

## ***Interactive comment on “Impact of environmental changes and land-management practices on wheat production in India” by Shilpa Gahlot et al.***

### **Anonymous Referee #3**

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Comments on the MS The manuscript entitled “Impact of environmental changes and land-management practices on wheat production in India” is a very good study to quantify the role of various environmental factors and agricultural management practices on spring wheat production in India during 1980-2016 by Integrated Science Assessment Model (ISAM). Elevated atmospheric CO<sub>2</sub> and rising temperature are considered in environmental factors while nitrogen fertilizers applications and water availability through irrigation practices are considered in land management factors. The author’s effort is commendable however some minor corrections needed in the draft: 1) From 1980-2016 for every ppm rise in [CO<sub>2</sub>] level total wheat production of the country has increased by 0.37 Mt and 39% increase in production compared to the 1980-84 period (Fig. 6a; R<sup>2</sup> 0.97 while described in the draft R<sup>2</sup> 0.93) and thus a strong positive corre-

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lation has observed. While during the same period total wheat production increased at the rate of 0.10Mt for every kg nitrogen fertilizer-N/ha applied to the farm and 20% increase in production compared to the 1980-84 period (Fig. 6c; R2 0.39), a decrease of 8.38 Mt (~10% reduction) of wheat per degree Celsius increase in the average growing season temperature (Fig. 6b; R2 0.26) and 15% increase in production compared to the 1980-84 period due to increased irrigation. (Fig. 6d; R2 0.13). These factors have not shown a strong correlation that needs to improve. 2) In the draft different equations of the models are not shown e.g. Eq. A1, A2, A3 (line no. 170), Eq. A4, A5 (197); Eq. A6, A7, A8 (205); Eq. A9 (207), Eq. 10 (233), Eq. 11 (259) or may be included in the additional/supplement materials. 3) Data for the actual amount of water used for irrigation is not available. So in the SCON simulation, every grid cell is considered 100% irrigated and crops do not undergo water stress at any point in the growing season and all the regions are 100% irrigated. Since wheat is a non-monsoon crop, is highly dependent on the availability of irrigation. The development of irrigation water use datasets could reduce the uncertainty in simulating the effect of water stress on crop production. 4) Variation in wheat productivity in different regions as well as in different years of the study period (1980-2016) depends not only on environmental factors and management practices but also on the genetic factors, multiple cropping's, insect pests and diseases. Since 1980 various hybrids and high yielding wheat varieties were cultivated to increase the input use efficiency and higher economic yield. Similarly, in different climatic zones, area-specific resistant wheat varieties were also grown to enhance wheat productivity. The addition of new processes accounting for the effects of pests, multiple cropping and genotypes will make the simulations more representative of the Indian situation. 5) The study is more generalized for different climatic zones/spring wheat environment (SWE) while there is a need for more focused regional-scale studies. However, the study is an attempt to work in the similar direction with a focus on wheat in India. 6) In the draft multiple citations should be arranged in descending order of the publication year (line no. 54, 58-59, 68-69, 76, 79-80, 83, 137, 145, 212, 270-271, 277-278, 303) and citation of line no. 76, 212, 213 needs to correct

as per the formatting guidelines of the journal. 7) References missing for some of the citations in the draft e.g. FAO Statistic 2014 (line no. 43-44), Leaky et al. 2009 (58-59), Bondeau et al., 2007 (76, 80), Drewniak et al. 2012 (79-80), Lu et al. 2017 (80), Zhao et al. 2007 (168), Meinshausen et al. 2011 (179), Lamarque et al. 2011 (180), Ren et al. 2015 (197), Harris et al., 2014 (212), Viovy, 2016 (212), Meinshausen et al., 2011 (213), Lamarque et al. 2011 (214). 8) Some listed references have missing citation in the draft e.g. Ball & Berry 1987 (line no. 470-472), Chen 1992 (479-480), Drewniak et al. 2013 (488-490), Farquhar et al 1980 (500-501), Gill et al 2014 (505-507), Jonckheere et al. 2004 (508-510), Rajaram et al. 1993 (558-560), Xiaolin R. Weitzel et al. 2013 (595-598). 9) Some word formatting error needs to be corrected e.g. in line no. 110, 111, 382, and 511. 10) In the reference list prescribed journal format should be followed. As the reference of line no. 462-466, 542-545, and 569-571 seems out of the format.

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