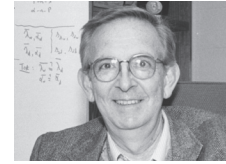

Ignacio Rodriguez-Iturbe

Theodora Shelton Pitney Professor in Environmental Sciences
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Ph.D., Colorado State University, 1967



Research Interests

The dynamics of the interaction between climate, soil, and vegetation are the main focus of Rodriguez-Iturbe's research group. These dynamics are crucially influenced by the scale at which the phenomena are studied as well as by the type of climate, the physiological characteristics of the vegetation, and the pedology of the soil. Moreover, not only the temporal aspects but also the spatial aspects of the dynamics are crucially dependent on the above factors.

Soil moisture plays a key role in these dynamics, and his group is involved in its space-time characterization. This involves a range of approaches that include challenging problems in the physics of the interaction as well as on its mathematical description. It is necessary to account for the random character of precipitation, both in occurrence and intensity, as well as for the nonlinear dependence of infiltration, evapotranspiration, and leakage on the soil moisture state. His group's approach has been to understand and model first the balance of soil moisture at a point under the above conditions. The solution of the stochastic differential equations corresponding to the point dynamics have provided the probabilistic description of the soil-plant-climate interaction at a site. The spatial interaction between different sites with the same or with different types of vegetation is being implemented via cellular automatas operating under rules governed by the characteristics of the stress existing in the vegetation.

At larger spatial scales, precipitation itself is influenced by the soil moisture present in the region, and this phenomenon needs to be incorporated into the modeling scheme. At intermediate scales involving river basins, the geomorphologic characteristics of the drainage network is a commanding factor in the spatial organization of soil moisture. Rodriguez-Iturbe's group is trying to link the recent advances on the scaling characteristics of the network with the dynamics of the soil moisture. With the above framework the group hopes to elucidate some of the most fundamental issues of the climate-soil-atmosphere interaction that lie at the heart of hydrology.

Rodriguez-Iturbe was awarded the Stockholm Water Prize in 2002.

Courses

CEE 368/ENV 368: The Fractal Beauty of Nature
CEE 505: Introduction to Probabilistic Modeling in Civil Engineering and Environmental Science
CEE 587: Ecohydrology

Selected Publications

- Rodriguez-Iturbe, I., and A. Porporato. 2004. *Ecohydrology of Water Controlled Ecosystems: Soil Moisture and Plant Dynamics*. Cambridge UK: Cambridge University Press.
- Caylor, K., T. Scanlon, and I. Rodriguez-Iturbe. 2004. Feasible optimality of vegetation patterns in river basins. *Geophysical Research Letters* 31:L13502.
- Rodriguez-Iturbe, I., P. D'Odorico, A. Porporato, and L. Ridolfi. 1999. Tree-grass coexistence in savannas: The role of spatial dynamics and climate fluctuations. *Geophysical Research Letters* 26(2):247-250.
- Rinaldo, A., and I. Rodriguez-Iturbe. 1998. Channel networks. *Annual Reviews of Earth and Planetary Sciences* 26:289-327.
- Rodriguez-Iturbe, I., M. Marani, P. D'Odorico, and A. Rinaldo. 1998. On the space-time scaling of cumulated rainfall fields. *Water Resources Research* 34(12):3461-3470.
- Rodriguez-Iturbe, I., P. D'Odorico, and A. Rinaldo. 1998. A possible self-organizing dynamics for land-atmosphere interaction. *Journal of Geophysical Research-Atmospheres* 103(D18):23,071-32,077.

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