Geophysical Research Abstracts
Vol. 17, EGU2015-11635, 2015
EGU General Assembly 2015

Evolutionary direction of land-atmosphere system

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Natural landscape is always subject to dynamic change, leaving characteristic patterns at various time scales. Noticeable patterns, ranging from meandering to fractal characteristics of river networks, have been investigated with physical modeling, mathematical modeling, and other manners. One revolutionary idea to foster holistic understanding of landscape evolution is the optimality concept. There have been several optimality hypotheses proposed for different types of landforms. However, none of them seems fully verified (*Paik*, 2012).

It has been argued that lack of feedbacks between different processes into account is critical limitation of present optimality hypotheses (*Paik and Kumar*, 2010). In this regards, this study presents how optimality context to be formulated for a clear case where strong feedbacks are exchanged during co-evolution, i.e. land-atmosphere system. While most landscape evolution models, either physical, numerical, or optimality-based, assume simple spatio-temporal variability in climate forcing (e.g., rainfall), climatic field evolves together with landscape in reality. For example, orographic precipitation is enhanced as tectonic uplift continues. Accordingly, landscape and atmosphere are closely linked and we should look at them as a single system, rather than separated individuals. In this presentation, limitation of existing optimality hypotheses will be demonstrated with examples of coupled evolution of land-atmosphere system. Fundamental implications for general optimality concept for evolutionary direction of the coupled system will be discussed.

Keywords: Optimal channel network; Landscape evolution; Orographic rainfall

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