Response to Reviewer Comment 1

We would like to thank Alessandra Asioli for the helpful comments and suggestions that will help to improve the manuscript. Below we added our point to point reply to all comments. Referee comments are displayed in italic font, our response is written in normal font.

1) Section: Environmental setting Page 3, lines 36-38: "The WAC (<37 psu; Lipizer et al., 2014) moves as a narrow coastal band along the western Adriatic margin and is further enriched in nutrients and sediment by smaller river systems of the Apennines before it reaches the Gulf of Taranto." The reference cited (Lipizer et al. 2014) does not seem to me to treat the path of the WAC beyond Otranto channel into the Gulf of Taranto, as well as other references cited in the same section, such as Budillon et al 2010, Artegiani et al. 1997, Turchetto et al., 2007. It is important that the authors provide the correct references for this topic, as the results of the study are linked to paleoclimatic scenarios of the northern Adriatic basin (Po river area). Moreover, the authors should report an appropriated reference (not Milligan and Cattaneo 2007) reporting the path of the Padane sediment flux aside (and not mixed with) the Appenine flux, as illustrated in Fig 1.

We agree with the reviewer that in the settings section we mostly cite publications on the oceanography of the water currents up to the Strait of Otranto. To improve this section and underline our argumentation we will for example include studies of: Goudeau et al. (2014) (finding evidence that the dominant provenance of Gallipoli Shelf sediments originates from the western Adriatic mud belt, transported by the WAC), Grauel et al. (2013 a, b) (finding evidence that relatively nutrient-rich and fresher waters of the WAC influence the isotopic composition of surface-dwelling planktonic foraminifera on multi-decadal time scales) and Zonneveld et al. (2012) (finding a correlation between Po River discharge and the accumulation and relative abundance of dinoflagellate cysts in samples from the Gulf of Taranto and the Gulf of Manfredonia).
We agree with the reviewer that our phrasing suggests a strict separation between the Padane and Apennine sediment flux and we don't emphasize enough, that there is a mixing between the two. We will rephrase the corresponding section in the introduction and modify Figure 1 in the manuscript as suggested by reviewer 2. Furthermore, we generated a new record of clay mineral data using surface samples from the Adriatic Sea and the Gulf of Taranto to show that there is a spatial gradient in Padane and Apennine generated material (see Response to Reviewer Comment (RRC) 2 Figure 1). We will add a corresponding figure (in the style of Figure 6 of the current manuscript) and explanation to the main body of the text and rephrase respective sections in the discussion accordingly.

2) Page 3, lines 38-39 and page 4 lines 1-3: "The sediment supply from the southern Apennines is relatively small, but detectable near the coast through elevated Smectite concentrations (Degrobbis et al., 1986; Tomadin 2000; Milligan and Cattaneo, 2007) (Fig. 1 A). The stronger Padane detrital matter flux dominated by illite (from rivers Po, Brenta, Adige, Reno) is seen in a parallel band further in the basin (e.g. Milligan and Cattaneo 2007; Tomadin 1979, 2000) (Fig. 1 A)." Milligan and Cattaneo (2007) is the introduction to a special issue dedicated to the sediment dynamic in the western Adriatic Sea. I recommend the authors to go through the papers of the special issue for a more complete presentation of the Adriatic sediment deposition and path (for instance Syvitski and Kettner regarding the sediment contribution of the Appenine rivers vs total Adriatic sediment load (ca. 50%)).

We agree with the reviewer that our description of the depositional environment could be improved. We will include studies of for example Syvitski and Kettner (2007), Milliman and

Syvitski (1992) and Amorosi et al. (2016) and elaborate more on the northern Apennine sediment contribution to the Po River sediment flux and the central Apennine sediment contribution to the Adriatic Sea sediment load.

3) Section Methods: Regarding the age-depth model, it seems from table 1 and fig. 2 that the modern time (2011 year of the core collection) is present. It is not clear to me if the authors assumed that the modern sediment is present or they based on other data (the sentence at page 5 line 5-6: "The core tops contain basically undisturbed surface sediments as indicated by the presence of an oxidized sediment layer" seems to me not enough strong to support this assumption).

The maximum depth of oxygen penetration into the surface sediment of gravity core GeoB 15403-4 was identified by distinct color changes at 6 cm. The oxygen penetration depth in a multicore from the same station (GeoB15403-6) was identified at 8cm sediment depth. Furthermore, when the core was opened and sampled, the sediment surface appeared undisturbed with no indications of compression or sediment loss as seen on core pictures. Therefore we argue, that the core top represents the year 2011 when the core was retrieved. To support this, we correlated Ca/Ti data from XRF core scanning to the adjacent sediment core DP30, which contains modern sediments at the core top as proven by ^{210}Pb dating (Goudeau et al., 2014) (see RRC3, Figure 1). Although accumulation rates at the two sites are different, the close correspondence of the Ca/Ti records (further validated by the available AMS ^{14}C ages) suggests undisturbed records and confirms the reliability of our age model. The presence of an undisturbed sediment surface in GeoB15403-4 is further supported by the continuation of the Ca/Ti curve at site GeoB15403-4 since it was sampled few years after core DP30. Explanations will be added to the manuscript appropriately.

4) Page 6 lines 8-9 "The age model for GeoB15403-4 is based on 11 analyses of surface dwelling planktonic foraminifera by the AMS 14C method". Please report the species of planktonic foraminifera picked up for the radiocarbon dates.

We selected shells of surface dwelling planktonic foraminifera, preferentially *Globigerinoides ruber* (variety pink and white), *Globigerinoides conglobatus*, *Globigerina bulloides*, *Orbulina universa* and *Globigerinella siphonifera*. We avoided shells of subsurface-dwelling taxa such as *Globorotalia inflata, Globorotalia truncatulinoides,* and *Neogloboquadrina dutertrei*. This information will be added to the methods section.

5) Page 6 lines 9-11: "Radiocarbon dates were converted to calendar years using the MARINE13 database (Reimer et al., 2013) with a Delta R value of 73_34". Please explain how the Delta R has been calculated.

Delta R was calculated based on a weighted mean between the adjacent stations MapNo 234 (Lon.: 40.83; Lat.: 18.33) and MapNo 238 (Lon.: 42.5; Lat.:17) derived from the marine reservoir correction database MarineChrono (www.calib.org/marine/). We will include this information in the methods section of the manuscript.

6) Section 5 Discussion Page 9 lines 6-7. "Low Sm/Ill ratios therefore document a strong influence of the Padane flux. Minima occur around 1750 AD, 1470 AD and 1250 AD (Fig. 9 D). They coincide with high abundance of SIIBF (Fig. 9 B). I agree regarding the correspondence between 1750AD minima and abundance peak of SIIBF, but it is not much clear the correspondence between the other more recent Sm/Ill minima and SIIBF peaks, as *the amplitude of the SIIBF fluctuations before 1750AD is not very high and it seems difficult to select the abundance peak corresponding to the Sm/Ill minima. The authors may trace correlation lines among the peaks.*

We will consider this issue in the revised version, either by modification of Figure 9 to show the correlation more clearly or by rephrasing the description accordingly.

7) Please check the text for typing errors (for instance Despart instead of Desprat page 2 line 30; Degrobbis instead of Degobbis page 3 line 39) while some reference in the list is not complete (for instance, Lipizer et al. 2014, Luterbacher et al., 2012, Rodolfi 1988).

All references will be double checked and typing errors will be corrected.

Cited References:

Amorosi, A., Maselli, V., and Trincardi, F., 2016, Onshore to offshore anatomy of a late Quaternary source-to-sink system (Po Plain–Adriatic Sea, Italy): Earth-Science Reviews, v. 153, p. 212-237.

Goudeau, M. L. S., Grauel, A. L., Tessarolo, C., Leider, A., Chen, L., Bernasconi, S. M., Versteegh, G. J. M., Zonneveld, K. A. F., Boer, W., Alonso-Hernandez, C. M., and De Lange, G. J., 2014, The Glacial-Interglacial transition and Holocene environmental changes in sediments from the Gulf of Taranto, central Mediterranean: Marine Geology, v. 348, p. 88-102.

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Milliman, J. D., and Syvitski, J. P., 1992, Geomorphic/tectonic control of sediment discharge to the ocean: the importance of small mountainous rivers: The Journal of Geology, v. 100, no. 5, p. 525-544.

Syvitski, J., and Kettner, A. J., 2007, On the flux of water and sediment into the Northern Adriatic Sea: Continental Shelf Research, v. 27, no. 3-4, p. 296-308.

Zonneveld, K. A., Chen, L., Elshanawany, R., Fischer, H. W., Hoins, M., Ibrahim, M. I., Pittauerova, D., and Versteegh, G. J., 2012, The use of dinoflagellate cysts to separate human-induced from natural variability in the trophic state of the Po River discharge plume over the last two centuries: Marine pollution bulletin, v. 64, no. 1, p. 114-132.