We are thankful to both reviewers for their critical comments and suggestions, which we thoroughly considered. Most of them were incorporated in the revised manuscript, which we believe is greatly improved as a result. All changes are listed in the detailed point-by-point response letter below.

**Comments to Referee #1:**

**Referee #1:** "… the oak TRW data they use are simply not up to the task and are not responsive enough to hydroclimate. I cannot see how these data could lead to any confidence about the "trends" in hydroclimatic extreme in the CR."

**Response:** To our knowledge, there is no other countrywide oak tree-ring width dataset of similarly high replication and spatiotemporal extent. Moreover, it is well known that the growth-climate response of Central European oaks is generally lower than the temperature signal often found in conifers from upper or northern treeline ecotones. However, oak represents the most important deciduous species for the development of multi-centennial or even multi-millennial long tree-ring composite chronologies for large parts of Central Europe, because this species accounts for most of the historical timber (e.g. Tegel et al. 2010). Moreover, many recent studies successfully used living and historical oak samples to reconstruct year-to-year and longer term changes in local to synoptic-scale spring-summer precipitation totals and/or drought variations (Kern et al. 2009; Büntgen et al. 2010, 2011b; Cooper et al. 2013; Wilson et al. 2013; Rybníček et al. 2015b). The reported climate sensitivity in all these studies did not exceed correlation coefficients of 0.5 significantly. In this regard, we are convinced that our newly developed dataset of 3194 oak (*Quercus* spp.) ring width samples from living and historical oaks from all over the Czech Republic represents a sound basis for providing a robust perspective on temporal changes in the frequency and intensity of hydroclimatic extremes back to 761 AD. It should be further noted that we deliberately restricted all time-series analyses and subsequent climatological interpretations to the high-frequency domain only, where the signal-noise ratio is generally enhanced.

**Referee #1:** Ultimately, the main question that must first be better addressed is what environmental factors are driving the extreme annual values in the oak TRW chronologies. With a calibrated signal of only 18-20% to precip/SPEI, one must not forget that 80% of the variability in the chronologies is explained by something else.

**Response:** Although a multitude of factors has been applied to assess the growth-climate response patterns of the Czech oak composite tree-ring width (TRW) chronology, i.e. negative and positive TRW extremes were compared with instrumental measurements back to 1805AD, with documentary-based temperature and precipitation reconstructions between 1804 and 1500, as well as against documentary evidence before 1500 AD.), we **deliberately did not calibrate the new extreme year proxy record to any meteorological target.** Nevertheless, we could demonstrate that negative TRW extremes coincided with above-average March–May and June–August temperature means and below-average precipitation totals. Positive extremes coincided with higher summer precipitation, while temperatures were mostly normal. Mean sea level pressure (SLP) over the European/North Atlantic sector suggested drought for the negative oak TRW extremes, whereas the positive extremes corresponded to wetter conditions overall. More consistent patterns of synoptic SLP were found for negative rather than for positive extremes.

**Referee #1:** If the authors plotted the chronology ensemble and the main hydroclimate parameters, how many extreme years (positive and negative) actually agree between the proxy and actual data – not many I would guess.

**Response:** A total of 26 years with negative TRW extremes were identified in the 1805–2010 period. While MAM and JJA Czech precipitation totals and SPEI-1 values were significantly below mean ($p < 0.05$), temperatures did not diverge significantly from normal patterns. Moreover, temperatures fluctuated on a broad scale in both seasons (Fig. 4). Thus negative extremes correspond to dry conditions, when tree growth stress is particularly related to the shortage of available precipitation. In contrast, the climate patterns 25 for the 23 years with positive extremes were less pronounced. Only JJA precipitation totals and SPEI-1 show the above-mean values that might indicate a surplus of moisture and favourable conditions for oak growth. Both MAM and JJA mean SLP fields in extremely negative (positive) seasons in the instrumental period indicate circulation patterns that are highly favourable to the occurrence of dry (wet) conditions in CE (Fig. 5). For negative extremes, a statistically significant increase of SLP in a large part of Europe in spring emerged in comparison with the reference period. The positive pressure anomaly diminished somewhat in the summer months. Positive pressure anomalies signal below-mean precipitation totals and above-mean temperatures in both seasons. This corresponds to the characteristic prerequisites for drought occurrence in CE.

**Referee #1:** Although hydroclimate might be the dominant factor, it still only explains 20% of the TRW variability. … Much more is needed to try and model better the controlling factors of the inter-annual.
**Response:** See our earlier responses. Moreover, we added a new text better explaining how the relative homogeneity of environmental factors affecting CR oak chronology was controlled:

Possible differences in oak growth due to different geography and role of environmental factors (e.g. soil types, altitude) in western and eastern part of CR were tested as follows: two separated chronologies were composed for Bohemia and Moravia and compared over the common period 960–1826. These two chronologies are extremely similar to each other: overlapping by 867 years, the t-value according to Baillie and Pilcher (1973) is 19.43 and the value of Gleichlaufigkeit (Eckstein and Bauch, 1969) is 70.88% (Kolář et al. 2012).

**Referee #1:** I assume the authors have also examined more secular scale changes in the TRW data, when appropriately detrended, and I wonder if these data would be simply be better at decadal and longer time-scales?
**Response:** We deliberately restricted all time-series analyses and subsequent climatological interpretations to the high-frequency domain only, where the signal-noise ratio is generally enhanced. Developing a high-frequency, extreme year record of oak growth back to 761 AD is actually the focus of this paper.

**Referee #1:** Perhaps consider more comparison to extremes in other TR records such as Brazdil (2002) and further afield records (including Oak and conifer records from Germany??) and possibly the gridded multi-proxy (but dominated by historical data?) precipitation/ hydroclimate products of the Luterbacher group (e.g. Pauling etc).
**Response:** Further comparison beyond documentary evidence was added. Revised version was completed with a complete list of negative and positive extremes (Table S1 in supplement). This table compares TRW extremes found in oak chronology with seven different documentary, tree-ring and instrumental data sets from Central Europe. Following text was added:

Complete list of 144 negative and 134 positive extremes identified in Czech oak TRW oak chronology in the 761–2010 period is provided in Table S1 in supplement. Moreover, CR oak extremes were validated against hydroclimatic extremes identified in seven various datasets compiled from documentary evidence, tree-rings and instrumental measurements from Central Europe. Besides proxy reconstructions from the territory of CR (Brázdil et al., 2002; Büntgen, 2011a; Dobrovoný et al., 2015) another datasets from Central Europe were used for comparison. Several TRW hydroclimate reconstructions exist for central and southern Poland – the territory that has precipitation/moisture regime comparable to CR. Cross-checking of CR oak extremes against two Scots pine tree ring chronologies sensitive to hydroclimate from Upper Silesia and southern Poland in the 1770–2010 period (Opala and Mendecki, 2014) and the 1568–2010 period (Opala, 2015) was done.

As our new oak chronology covers much longer period of time compared to other datasets, reasonable validation may be done not until the beginning of 14th century. Even if this type of direct validation may be biased due to several factors (e.g. length of common period, different way of the negative/positive year definition, different species of tree-ring chronologies and their different sensitivity to hydroclimate), we were able to confirm 67% of negative and 56% of positive extreme years found in CR oak chronology from the beginning of 14th century. Over the common period 1770–1932 we found an agreement for 89% and 57% negative/positive extremes.

**Referee #1:** I believe the authors should also read the recent paper by McCarroll et al. in The Holocene, “Measuring the skill of variance-scaled climate reconstructions and a test for the capture of extremes” which could provide an alternative method of assessing how well the TRW data actually represent extreme climate.
**Response:** We actually did read the paper by McCarroll et al. (2015). However, the statistical measures proposed in this paper – especially ‘Extreme Value Capture’ may be very useful to quantify how well proxy-based reconstruction is able to capture extremes. In our paper we did not any calibration or reconstruction. We think that the above mentioned measure can be hardly used.

**Referee #1:** Page 3110, line 27: we are a long way from modelling high frequency hydroclimate. Consider removing this statement.
**Response:** Accepted and removed

**Referee #1:** Page 3111, line 26: . . ..essential for. . ...
**Response:** Accepted and corrected

**Referee #1:** Page 3112, line 14: . . ..have, to date, been. . ..
**Response:** Accepted and corrected

**Referee #1:** Page 3113, text w.r.t. Fig 1a, b: It seems to me that there is an obvious NW / SE split to the CR data-set with about 150-200kms between the centres of both regions. Although I am sure there would be some similarities in hydroclimate between these regions, there surely would be some differences as well which could impact on the analyses. Did the authors consider splitting the country into two regions? Some compromise might need to be made w.r.t. replication and chronology expressed population signal quality, but it could refine the regional relevance of such records? This is just a suggestion and maybe has been addressed in other papers.

**Response:** Yes, we considered this aspect. In revised version of our manuscript new text was added as follows:
Possible differences in oak growth due to different geography and role of environmental factors (e.g. soil types, altitude) in western and eastern part of CR were tested as follows: two separated chronologies were composed for Bohemia and Moravia and compared over the common period 960–1826. These two chronologies are extremely similar to each other: overlapping by 867 years, the t-value according to Baillie and Pilcher (1973) is 19.43 and the value of Gleichlaufigkeit (Eckstein and Bauch, 1969) is 70.88% (Kolář et al. 2012).

**Referee #1:** Page 3113, line 22: Delete “quite”
**Response:** Accepted and corrected

**Referee #1:** Page 3116, lines 14-21: It would be useful to plot the chronology ensemble with the precip/SPEI time-series with an associated table listing the 10 or 20 most extreme positive/negative years in the instrumental data and how many of them the TRW data actually capture (including intensity?). With r values of around 0.4, I would imagine that they proxy data do not capture many of these extreme events well. Also – for correlations, state what period analysis was undertaken over, and were the instrumental data high pass filtered in the same way as the TRW data.
**Response:** In this paper we used a correlation analysis to optimize the selection of the season for which oak TRW extremes are compared with several climate variables. This was the only intention of the first paragraph of Section 3. Here we correlated high-pass filtered oak TRW chronologies (that are used for selection of positive / negative extremes) with climatological series. For real calibration (which was not aim of this paper) would be necessary to use different standardization (e.g. that would

preserve both high and low frequency signals). Referee's suggestion was realized in the form of table S1 in supplement. Besides the full list of positive and negative extremes we added comparison between CZ oak extremes and CZ reconstructed (1501– 803) and measured (1804–2010) precipitation along with their ranking.

**Referee #1:** Page 3117, line 17: Considering showing a STD or RCS version of the TRW chronology for better assessment of long term trends with inference of decadal long drought and pluvials – with caveats that the TRW chron actually matches well with the instrumental data.
**Response:** See our response above. We restricted our analyses to the high-frequency domain only. Developing a high-frequency, extreme year record of oak growth back to 761 AD is actually the focus of this paper.

**Referee #1:** Page 3121, line 18: . . ...still an open. . .. . .. NB. Discussion on response of both species has already been mentioned earlier. These few lines could be removed.
**Response:** these lines were removed

**Referee #1:** Page 3122, lines 12-21: The authors state exactly my concerns about the record here. For these reasons alone, even the authors surely can see that this TRW record is not fit for this specific purpose.
**Response:** We agree that our TRW oak chronology is far from ideal. However, from many aspects and also – more formally - from several computed statistics frequently used in dendroclimatology our oak TRW chronology is comparable with similar databases – see details in our first response above.

**Referee #1:** Page 3122, line 26: w.r.t. Buentgen (2011), was pollution not a factor in the recent period for Fir? Could this not also be a factor for Oak as well?
**Response:** New text was added: Thus, for example, Büntgen et al. (2011a) discussed reduced sensitivity of fir TRWs to drought in southern Moravia. Authors – among other stressors – mentioned air pollution as a possible factor that may be responsible for temporal instability in the growth–climate relationship. Significant tree growth reduction of conifers due to high $SO_2$ concentrations in Northern Bohemia was already proved (Rydval and Wilson, 2012). Thus one can assume that the gradual increase of air pollution in Central Europe since 19th century was the factor affecting also oak TRW growth–climate relationship.

**Referee #1:** Page 3123, lines 17-28: One of the difficulties with Oak is its deep tap root to it is likely that they truly only respond to drought when ground water is in significant deficit. Therefore, winter precipitation and ground water re-charge is surely a factor in modulating tree growth response during the spring/summer period. Possibly worth more discussion on this issue as I am sure it is a crucial factor in the poor response of these trees to hydroclimate. As I said above, tree-growth modelling may help with this.
**Response:** We realize that the growth response of Oak to climate and other environmental factors is very complex. Its quantification requires precise site control (e.g. Rybníček et al. 2015b), much more extensive climate database (e.g. Friedrichs et al. 2009) and possibly also a modelling approach. Precise site control and detailed database on climate conditions is available only for relatively short part of the chronology and this type of study, however, was not the main aim of this paper.
As mentioned above, oak TRW climate sensitivity reported in numerous studies did not exceed correlation coefficients of 0.5 significantly. Our correlation analysis (rxy = 0.43 for March–June precipitation totals) was applied to high-pass filtered data and one can suppose that the correlation results for real calibration may be better.

**Referee #1:** Page 3124: It is not clear to me why there is so much discussion on the 1540 drought. Pauling et al. clearly showed this to be an extreme year and the CR TRW oak data show a lagged response in 1541. Overall, as authors say, this just highlights that again, these data are not good for such analyses.
**Response:** This part of discussion on 1540 was significantly reduced in revised version:

Such disagreement is particularly remarkable for 1540, classified by Wetter and Pfister (2013), on the basis of numerous documentary sources, as one of the hottest years for the previous 500 years in a substantial part of Europe. The Czech oak TRW chronology classifies 1541 as a negative extreme. It seems highly probable from combining information from documentary sources and tree rings that the extremely warm and dry weather of 1540 is at least partly “hidden” in some tree-ring datasets dating to 1541 and/or 1542. All these uncertainties lead to the conclusion that the absolute intensity of such extremes is difficult to estimate, at best, to evaluate from any type of proxy record.

**Referee #1:** Page 3124, lines 26-27: Not clear what is meant by “. . . also disclosed by the results in this contribution”???
**Response:** accepted and corrected: “…were also identified in the Czech oak TRW chronology.”

**Referee #1:** Page 3125: Much of this discussion simply highlights the mixed signal nature of the oak TRW record and the authors are arguing themselves into a corner as to the utility of these data to assess extremes.
**Response:** We think that “the mixed signal nature” is common to all proxies. As already mentioned above, negative and positive Oak TRW extremes were compared with instrumental measurements back to 1805AD, with documentary-based temperature and precipitation reconstructions between 1804 and 1500, as well as against documentary evidence before 1500 AD. We demonstrate that negative TRW extremes coincided with significantly below-average March–May and June–August precipitation totals and SPEI. Positive extremes coincided with significantly higher summer precipitation and SPEI. Moreover, comparing Czech Oak TRW extremes with seven different moisture-sensitive datasets from Central Europe we found an agreement for 89% negative and 57% positive extremes in the common period 1770–1932.

**Comments to Referee #2:**

**Referee #2:** The state of art part needs additions. Lack of some important citations in the field of dendroclimatology of Central Europe, which should be discussed and added especially in the introduction part and for comparisons. For example many papers on dendroclimatic reconstructions were recently published for area of Poland, in the context of Central Europe (see for example: Przybylak et al. 2010, Szychowska-Krapiec, 2010, Koprowski et al. 2012, Opala and Mendecki 2014, Opala 2015). There is also much more literature considering potential of oak chronologies and its growth responses (see for example: Krapiec 1998, 2001, Ufnalski 2006, Cedro 2007, Bronisz et al. 2012). Check also the new findings connected with dendrochronology of oak in Europe published by Wazny et al (2015). You are only given examples of papers. Please pay more attention to look through literature.
**Response:** We appreciate the list of papers that will definitively help updating the present “state of the art” and discussion parts. In the revised version we included especially those papers that are dealing with oak and hydroclimate and papers that provide concrete list of negative/positive years (Cedro, 2007, Bronisz et al., 2012 and especially Opala and Mendecki, 2014 and Opala, 2015). These were used for direct comparison in a new Table S1. However, we did not included papers focusing to geographically different areas (e.g. Koprowski et al. 2012). From the same reason we do not compare our results with those from British Islands (Cooper et al., 2013; Wilson et al., 2013) or from South Eastern Europe (Wazny et al., 2015), because the precipitation/moisture regime are different from that of CR. We do not compare with studies presenting temperature extremes.

**Referee #2:** Very weak and short part connected with study area should be extended (give some information on relief differentiation, altitudes, soils, etc.). There is disproportionate amount of information on statistical methods. Better description of study area and some information about wood origin (since you utilize a lot of timber) is needed.
**Response:** More information on study area and on chronology compilation was added:

To build the oak chronology, 527 tree-ring series from subfossil oak trunks were processed, out of which 211 subfossil oak trunks were sampled in the past three years and 316 measurements were obtained from subfossil oak trunks found earlier in the Czech Republic. The tree-ring data of subfossil oak trunks were cross-dated using foreign chronologies (Friedrich et al., 2004; Tegel et al., 2010); in several cases C14 dating was also used.

Further, we used wooden archaeological finds, historic wooden constructions and living oak stands. The prevailing part of the human-touched material came from the High Middle Ages and more recent periods of settlement. In that time, oak wood was used for constructions with high mechanical loading and for constructions where material with high durability was needed. The highest proportion of oak can be found in constructions of belfries (bell holding frames), water constructions and wall enforcements. On the other hand, oak is seldom found in timber houses, ceiling constructions or trusses, where coniferous wood prevails in CR. In such constructions, oak wood is only used in areas where softwood does not occur (e.g. the Elbe River valley, the Bile Karpaty Mts.).

Compared to previous version of CR oak chronology (Kolář et al. 2012) additional sampling and collecting of 1036 series from living trees was done. Finally, the well-synchronizable tree-ring series were used to create a new oak chronology for the whole territory of CR.

Moreover, in discussion we also newly refer to possible differences between samples from western and eastern part of CR:

Possible differences in oak growth due to different geography and role of environmental factors (e.g. soil types, altitude) in western and eastern part of CR were tested as follows: two separated chronologies were composed for Bohemia and Moravia and compared over the common period 960–1826. These two chronologies are extremely similar to each other: overlapping by 867 years, the t-value according to Baillie and Pilcher (1973) is 19.43 and the value of Gleichlaufigkeit (Eckstein and Bauch, 1969) is 70.88% (Kolář et al. 2012).

**Referee #2:** The article describes the extreme years over the last 1250 years, but I did not find the exact dates of the particular extreme years in the text. It is hard to read these information from Fig. 3 or table 1 (only selected time period is presented). Since authors made a lot of effort collecting materials for long chronology this information should be described more precisely. Please modify table 1, or give full list of distinguished extreme years elsewhere. In the table 1 you should also give the years for which you did not find historical information.
**Response:** Full list of positive and extreme years identified in CZ oak TRW chronology is given in supplement. With respect to referee #1, we also added a more straightforward comparison of our findings against previously published results from independent studies. In the new Table S1 we summarize comparison with seven different datasets of extreme years found in documentary, tree-ring proxies and instrumental measurements.

**Referee #2:** In general more comparisons to extremes in other TR data are essential (for example check recently published paper by Opala M. 2015, dealing with TR record from closely located Silesia region, and paper by Szychowska-Krapiec E. 2010 from Malopolska region). Such comparisons are especially important as you did not find full match with historical records. In discussion the authors based mainly on the Buntgen et al. works, which are high quality, but there is much more research from this part of world.
**Response:** see our response to the first comment of Referee#2 above. Moreover the following text concerning validation of CZ oak extremes from different datasets was added:

Complete list of 144 negative and 134 positive extremes identified in Czech oak TRW oak chronology in the 761–2010 period is provided in Table S1 in supplement. Moreover, CR oak extremes were validated against hydroclimatic extremes identified in seven various datasets compiled from documentary evidence, tree-rings and instrumental measurements from Central Europe. Besides proxy reconstructions from the territory of CR (Brázdil et al., 2002; Büntgen, 2011a; Dobrovoný et al., 2015) another datasets from Central Europe were used for comparison. Several TRW hydroclimate reconstructions exist for central and southern Poland – the territory that has precipitation/moisture regime comparable to CR. Cross-checking of CR oak extremes against two Scots pine tree ring chronologies sensitive to hydroclimate from Upper Silesia and southern Poland in the 1770–2010 period (Opala and Mendecki, 2014) and the 1568–2010 period (Opala, 2015) was done.

As our new oak chronology covers much longer period of time compared to other datasets, reasonable validation may be done not until the beginning of 14th century. Even if this type of direct validation may be biased due to several factors (e.g. length of common period, different way of the negative/positive year definition, different species of tree-ring chronologies and their different sensitivity to hydroclimate), we were able to confirm 67% of negative and 56% of positive extreme years found in CR oak chronology from the beginning of 14th century. Over the common period 1770–1932 we found an agreement for 89% and 57% negative/positive extremes.

**Referee #2:** Results of correlation with climate are weak. Therefore, this part of the manuscript requires more ecological explanations and comparisons with other studies from similar environmental conditions. Please consider the research results described in the other papers.
**Response:** The purpose of correlation analysis in our paper was to optimize the selection of the season for which oak TRW extremes are compared with climate. This was the only intention of the first paragraph of Section 3. Here we correlated high-pass filtered oak TRW chronologies (that are used for selection of positive / negative extremes) with climatological series. We did not do any "calibration" in our paper. For real calibration (which was not aim of this paper) and subsequent reconstruction will be necessary to use different standardization (that would e.g. preserve both high and low frequency signals). Additionally, for substantial part of the new chronology (subfossil and historical woods) we have limited control of environmental conditions, which is needed for such types of study (e.g. Friedrichs et al. 2009 or Rybníček et al. 2015b).

**Referee #2:** Böhm et al., 2009 or 2010, which date is true?
**Response:** accepted and corrected to Böhm et al., 2010

**Referee #2:** Wetter and Pfister, 2013 are cited in the text as Wetter et al. 2013, this is not consistent with the requirements of the journal
**Response:** accepted and corrected to Wetter and Pfister, 2013