# 1 Nueva función de recarga con datos diarios y cálculos horarios

```
def ugw_drainage(whcmax, whc0, kuz, exp, winput, et):
    """
    args
    whxmax: max water holding content mm
    whc0: initical whc mm
    kuz: satured permeability mm/h
    exp: empirically deduced exponent
    winput: water input mm/h
    et: evapotranspiration mm/h
    output
    whc3: whc at the end
    wd: water drained
    runoff: runoff
    etr: real et
    """
    tiny = 0.00001
    if whcmax < tiny:
        return 0., 0., winput, 0.
    whc1 = whc0 + winput
    whc2 = min(whcmax, whc1)
    runoff = whc1 - whc2
    wd = kuz * (whc2 / whcmax)**exp
    wd = min(whc2, wd)
    whc3 = whc2 - wd
    if winput > 0:
        etr = 0.
    else:
        etr = min(whc3, et * whc3 / whcmax)
    whc3 -= etr
    balan = winput - wd - runoff - etr + whc0 - whc3
    if balan > tiny:
        raise ValueError(f'error de balance {balan}:0f')
    return whc3, wd, runoff, etr
```

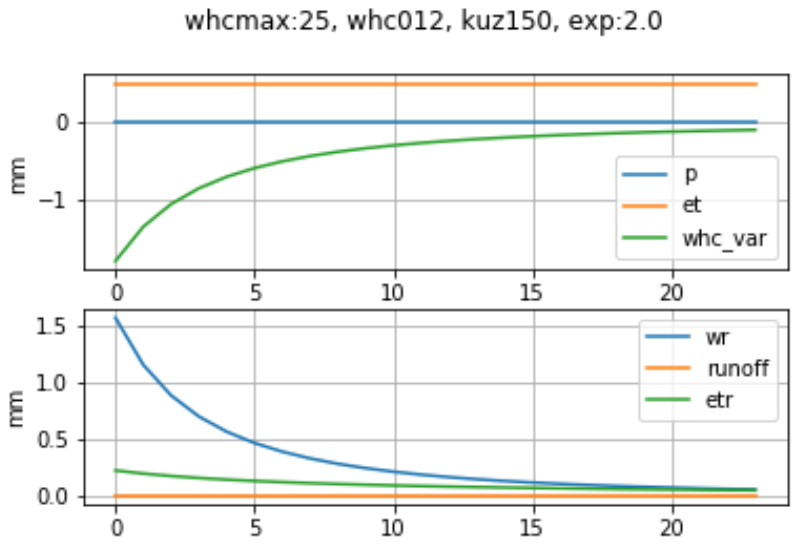
## 2 Sin Lluvia

Los efectos del drenaje diferido y la etr resultan en una disminución del almacenamiento

whc_var = whc[i] – whc[i-1]

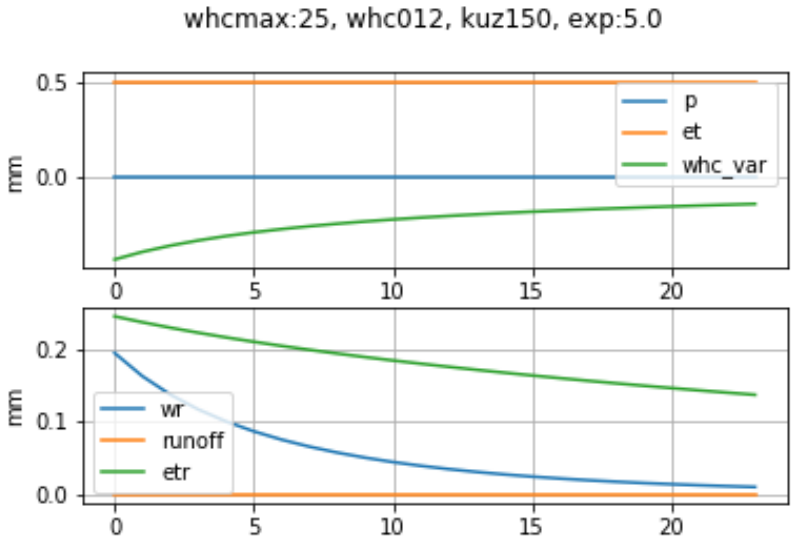
### 2.1 Exponente 2

p: 0.0, et: 12.0; wr: 8.0, runoff: 0.0, etr: 2.3, whc final: 2.2



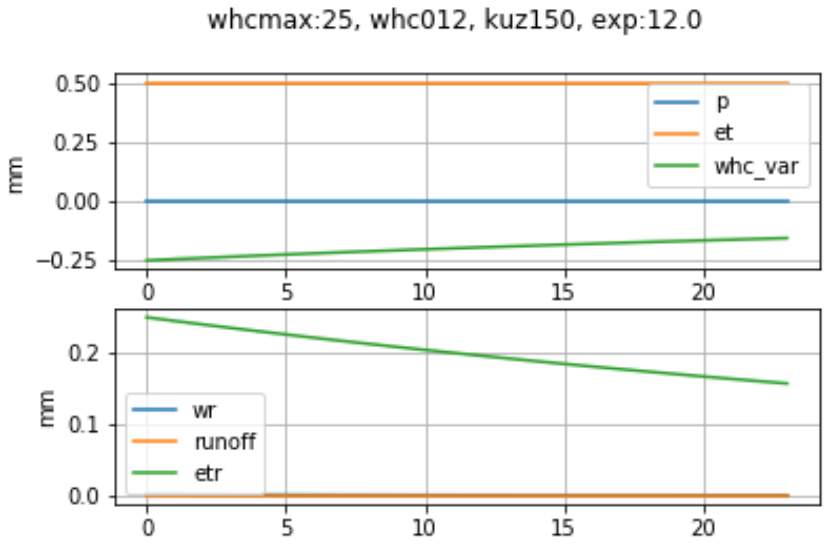

### 2.2 Exponente 5

p: 0.0, et: 12.0; wr: 1.4, runoff: 0.0, etr: 4.4, whc final: 6.7



## 2.3 Exponente 12

p: 0.0, et: 12.0; wr: 0.0, runoff: 0.0,  etr: 4.8,  whc final: 7.7

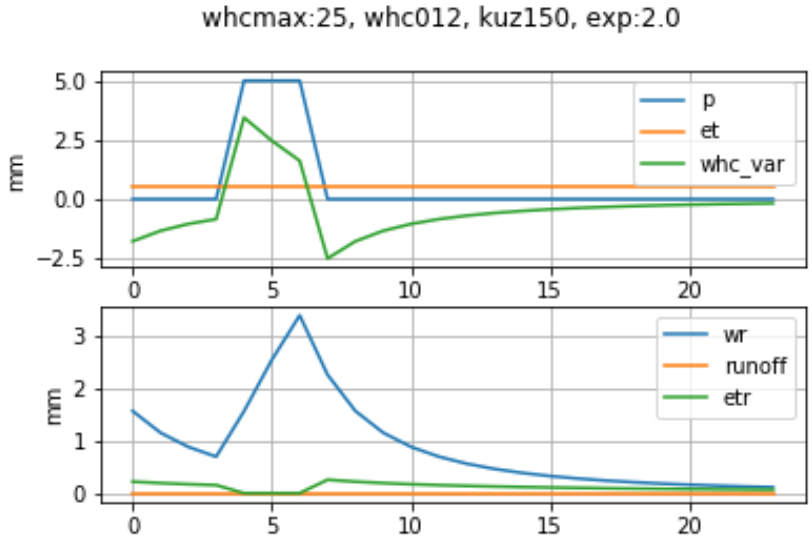


# 3 Con lluvia

Aumento del drenaje y el almacenamiento del suelo a consecuencia del pulso de lluvia; en algunos casos se puede producir escorrentía superficial.

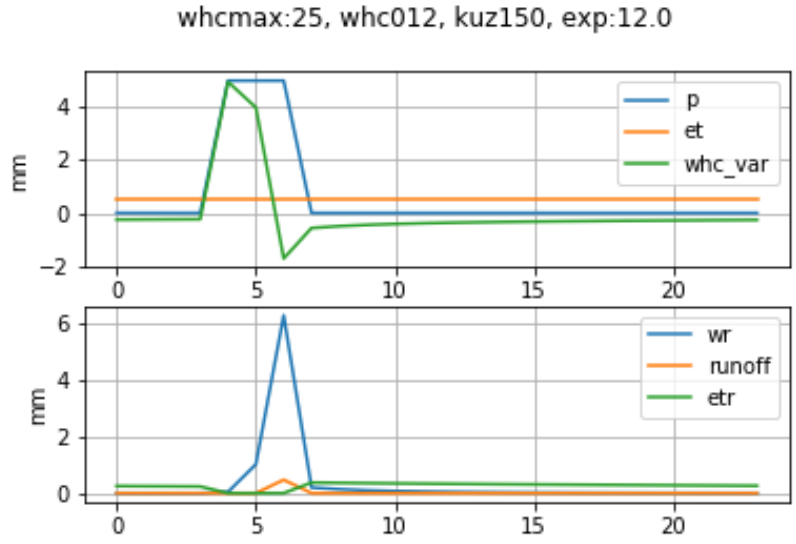
## 3.1 15 mm de Lluvia en 3 horas y exponente 2

p: 15.0, et: 12.0; wr: 21.5, runoff: 0.0, etr: 2.9, whc final: 3.2



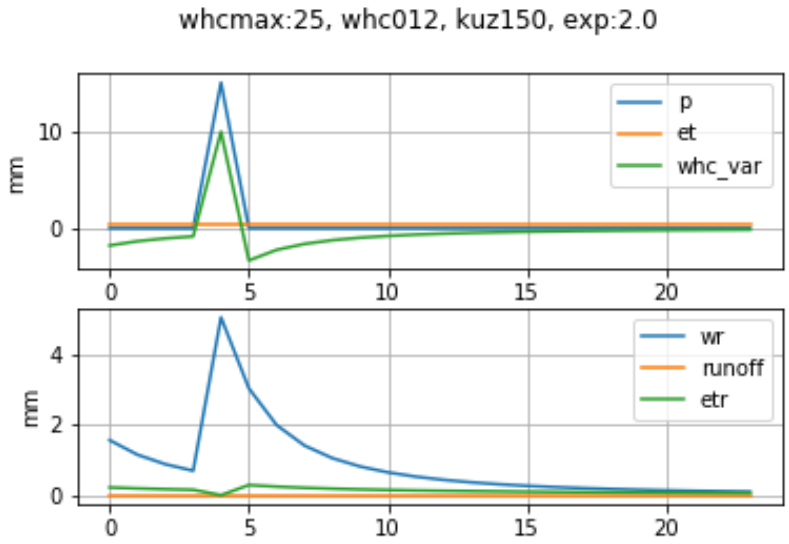

## 3.2 15 mm de Lluvia en 3 horas y exponente 12

p: 15.0, et: 12.0; wr: 8.0, runoff: 0.5, etr: 6.2, whc final: 12.8



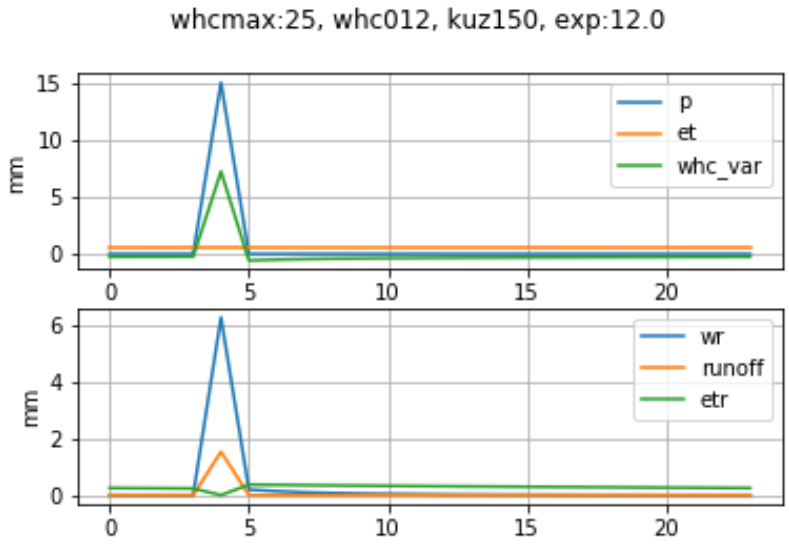
### 3.3 15 mm de Lluvia en 1 hora y exponente 2

p: 15.0, et: 12.0; wr: 21.4, runoff: 0.0, etr: 3.1, whc final: 3.0



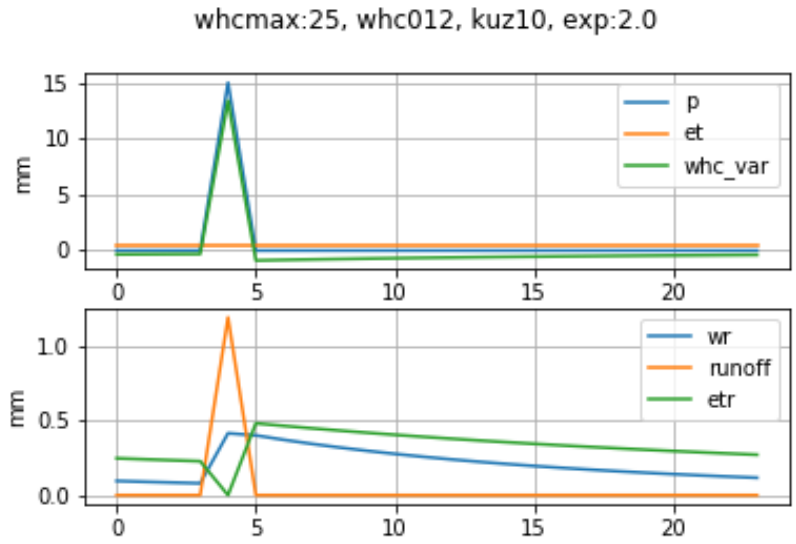

### 3.4 15 mm de Lluvia en 1 hora y exponente 12

p: 15.0, et: 12.0; wr: 7.0, runoff: 1.5, etr: 6.7, whc final: 12.2



### 3.5 15 mm de Lluvia en 1 hora, exponente 2 y kuz 10

p: 15.0, et: 12.0; wr: 5.1, runoff: 1.2, etr: 7.9, whc final: 13.3




### 3.6 15 mm de Lluvia en 1 hora, exponente 0.5 y kuz 10

p: 15.0, et: 12.0; wr: 8.1, runoff: 0.5, etr: 7.5, whc final: 11.4