

Discussion 4

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6/28/2020

1. Explain the balance equations from the rainwater harvesting paper posted to this week's reading.

This reading discuss the design of a Rainwater Harvesting (RWH) system in non-parametric stochastic rainfall generator simulation.

Balance Equations:

1. Volume in the cistern on a given day(t)

$$V_t = \text{Max}\{0, V_{t-1} + C_t - D_t - O_t\}$$

2. Min/Max tank capacity

$$V_t = \text{Min}\{\text{Max}(0, V_{t-1} + C_t - D_t), \text{Cap}\}$$

where (C) is captured supply of rainwater from the roof, (D) is demand for purified water, and (O) is overflow are the primary considerations for the volume (V) in the cistern. On any given day, indexed with $t \in T$, the volume in the cistern is expressed as shown in Equation (1). Note that t is a daily index.

Equation (2) illustrates a minimum/maximum approach for modeling tank capacity (Cap), which ignores the amount of overflow.

2. Share some code from last week that was particularly rewarding or frustrating. We will comment on it.

Exercise: In the book, I present a different way to parameterize the quadratic model:

$$\Delta p = rp(1 - p/K)$$

where $r = \alpha$ and $K = -\alpha/\beta$. Write a version of `update_func` that implements this version of the model. Test it by computing the values of `r` and `K` that correspond to `alpha=0.025`, `beta=-0.0018`, and confirm that you get the same results.

```
1 # Solution goes here
2 def update_func_quad2(pop, t, system):
3
4     r = system.alpha
5     K = -system.alpha/system.beta
6
7     net_growth = (r * pop * (1 - (pop/K)))
8     return pop + net_growth
```

```
1 # Solution goes here
2 t_0 = get_first_label(census)
3 t_end = get_last_label(census)
4 p_0 = census[t_0]
5
6 system = System(t_0=t_0,
7                 t_end=t_end,
8                 p_0=p_0,
9                 alpha=0.025,
10                 beta=-0.0018)
```

This was rewarding experience in this exercise. I like to we can store different attributes values in a variable System. For example: `t_0`, `t_end` etc and called by using `.` like `system.alpha`