Reply to reviewer #2

Thank you very much for reviewing the manuscript and your comments. Below, the reviewer comments are presented in italics and our responses follow in normal letters.

The climate change in Europe during the last 100 years is an important scientific topic and question why it has happened is addressed in the paper through attributing the trends in temperature and precipitation to changes in atmospheric circulation. The method used is novel and data are suitable for that task. The questions rise in presenting methodology and presentation of results.

- We will improve the presentation of the methodology and the results following your suggestions below.

The used circulation types (CT-s) are defined by the objective SynopVis Grosswetterlagen, a new classification not very well known or used yet. After reading about the methodology by what the CT-s are calculated raises the question, why these types or classes are called circulation types? Huth et al (2007) defined the term circulation pattern/type: "A circulation pattern in this context means a field of sea level pressure (SLP), geopotential height, or possibly another variable describing atmospheric circulation that is defined for each time instant of the analysis (e.g., hour, day, month) and usually on a regular grid. We refer to such classifications as "circulation classifications," and individual groups (classes) are referred to as "circulation types."" When also other fields as temperature or humidity etc are used in classification they suggest to name these classes weather types or synoptic types or air mass types.

SynopVis Grosswetterlagen is the case when addition to classifying of sea level pressure and 500 hPa GPH fields, through what it is possible to describe the atmospheric flow or circulation, are added also the relative thickness of the lower troposphere (Z500–Z1000) and total column precipitable water (PWAT) fields. These two last characteristics describe the temperature and humidity of the air column. It is also admitted in the paper "to improve the method's ability to distinguish between relevant air mass types affecting the European region" (p12804 r16). Therefore I suggest to rename the types used synoptic or weather types as these names correspond better to the real essence of the used types. What brings along rewriting and rethinking of the whole concept of the paper. As it is not correct to name the trends "circulation-induced trends" (p 12810) if the classification does not describe only atmospheric circulation, but actually also the properties of air masses.

- We agree the SynopVis Grosswetterlagen are synoptic types which characterize the atmospheric conditions including circulation and air-mass properties over a large – synoptic – region. However, we still think, we can use the SynopVis Grosswetterlagen in order to differentiate between synoptic-circulation-induced trends and the mostly more local within-type trends. We will accordingly change the phrasing "circulation-induced trends" to "synoptic-circulation induced trends" and refer to the SynopVis Grosswetterlagen as "synoptic types".

My second concern relates to how the trend analysis is described (3.1, 3.2). The description is too long and difficult to understand, it should be rewritten. Indexing of variables should be uniform. If CT is used as an abbreviation of circulation type, it can not be used also as an index (eg p12806 r11), just a third index (j) should be used instead. These indices should be used also in equation (1). The common tradition is to write at first the equation and then to explain it, here it is vice versa. In Eq-s 2,3,4 is not clear to which wetness class belongs the cell when the average precipitation of the CT is equal to the period average. These were only some of the shortages that are mentioned.

- We will improve the description of the methodology following your suggestions on indexing and correction of equations.

The colours chosen for marking trends in figures are confusing. In the same figure positive trends for temperature and precipitation should be marked with the same colour and a colorbar for all subfigures should be added, then it is much easier to follow the figures. In some figures colourcode is not all introduced. The amount of very small figures is large, maybe it is somehow possible to condense the information in them to make the message of the paper more clear.

- We chose opposite colors for positive and negative trends in precipitation and temperature, as most people associate “red” with warm temperatures and dry conditions and “blue” with cold temperatures and wet conditions. Also with respect to the hydrological interpretation of the results, we think that warming and drying trends should be represented by the same color, as they during most of the time and in most regions (i.e. when there is no frost or snowmelt) lead to the same hydrological consequences, i.e. reduced water ability.

  A colourcode is included in all subfigures, with a scale indicating positive and negative values for the trends or a numeric scale in case of trend ratios. We realize that the manuscript includes are large number of small figures. In the final version of the paper each figure will cover a whole A4-page, which will hopefully improve readability. One option to condense more information into a smaller number of figures would be using a color scheme, which presents all combinations of positive and negative temperature and precipitation trends at different significance levels in one figure. However, in our opinion this would complicate the interpretation of the trends rather than simplifying it. We would therefore prefer to keep the figures as they are.