# Unraveling water monitoring association towards weather attributes for response proportions data:

## A unit-Lindley learning

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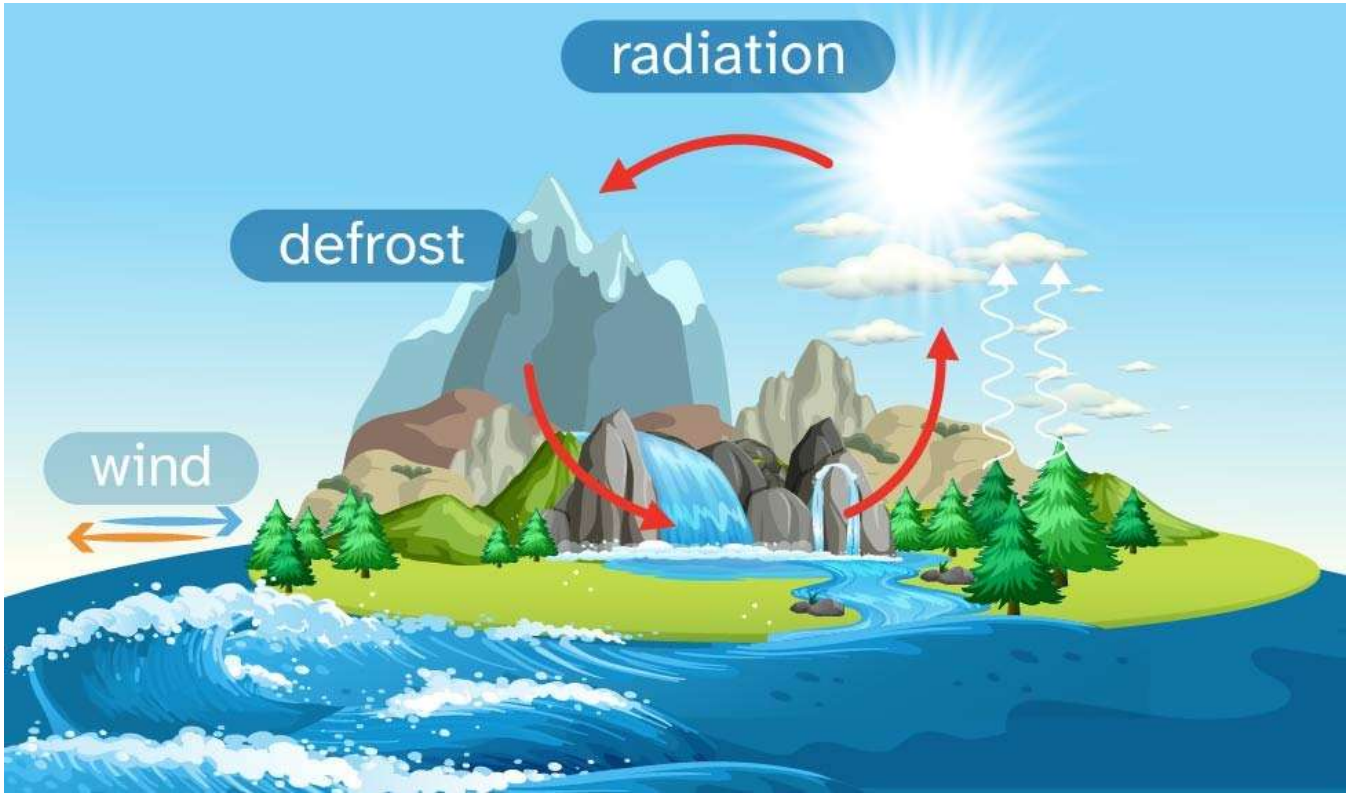
# Motivation

- Atacama desert (Chile)
- Most arid non-polar region in the world
- Application to data on relative air humidity
- *Camanchaca*



# Unit-Lindley chart

Suppose that a process generates outputs according to a UL($\mu$) distribution, and the probability of false alarm is given by $\alpha$. Then, the lower control limit (LCL), centerline (CL) and upper control limit (UCL) of the UL control chart are defined as follows:

$$\text{LCL} = Q\left(\alpha/2 \mid \mu\right), \qquad \text{CL} = \mu, \qquad \text{UCL} = Q\left(1-\alpha/2 \mid \mu\right),$$

where $Q(.)$ is the quantile function.
LCL, CL and UCL of the proposed UL regression control chart are given by

$$\text{LCL}_i = Q\left(\alpha/2 \mid \mu_i\right), \qquad \text{CL}_i = \mu_i, \qquad \text{UCL}_i = Q\left(1-\alpha/2 \mid \mu_i\right),$$

for $i = 1, 2, \ldots, n$, where $\mu_i$ is linked to the covariates through an appropriate link function, e.g., the logit link function.

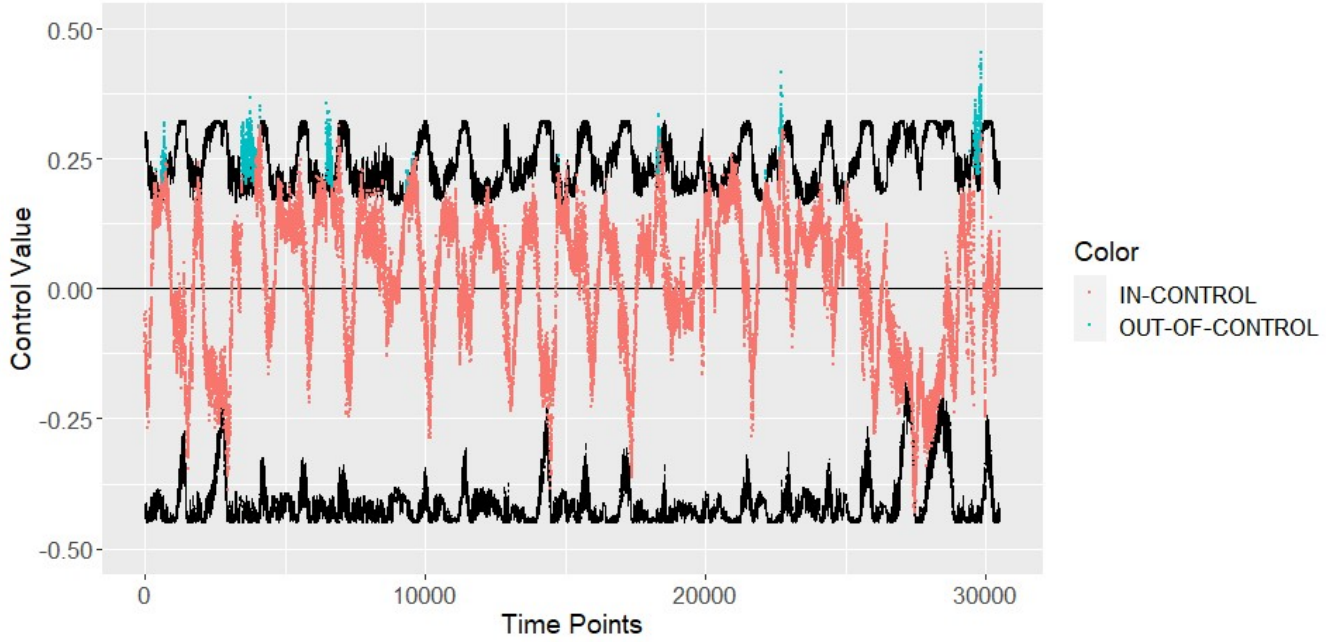
# Aplication

The theoretical model adopted for this problematic was:

$$\text{Relative Humidity}_i \sim \text{UL}(\mu_i), \quad \text{where}$$

$$\text{logit}(\mu_i) = \beta_0 + \beta_1 \text{Wind Speed}_i + \beta_2 \Delta\text{Temperature}_i + \beta_3 \text{S. Radiation}_i,$$

for $i = 1, 2, \ldots,$ 1,207,079 (Phase I).



# References


- Bayer, F.M.; Tondolo, C.M.; Muller, F.M. (2018). Beta regression control chart for monitoring fractions and proportions. *Computers & Industrial Engineering*, v.119, p.416-426.
- Corless, R.M., et al. (1996) On the LambertW Function. Advances in Computational Mathematics, 5, 329-359. https://doi.org/10.1007/BF02124750
- Ho, L.L.; Fernandes, F.H.; Bourguignon, M. (2019). Control charts to monitor rates and proportions. *Quality and Reliability Engineering International*, v.35, n.1, p.74-83.
- Lima-Filho, L.M.A.; Bayer, F.M. (2019). Kumaraswamy control chart for monitoring double bounded environmental data. *Communications in Statistics - Simulation and Computation*, p.1-16.
- Mazucheli, J.; Menezes, A.F.B.; Chakraborty, S. (2019). On the one parameter unit-Lindley distribution and its associated regression model for proportion data. *Journal of Applied Statistics*, v.46, n.4, p.700-714.
- Montgomery, D.C. (2020). *Introduction to statistical quality control*. John Wiley & Sons.
- Nascimento, D.C.; Pimentel, B.; Souza, R.; Leite, J.P.; Edwards, D.J.; Santos, T.E.; Louzada, F. (2020). Dynamic time series smoothing for symbolic interval data applied to neuroscience. *Information Sciences*, v.517, p.415-426.
- Sant'Anna, A.M.O.; ten Caten, C.S. (2012). Beta control charts for monitoring fraction data. *Expert Systems with Applications*, v.39, n.11, p.10236-10243.