The manuscript "Pollen-based reconstruction of Holocene vegetation and climate in Southern Italy: the case of Lago di Trifoglietti" by Joannin *et alii* provides new important data on the Holocene vegetation history of Southern Italy. Despite the very high quality of pollen analysis, the manuscript shows a major weakness in the quantitative reconstruction of the past mean annual precipitation by means of the Modern Analogue Technique (MAT), which has been extensively used to detect and support climate changes from the pollen record. Such reconstructed precipitation values, ranging from 500 to 900 mm, appear too low to support the local presence of dense woodlands dominated by *Fagus sylvatica* and *Abies alba* throughout the Holocene. This raises doubts on the accuracy of the applied methodology to reconstruct the palaeoclimate.
I recommend publication pending on a major revision of the work taking into account the following general comments and detailed remarks.

General comments

- The authors state that a mountain forest ecosystem dominated by beech and fir trees was established in the surroundings of Lake Trifoglietti since at least 11,000 cal. BP and lasted until the Late Holocene. This assumption contrasts with the reconstructed mean annual precipitation rates (Fig. 9), which are too low (500 mm$<P_{ann}<$900 mm) to support the local presence of this type of vegetation throughout the Holocene. According to Quézel (1998, Forêt méditerranéenne 19,2, p. 93-104), firs are very demanding from the standpoint of water requirement. At present the natural populations of Mediterranean *Abies* live in areas where mean annual precipitations are above 1000 mm. Blasi (2005, Il Fitoclima d'Italia) includes the forest coenoses dominated by *Fagus* with *Abies alba* in Calabria within very humid ombrotypes of the supratemperate bioclimate ("Supratemperato ultraiperumido-iperumido" and "Supratemperato iperumido"). Ducci *et alii* (1998, Forêt méditerranéenne 19,2, p. 153-164) show the climate parameters of the natural populations of *Abies alba*, which are characterized in Calabria by very high mean annual precipitations (>1800 mm). Hence, it is difficult to hypothesise in a recent past an adaptation of these vegetation types to the precipitation range proposed in the present study. Moreover the mean annual precipitations produced by MAT are rather far from the present day values. The record (Fig. 9) is therefore unable to replicate the current precipitation variability displayed by the ombrothermic diagram of the meteorological station chosen as reference (see Fig. 3). As the authors give major emphasis to this quantitative reconstruction, I suggest them to explain accurately the quality of their data in paragraph 3.3.3, also adding lines concerning the detailed procedure undertaken to obtain them.

- In section 4.2.4 the authors reconstruct the fluctuations in water depth at Lago Trifoglietti, as reflected by variations in the hygrophilous taxa (Figs 7 and 8), through the ratios of indicators of lake development and those characteristic of peatland. The authors use *Alnus*, *Botryococcus* and fern (*Osmunda* and monolete spores) for their function. Although the hygrophilous coenoses evolution is consistent with a quite convincing hydrosere succession, one should be cautious in choosing the above mentioned indicators for quantitative hydrological reconstructions, since their development may be not unequivocally related to water level variations. For example, the development of *Osmunda* may also reflect the establishment of local oceanic climate conditions rather than hydrological dynamics of the lake. *Osmunda* can grow in different micro-habitats, with soils characterized by different moisture conditions, within the same area (e.g. under-wood, or spring and stream present in the area, see P 2228, L 1-2). The local record of *Alnus* may also be increased by wind-transported pollen from well-development alder coenoses elsewhere in the region. Reille (1984, Pollen et Spores 26, 43-60) suggests that *Alnus* experienced a typical Subboreal development in the Mediterranean domain. This is evident in many sites of the northern and central Tyrrhenian Sea as already discussed by Di Rita *et alii* (2010, Journal of Paleolimnology 44, 51-67). The authors should take into account this hypothesis, the more so that they state that "Pollen catchment is likely to include lower-altitude vegetation signals due to the topography of the

Catena Costiera Mountains and by ascending air flow along the slopes" (Page 2234, Lines 21-23). Moreover, they should explain why other aquatic indicators have not been considered in their water-depth reconstruction.

- In some parts of the discussion the authors rely on their reconstructed palaeoclimate and palaeoenvironmental record more than on the pollen record. This is the case, for instance, of the vegetation development recorded at Trifoglietti from ca 5200 to 3500 cal. BP (Zones T6-T9). From 5200 to 4300 the authors hypothesise a more humid climate than in the preceding phase on the basis of an increase in the reconstructed water depth, in spite of a clear reduction of AP frequencies between ca. 5000 and 4600 mainly related to low values of moisture-demanding trees (*Fagus* and *Abies*). The associated increase in NAP percentages was tentatively attributed to a development of both *Phragmites* and aquatic sedges consistently with the increased water level, while the clear decrease in AP was simply interpreted by the authors as a bias in AP_{wa} percentages partly influenced by autocorrelation between percentages due to high amounts of aquatic plants and *Osmunda*. However, the increase in Poaceae and anthropogenic indicators and the low frequencies of *Fagus* and *Abies* may also be interpreted as decreased humidity and/or increased human activity that should be considered in the discussion.
From ca. 4300 to 3500 the authors suggest drier climate conditions on the basis of the reconstructed P_{ann} between 4400 and 4000 cal. BP and by the reconstructed water depth between 4000 and 3500 cal. BP. The pollen record partly contrasts this interpretation, since high amounts of *Fagus* and *Abies* between ca. 4600 and 4000 indicate forest development under humid conditions. An accurate description and interpretation of the signal recorded in the pollen diagrams of Southern Italy during the climate oscillation occurred at around 4 ka BP would be very useful to assess the amplitude and magnitude of this event and the regional environmental response.

- The data are sometimes difficult to read. The comparison between Figs 7 and 8 reveals a discrepancy in the percentage values both in the Aquatics and AP records, particularly appreciable in zones T6 and T7. These different frequencies do not depend on the depth/age conversion, but possibly on a different composition of the aquatics in the two records. Please explain the nature of these differences.

- The chronological limits of the early, middle and late Holocene are not clear. For example, in the section 5.1.3 the early Holocene ranges from 11,000 to 9000 cal. BP (P 2244 and L 5-22), while in the section 5.2.1 it includes also the time interval 9000-6000 cal. BP (P 2246-2248).

- I suggest producing a concentration diagram of the most important pollen taxa and ecological groups. This would be useful to interpret the data when problems of pollen percentage representation are envisaged.

- The authors should take into account also other palynological references from Southern Italy that may help to support climate processes and spells recognized at Trifoglietti: Caroli and Caldara (2007, Vegetation History and Archaeobotany 16: 317–327); Di Rita *et alii* (2011, Palaeogeography, Palaeoclimatology, Palaeoecology 310: 139-151); Calò *et alii* (2012, Palaeogeography, Palaeoclimatology, Palaeoecology 323–325:110–122); Di Rita (2012, Quaternary International, doi: 10.1016/j.quaint.2011.11.030);

Detailed remarks

Title: "Lago di Trifoglietti" or "Lago Trifoglietti". Use the same name in the text and figures.

Page 2224, Line 23-25: the pollen record approximately starts with the possible PBO oscillation. The authors do not have evidence of what happens before, so I suggest them to mitigate the phrase “marked decline in timberline altitude”.
P 2227, L 19: “Carta dei suoli Regione Calabria, 2007” it is not reported in the reference list.
P 2228, L 21: *Helichrysum italicum*.
P 2229, L 3: builds up.
P 2229, L 16: change “sedgebed” with “sedge bed”.
P 2230, L 10: The cores were split…
P 2231, L 4: program Calib 6.0 (Stuiver and Reimer 1993); in Radiocarbon 35, 215-230. IntCal09 Calibration dataset (Reimer et al., 2009).
P 2231, L 8: Please indicate which program was used to calculate and plot the age-depth model and motivate the choice of a cubic-spline interpolation method.
P 2231-2232 (Section 3.3.2): Here the authors should better define which taxa and/or groups are excluded from the main pollen sum for the calculation of the relative frequencies, since the text is vague. Please include a detailed list of the excluded pollen and other palynomorphs.
P 2231-2232: In the same Section 3.3.2 the authors should also better clarify the composition of the AP_t and AP_{wa} percentages. The percentages of AP_{wa} are calculated excluding also Aquatics and *Eupatorium* from the NAP. Instead AP_t are calculated including all NAP. For this reason in some parts of the diagrams AP without *Alnus* show rates higher than the total AP (Figs 7 and 8). This complicates the readability of the data.
P 2232, L 12: “*Plantago major*/*P. media*” is maybe more correct.
P 2232, L 12: delete “and spore producers:”
P 2234, L 20: write *Quercus robur* tp., as in Fig. 6, instead of *Quercus* caduc.
P 2234, L 24: The *Osmunda* percentages (10-30%) are... instead of “The *Osmunda* pollen...”
P 2235, L 25: Cichorioideae
P 2236, L 24: Madonie Mountains
P 2236, L 25: sclerophyllous
P 2237, L 13: Zone T-7 (ca. 5100-4650 cal. BP)
P 2237, L 19: What is meant by “filter role of the *Alnus* fen”?
P 2238, L 25: Asteroideae
P 2240, L 7-9: This phrase is a bit confused. Please rewrite it, adding a complete math function if possible.
P 2242, L 1: mesophilous
P 2244, L 16: *Ostrya/Carpinus orientalis*
P 2244, L 19: sclerophyllous
P 2246, L 13: “inland” instead of “onland”
P 2248, L 10-15: between 6800 and 6500 cal. BP the anthropogenic indicators are not particularly developed with respect to other time intervals. On the basis of the AP decrease and the continuous records of anthropogenic indicators and cereals one could infer human impact also between 9600 and 9000 cal. BP. I suggest adding archaeological references in the discussion of the phase between 6800 and 6500 cal. BP.

Table 1: 14C with 14 in superscript
Figure 1: include the reference of Lago Battaglia (Caroli and Caldara 2007; Vegetation History and Archaeobotany 16: 317–327) and report it in the reference list.
Figure 3: include the recorded time interval for the ombrothermic diagram.
Figure 5: quote the program used to plot the age-depth model and explain what envelopes represent.
Figure 7: please add a calibrated timescale close to the depth.