SpatRain

A Space Time Rainfall Simulator

e-mu²

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World Agroforestry Centre
TRANSFORMING LIVES AND LANDSCAPES

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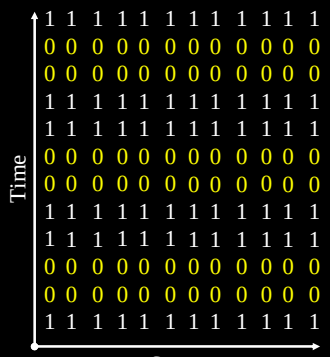
Introduction: why did we develop SpatRain?

- Representations of rainfall variability in space and time are needed for risk assessments (*e.g.* flood, crop growth); and
- Daily rainfall records from low-density networks of simple climate stations are often the only information available.

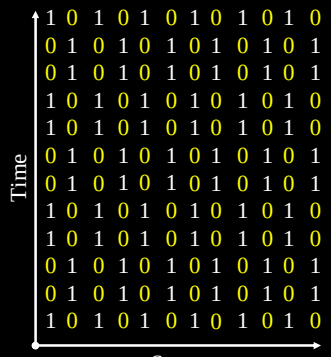
Algorithm: imagine a jackpot…



0 = dry
1 = rain

Uniform application of station-level rainfall records across catchment areas may look like this

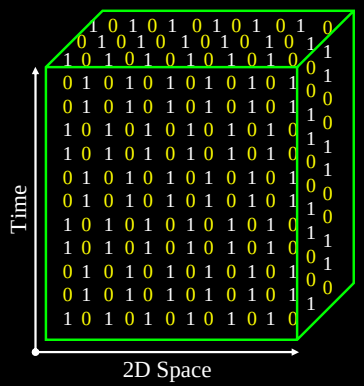
Algorithm: imagine a jackpot…



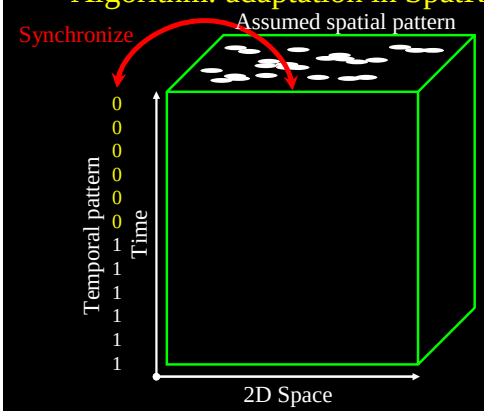
But in fact the real rainfall may have been like this, or any further permutation that maintains the ***expected value*** but modifies variance when measured across space or time.

We don't know what really happened, but we assume the '***distribution***' to be correctly sampled

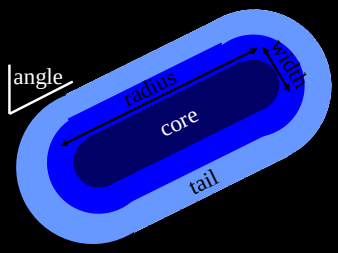
Algorithm: now imagine a 3D jackpot…



Algorithm: adaptation in SpatRain

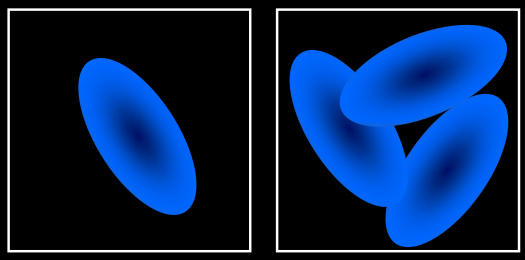


Step 1: assumed individual storm properties



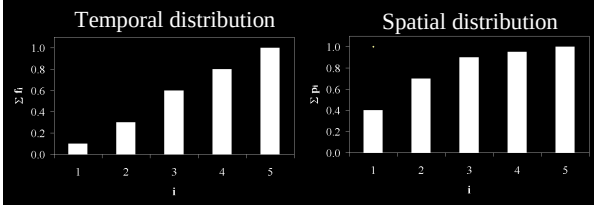
$I_d = I_0 * (1 - \exp(-(f \rightarrow / d)^{f \leftarrow}))$

Step 2: synchronizing dry cells to dry days (allowing multiple storm events)



P(dry days)=P(dry cells of single storm event)^N

Step 3: synchronizing rainfall distribution in space and time (generating core intensity)

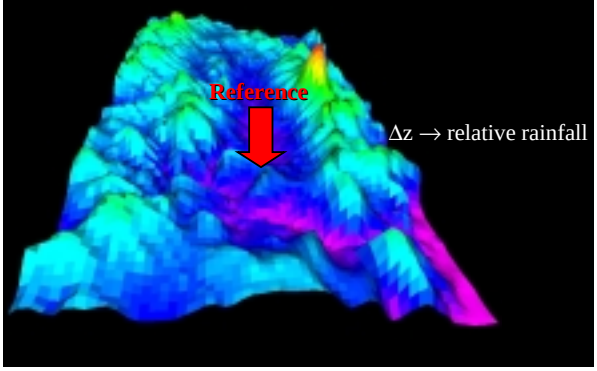


$\Sigma f = \Sigma p * \Sigma F$

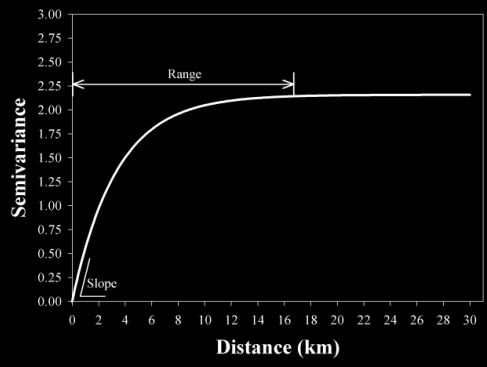
Step 4: synchronizing wet cells to wet days (storm event probability)

P(storm event) = wet days/wet cells

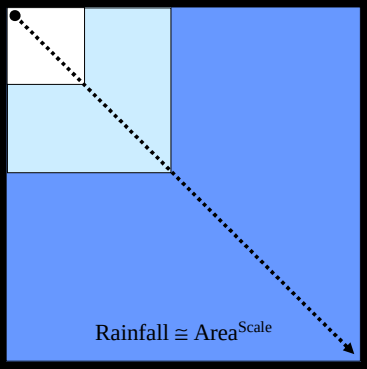
Further consideration: elevational effect



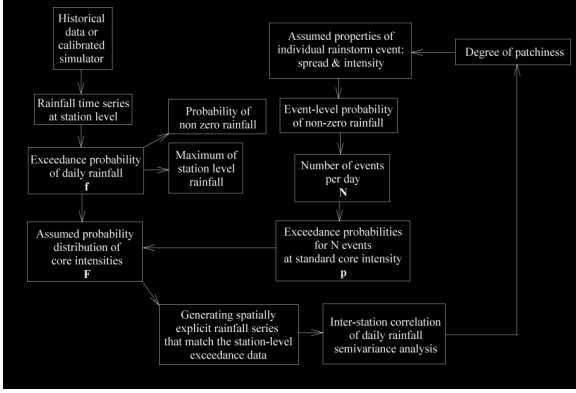
Toolbox: semivariogram



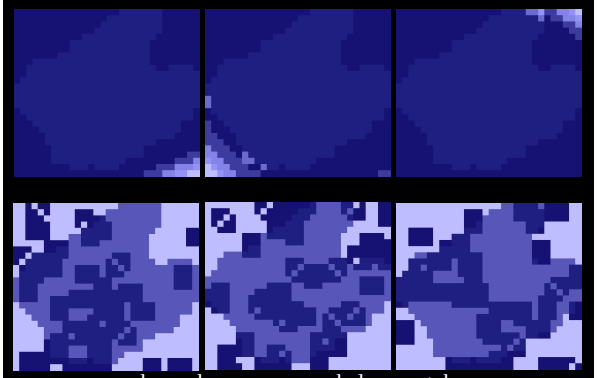
Toolbox: scale analysis



Overall flow chart

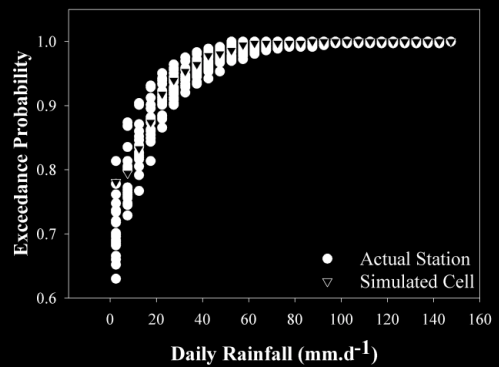


Results using Sumberjaya datasets



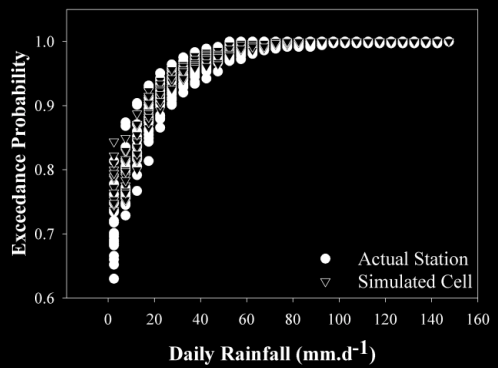
above: homogeneous, below: patchy

Results using Sumberjaya datasets



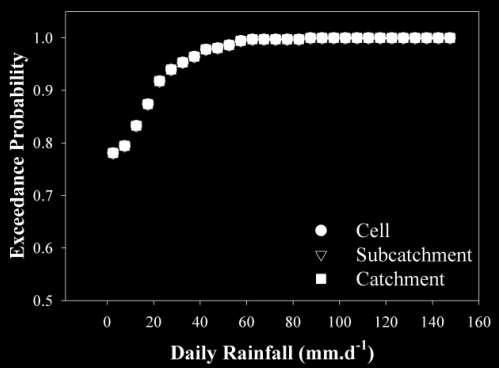
distribution consistency of homogeneous to the actual

Results using Sumberjaya datasets



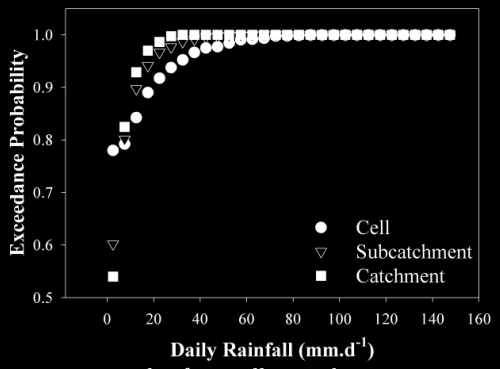
distribution consistency of patchy to the actual

Results using Sumberjaya datasets



homogeneous from cell to catchment

Results using Sumberjaya datasets



patchy from cell to catchment

$e=mu^2$