Comment on manuscript
'Decreased virtual water outflows from the Yellow River Basin are increasingly critical to China'

Summary:

The article explains how the complexity of virtual water footprint network determining the situation of crop production under water scarcity in the Yellow River Basin (YRB), China. The mechanism of increasing water footprint network complexity pushing the continuous development of the Yellow River Basin with limited water resources has been revealed and discussed. The authors emphasized the necessity of both ecological sustainability and high-quality development with the fact that water footprint network complexity can also increase of difficulty of relieving water stress by simply replacing scarce water.

General comment:

The main conclusion of the article is supported by clear thinking and accurate data analysis. As the authors provide detailed interpretation of virtual water network related mechanisms over the YRB during historical period (1980s to 2000s), it is recommended to extend the time axis to more recent period and show projections for future scenarios of virtual water network and water scarcity or disasters within the YRB. The intuitiveness and readability of the Mathematical method description can be improved. A major revision is recommended for further works on this manuscript.

The detailed comments are listed below.

Comment list:

(1) Line 55: Easing water shortage in the YRB by transferring water across the basin may not contradict the main conclusion of this research. The complexity of water footprint network brings high uniqueness of the YRB and makes it not easily to be replaced by other regions. Is this case, water transferring can be a useful approach at least for the current period. The authors may adjust the related sentences of the literature review here.

(2) Line 70: The research focuses on the historical evolution of virtual water footprint in the Yellow River Basin by applying data from 1980s to 2000s. Is there more recent dataset available especially for the previous decade?

(3) Line 75: It is recommended to use more concrete and precise description to introduce the meaning of Mpc = 0, rather than 'otherwise'.

(4) Figure 1: Is it possible to visually explain the Mathematical methods via the figures here? The description of methodology needs to be more intuitive.

(5) Figure 4: Figure 4A shows that the diversification of YRB monotonically decreases during the whole time period. The uniqueness of YRB (indicated by Figure 4B, smaller number means higher uniqueness) has increased from 1978~1995 but then decreased during 1995~2000 before it increased again after 2000. This fluctuation has also been further

verified by Figure 4C, is there any reason or background for this?

(6) Is there any connection between virtual water network complexity and the resilience of water resources system against climate change and natural disasters in the target basin? This could be important especially when considering extreme weather events such as the extreme rain and flood events happened in northern China in summer 2021, which has caused both economy and agriculture damages. This might also show the importance of taking more recent time period into account and carrying out future climate scenario analysis in further steps of the research.