

Exploring the complex network of the Amazon's water pump and flying rivers

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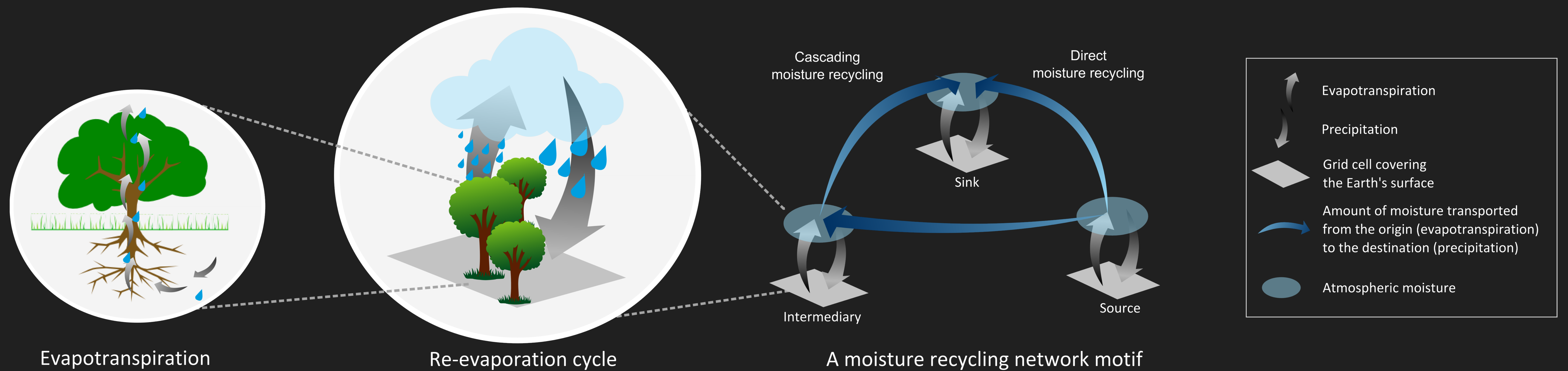


Fig.1: The transport of moisture from the source to the sink may be direct or indirect through cascading moisture recycling. In the latter case, re-evaporation cycle (precipitating water is re-evaporate in the same location) is taking place in an intermediary location.

Billions of liters of water vapor are pumped from the Amazon rainforest and released into the atmosphere throughout the year.

This atmospheric moisture is transported by winds to the subtropical La Plata basin through the “flying rivers”.

On the way from the Amazon to the La Plata basin, moisture is exchanged between the vegetation and the atmosphere through re-evaporation cycles (Fig. 1).

The process of cascading moisture recycling, which is the moisture transport on the continent involving re-evaporation cycles along the way, has been ignored in previous studies on moisture recycling.

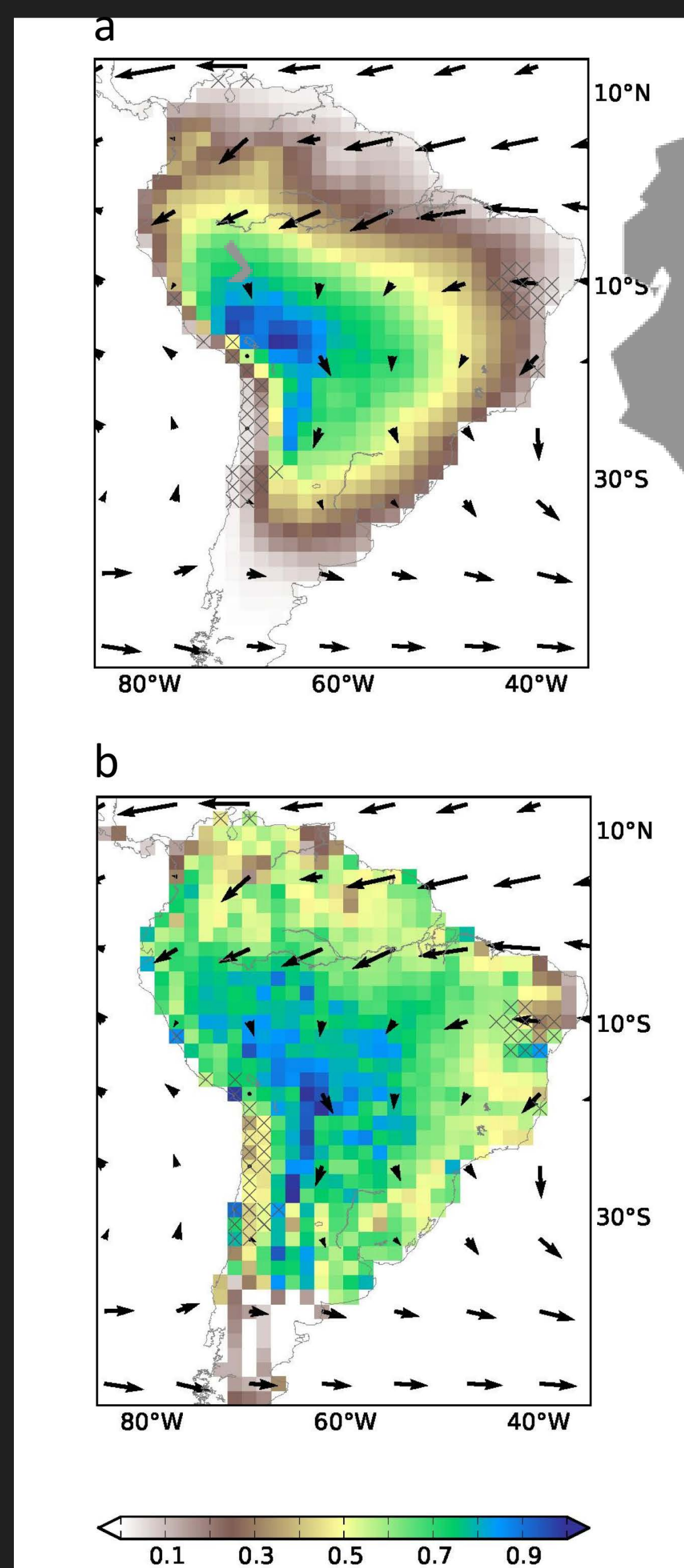


Fig.3 : Key intermediary region as identified by two measures from complex network analysis:
(a) Clustering coefficient showing the tendency to be the intermediary in a particular network motif (Fig. 1);
(b) Betweenness centrality showing the regions where cascading moisture recycling pathways are channeled.

Fraction of the evapotranspiration in the Amazon basin that contributes to rainfall over the La Plata basin during the wet season:

11-16%
through direct moisture recycling

16-23%
through cascading moisture recycling

Intermediary

Fraction of the total rainfall over the La Plata basin that comes from the Amazon basin during the wet season:

6%
through cascading moisture recycling

18-23%
through direct moisture recycling

La Plata basin

RESEARCH QUESTIONS

What is the importance of cascading moisture recycling in South America?
What are the key regions that sustain the moisture recycling network?

We track atmospheric moisture using a moisture recycling model [1] forced by historical climate data.

We construct a moisture recycling network for the wet season (from December to March).

We analyze its architecture using techniques from complex network theory [2,3] (Fig. 3).

We develop measures to quantify the amount of moisture transported via direct and cascading moisture recycling from the Amazon basin to the La Plata basin [3] (see main map).

CONCLUSION

Cascading moisture recycling plays an important role for the transport of moisture through flying rivers in South America.

The intermediary is a key region where moisture runs through re-evaporation cycles on its way from the entire Amazon forest to the La Plata basin. Land-use change in this region may reduce moisture supply in the La Plata basin where water is already a limited resource.

REFERENCES

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