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Solid Earth Discussions

Interactive comment on "Formation and dynamics of sandy dunes in the inland areas of the Hexi Corridor" *by* Bing-Qi Zhu

Anonymous Referee #1

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General comments:

The paper of Bing-Qi Zhu focusses on formation and dynamic of changes of aeolian landforms (only sanddunes) and desertification in the Hexi Corridor in China. The methods used are satellite image interpretations, field investigations and observations, comprehensive evidences from geomorphological, aeolianâĂŘphysical, granulometrical and geochemical analysis to discuss the formation of dune landforms, the mechanism of desertification and their environmental implications in the Hexi Corridor.

The author concludes, that the Gobi area in the west Hexi Corridor is not the main source area of sandstorms in the middle and east of the corridor except north probably. In the past half century, the warming and humidification of local climate is the main cause of the reduction of sandstorms in the study area, and the Hexi Corridor has a

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potential trend of antiâĂŘdesertification, which is mainly controlled by climate change but not by human activities. For the oases areas of the corridor, however, the effective measures to restrict desertification depend on human activities. Restriction of the decline of groundwater is the key to preventing desertification in oases. The abstract is a bit too long and should be shortened.

The focus on dune formation in the Hexi corridor in China is an interesting approach and could be of international interest - but this paper should be rejected in its current version for the following six main reasons:

(1) The paper discusses also desertification processes – which should appear in the title and in my opinion this is not the scope of this journal.

(2) The structure and data used for this paper is a bit confusing. The author used different topics, e.g. geomorphological parameters such as transport processes and dune movement, grain-size and geochemical data, meteorological data sometimes without clear connection between these different processes, data and the methods used. The manuscript shows in some parts a lot of details and methods, but at a closer look, quite a lot of things are missing (e.g. to the methods or the quality / origin of the data) or they are not appropriate. In part, this may result from the different data and sometimes confusing structure of the text, which is often not concise enough to see the main research question(s) and follow a line of arguments.

(3) The movements of sand including desertification processes were already mentioned and discussed decades ago, e.g. by Zhu et al. (1988). There is a long reference list including 32 papers in Chinese – but important international papers on desertification and sand movement are missing. There are more international papers focusing on desertification and dune movement worldwide and in China, which must be considered, e.g. the review on desertification in China from Wang et al. (2008). In addition, papers focusing on the aeolian sediments in the Hexi corridor (e.g. Nottebaum et al.) are not considered.

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(4) The substantial conclusions by the author are: the Hexi Corridor has a potential trend of antiâĂŘdesertification, which is mainly controlled by climate change but not human activities. For the oasis of the corridor, however, the effective measures to restrict desertification depend on human activities. The first statement is based on the metrological data and not (enough) testified with other data, the second is not very new.

(5) What is not discussed and also important: The lowering of groundwater table in this region is due to the enlargement of the irrigation around the oasis especially after Second World War. This leads to reduction in river discharge and lowering of groundwater table and resulting in the drying of Gaxun Nur and adjacent lakes at the lower reaches of the Heihe River. This fact is already known and published since decades (e.g. Zhu Zhenda about 30 years ago). In addition, the lowering of discharge of groundwater table increased the salt content in the ground water and reduced areas with populous trees already in the 1980th of the last century

One other main point: It should be considered, why a reduction in groundwater caused dune movements. There is no relation between these two factors – except and maybe with flat sand sheets in the floodplains of larger rivers or close to lakes vegetated with trees. Quite a lot of trees in these areas were mainly destroyed in former times (before 1980) for firewood (see Zhu et al. 1988) and enhanced the desertification processes in sandy regions. However, the main and important factor for dune movement and desertification is grazing and overgrazing. This is not mentioned at all. Several of these aspects were described and discussed in numerous international papers. (6) Figures and language need to be improved (see some comments below).

Selected additional references (and references therein):

Zhenda, Zhu, Shu, Liu, Xinmin, Di (1988): Desertification and Rehabilitation in China. The International Centre for Education and Research on Desertification Control, Lanzhou.

Wang, X., Chen, F., Hasi, E., Li, J. (2008): Desertification in China: An assessment, Earth-Science Reviews 88: 188-206

Nottebaum, V., Lehmkuhl, F., Stauch, G., Lu, H., Yi, S. (2015): Late Quaternary aeolian sand deposition sustained by fluvial reworking and sediment supply in the Hexi Corridor – an example from northern Chinese drylands. Geomorphology 250: 113-127.

Specific comments:

Line 76-85: references needed

Line 165-168: Why this climate details at the end? Much better to climate line 143-142

Line 453-466: Heihe, grain-size discussed by Nottebaum et al.?

Line 525-526 . . .closely linked to regional land degradation. . .: Please specify, references?

Line 542-554 Please specify, references?

Line 617-622: already stated somewhere above

Line 624-625: Question should be in the introduction

Line 675-680: enlargement of irrigation not mentioned in detail

Fig. 1: Rivers and locations of the paper have to be mentioned

Fig.2: Please improve, difficult to read.

In addition, some of the other figures should be improved..

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