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Assessment of the Water Cycle Acceleration in the Czech Republic

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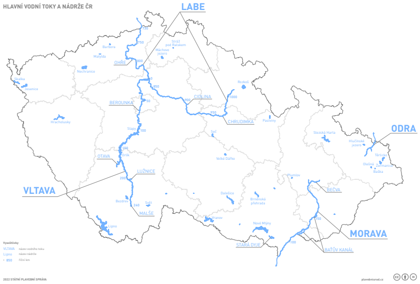
HS2.5.1: Large Scale Hydrology – Observations and Model Applications

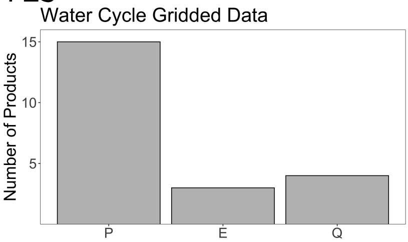
- An accelerating water cycle means that extremes and the general variability of the water cycle will increase, although not uniformly around the globe [1].



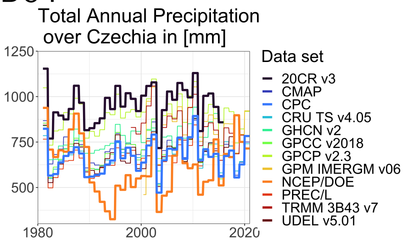
- Czechia is an essential headwaters area of the European continent.

- Is the Czech Water Cycle Accelerating?

YES



BUT



- 20CR v3[2], CHMI (`www.chmi.cz`), CMAP[3], CPC[4], CRU TS v4.05[5], ERA-5[6], GHCN v2[7], GPCC v2018[8], GPCP v2.3[9], GPM IMERGM v06[10], NCEP/DOE[11], PREC/L[12], TRMM 3B43 v7[13], and UDel v5.01[14].
- 20CR v3[2], ERA-5[6], and GLEAM v3[15].
- 20CR v3[2], ERA-5[6], GRUN[16], and NCEP/DOE[11].

- Which Data Do We Use?

Water Budget Equation:

$P = E + Q + \Delta$ TWS

At the annual time step $\Delta TWS \rightarrow 0$

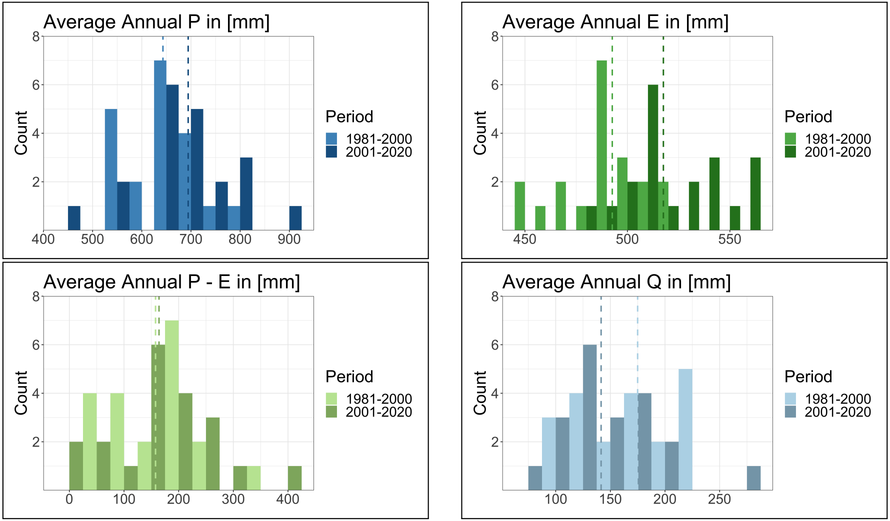
then: P - E - Q ≈ 0

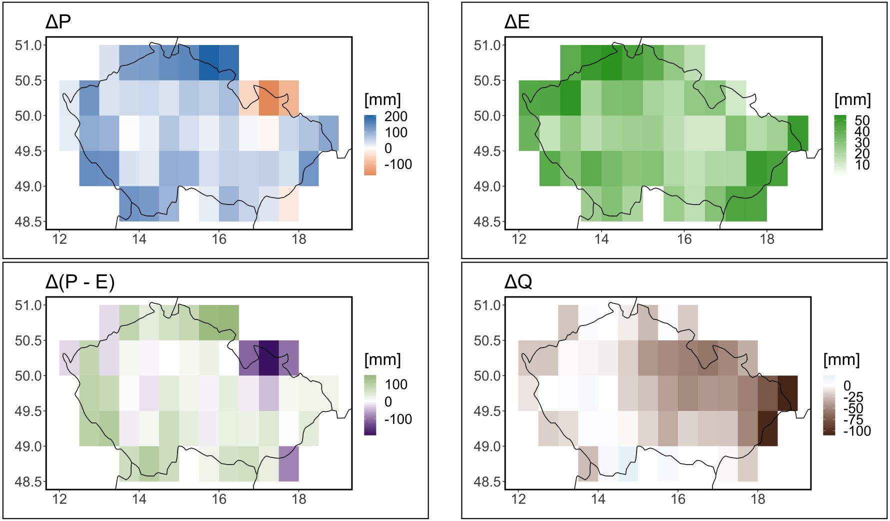
Metrics:

- cor(P, in-situ)
- cor(P - E, Q)
- mean(P - E - Q) $\rightarrow 0$
- sd(P - E - Q) $\rightarrow 0$

CPC[4], GLEAM v3[15], and ERA-5[6]
1981-2000 and 2001-2020

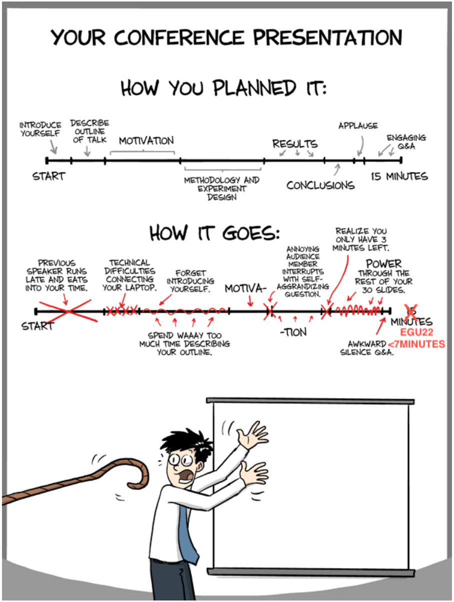
- Is the Czech Water Cycle Accelerating?


Average Annual P in [mm]
Count
Period
1981-2000
2001-2020
400 500 600 700 800 900
Average Annual E in [mm]
450 500 550
Average Annual P - E in [mm]
0 100 200 300 400
Average Annual Q in [mm]
100 150 200 250


ΔP
51.0
50.5
50.0
49.5
49.0
48.5
12
14
16
18
[mm]
200
100
0
-100
ΔE
[mm]
50
40
30
20
10
Δ(P - E)
[mm]
100
0
-100
ΔQ
[mm]
0
-25
-50
-75
-100

- Great variability from observations by various sources.
- Increase in atmospheric water flux.
- Decrease in surface water flux.
- Minimal temporal change of freshwater availability.

TIME: There is an acceleration of atmospheric water flux.
SPACE: Heterogeneous distribution of freshwater availability.



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