

Review of 'On the social dynamics of moisture recycling' by Patrick W. Keys and Lan Wang-Erlandsson

The article presents a new framework for understanding social ecological processes in regions sensitive to moisture recycling processes. The framework is novel and interesting. I applaud the authors for moving outside their comfort zone to give new insights on this issue. In general, however, I think the framework presented has limitations that I would like to see the authors critically reflect upon and explicitly mention in the text.

General Comments

Two-way social feedbacks are only relevant in a minority of cases

Biophysically it is clear that there is a one-way relation between source and sink regions regarding moisture recycling. I.e. changes in the source region can impact moisture recycling which can affect rainfall in the sink region. The authors state that social processes give rise to two-way feedbacks between the source and the sink. This is true but *only* in cases where there is tight coupling of trade in agricultural commodities between the source and sink region. For example, change in land use in the source region may reduce rainfall in the sink region. This reduces yields and increases market demand for agricultural crops. This demand can essentially be transmitted anywhere. There is only a positive socio-environmental feedback between the source and the sink if increased demand in the sink region (caused by reduced rainfall and reduced yield arising from land change in the source) is met by exports from the source region. I.e. increased demand in the sink may stimulate more land use change in the source which may reduce moisture recycling further. Other than this specific case, I cannot see a mechanism for socio-environmental feedbacks between the source and sink region. Please correct me if I am wrong on this.

Thus, to understand the relation between social changes and moisture recycling, you should focus on where the demand that drives land use change in the source region comes from. In most cases it is probably very local (subsistence), within a country or regional and international that you mention. You discuss these archetypes, but it is not obvious to the reader that they reveal that two-way social feedbacks between source and sink are of relatively minor significance when you go to the regional or tele-coupled archetype. It seems that you are trying to fit an SES framework between source and sink regions with regard moisture recycling, when it will only be relevant in a minority of cases. SES within source and sink regions is no-doubt important, however.

Comparison with river systems

In general, the biophysical characteristics of a moisture recycling system are similar to that of a river system. I.e. upstream users impact downstream users via biophysical changes but not the other way around. However, social changes may be in both directions. A river system differs from the moisture recycling case as the leverage points, as you term them, are specific (such as governance of a reservoir), whereas in a moisture recycling scenario they are highly diffuse and heterogeneous. I.e. Large area of variable landscape types and agricultural practices. Equally, the social and economic links are similar but perhaps stronger in river system, owing to the organisation of societies and trade around rivers. Also, users clearly understand where source and sink regions are in a river system, whereas this is not widely known in moisture recycling systems, and thus issues such as fairness of resource sharing are not widely recognised. There has been much work done examining upstream and downstream social and biophysical feedbacks in river systems which would provide a good template for this work, rather than trying to reinvent the wheel. I would like to see a more

complete review of this literature (I only see the reference of Grumbine et al., 2012) and explanation of the similarities and differences between a river system and a moisture recycling system.

Specific Comments

Page 1 Line 18-19 “socio-meteorology and socio-climatology” These concepts are surely central to the IPCC working group 2 and 3 reports.

Page 2 Line 12: Why should it have a social focus? What if natural scientists are examining the biophysical processes? Perhaps you mean “social component”

Page 2 Line 20 unexplored. These

Page 3 line 1-10 Are you using an SES Framework? If so, outline specifically the framework you use, rather than SES type of thinking.

Page 3 line 11-12 “Hydrologists specifically”, however moisture recycling is more in the subdiscipline of meteorology that focuses on land-atmosphere feedbacks.

Page 5 Tele-connection definition. I have never heard of a teleconnection referring to connection separated by time alone. In climatology I am only familiar with connections separated by space or space and time combined.

Page 7 line 16 **km** is in a different typeface.

Defensive language used which doesn't come across well: e.g. Page 7 line 30-34, Page 8 line 4-5, Page 23 Line 22 – 34

Page 8-19 In the results you cover many aspects of the economy within and between countries and many traded commodities. In one way every aspect of an economy is inter-related either directly or indirectly. However, the complexity of economies is such, that it seems necessary to narrow down analysis to the most relevant variables. Therefore, it would be helpful to constrain analyses to the agricultural economy. For example, France, Thailand, Malaysia and China are Niger's major trading partner (in terms of value) but not in agricultural products, thus what is the relevance here? You can find agricultural trade data from the FAOstat website.

Page 17 Line 13 – 25 It seems that these two paragraphs are only relevant to a source region. You should state here whether you refer to source, sink or the link between the two.

Page 18 Fig 5. I find this figure too complex. I would prefer an individual diagram for each archetype. Also, it is unclear what the arrows mean. Are they biophysical fluxes or social influence or resource flows? Some indication of the difference between material and immaterial links would be helpful as you have done in figure 1.

Page 20 Line 1. What feedbacks?

Page 21 Line 27: You talk about feedbacks but how do these actually emerge in your system? Feedbacks emerge from mechanisms that reinforce an initial change in the direction of that change. I guess here you are discussing positive socio-environmental feedbacks. So, what changes in the social or environmental realm (in source, sink or between the two) and how is that reinforced (in source, sink or between the two).

Page 23 line 10 pitfalls **of** their

Page 23 line 14 is **a** prerequisite

Page 23 Line 7-20 Lecturing of natural scientists seems to me slightly ungrounded. What is your evidence that nearly all natural scientists assume that every meaningful assertion ought to be verifiable or provable logically or mathematically? This is certainly the case when dealing with natural systems but in my experience there is openness of those engaging in interdisciplinary science to alternative worldviews. Either way, we natural scientists, and sound social scientists, certainly like evidence, however you provide none for these assumptions. Perhaps, perceptions of natural and social scientists on interdisciplinary science could be a study by itself grounded upon sound social science approaches such as surveys, co-publication network analysis etc. Thus, I would leave this part out of your paper or at least dampen the tone a great deal.

Page 23 line 33 well **with** research