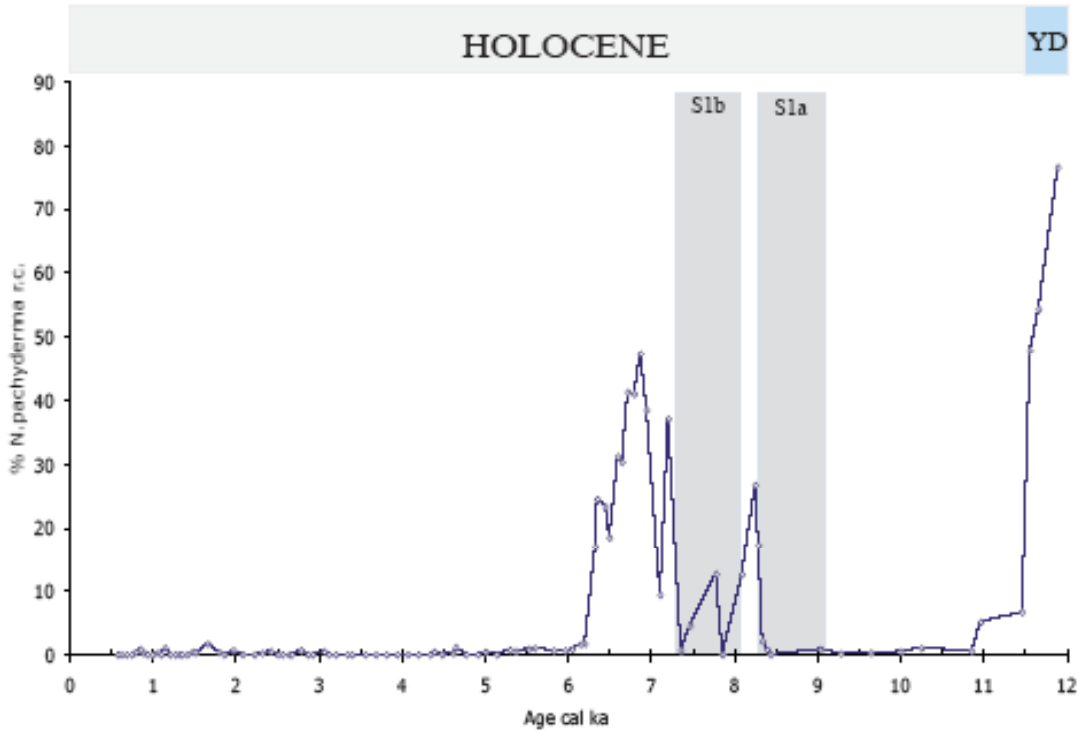
Line 28 sampling resolution every 2 cm: I suggest to indicate the resolution in time

Reply 9#
The sampling resolution expressed in time is already indicated in the paragraph 4 « Chronological framework » page 4365 line 21

Results
5.1 : It may be interesting to add also the distributional pattern of N. pachyderma. The cold events are associated to the N. pachyderma right coiling or left coiling? Please, give attention at the ecological requirements of this taxon.

Reply 10#
The cold events are associated to the occurrence of N. pachyderma right coiling. We don't find N. pachyderma left coiling species in our record. The N. pachyderma right coiling record was already published in Siani et al. (2010). Here, you can see below the complete record

with the new 35 supplementary points.



5.3: line 18: ..sapropelic horizons: : :why "sapropelic"?

Reply 11#
The profile of organic carbon (weight %) measured in core MD90-917 (Mercone et al., 2000) shows maximal values around 1%. In general, for values of Corg that do not exceed 1% it is used the terminology of sapropelic instead of sapropel ss.

Discussion
6.1.1
4371 line 14: : : :saprpel S1b event: : :.I suggest S1b "phase"

Reply 12#
We have taken into account this remark in the revised version of the manuscript.

4371 line 15: ..increase in the abundance of the benthic foraminifera Cibicidoides: : :.
This is wrong: the return of the oxic conditions are testified non ONLY by Cibicidoides but by different species of benthic forams (see litterature).

Reply 13#
We totally agree with Referee #2, we only mentioned Cibicidoides re-occurrence as it is the genus among the benthic foraminifera that seems to be more 'sensitive' to oxic conditions. Anyway, we have taken into account this remark.

6.2
It my be interesting to perform comparisons also with the eastern Mediterranean region in order to understand and provide additional informations about the origin of the identified climatic events.
The authors can also discuss here the data provided by Combourieu-Nebout et al. (1998) and Giunta et al. (2003) about the continental and marine paleoenvironmental evolution in the Adriatic sea basin during the last deglaciation and the early Holocene.

Reply 14#
We have taken into account these remarks and we have provided the suggested changes in the revised version of the manuscript.

6.3 I suggest as title: Frequency of the Holocene climatic variability in the SAS

Reply 15#
We have taken into account this suggestion and we have provided a new title of the 6.3.1 paragraph in the revised version of the manuscript.

Figures
Fig.1-caption: please, change in the lithological log the thickness of the grey lines (Astroni and Agnano are the same square). Grey lines mark: : :.their origin (I suggest their source)

Reply 16#
It is not possible to provide the suggested changes as the Astroni and Agnano Monte Spina eruptions do not correspond to a two distinctive glass-shard peaks in core MD90-917 but rather to a continuous cluster of marine tephra layers between 175 to 140 cm (see Fig.2b in Siani et al., 2004). This is due to the large number of eruptive events in the Phlegrean Fields between 5 to 3.8 ka closely spaced in time.

Fig.2: : : :two step sapropel unit: : :.I suggest two "phases" or "units"
Fig. 6: : :two step of sapropel: : :.. I suggest two "phases" or "units"
Insert in the caption: the yellow lines correspond to: : :.

Reply 17#
We have taken into account these remarks.

Fig 8 – I find the Fig 8 not convincing.

Reply 18
Concerning this point we mention here a recent published study from the Mont St Michel Bay Holocene coastal sedimentary record that reports evidence for enhanced storminess during the past 6.5 ka (Sorrel et al. 2012, Nature Geoscience). These authors showed the recurrence of high storm activity that occurred periodically with a frequency of about 1,500 years, closely related to cold and windy periods registered in the North Atlantic. This is a further study that overall confirms our conclusions.

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Piva, A., Asioli, A., Trincardi, F., Schneider, R. and Vigliotti, L. (2008). Late-Holocene climate variability in the Adriatic Sea (Central Mediterranean), The Holocene, 18, 153-167.

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