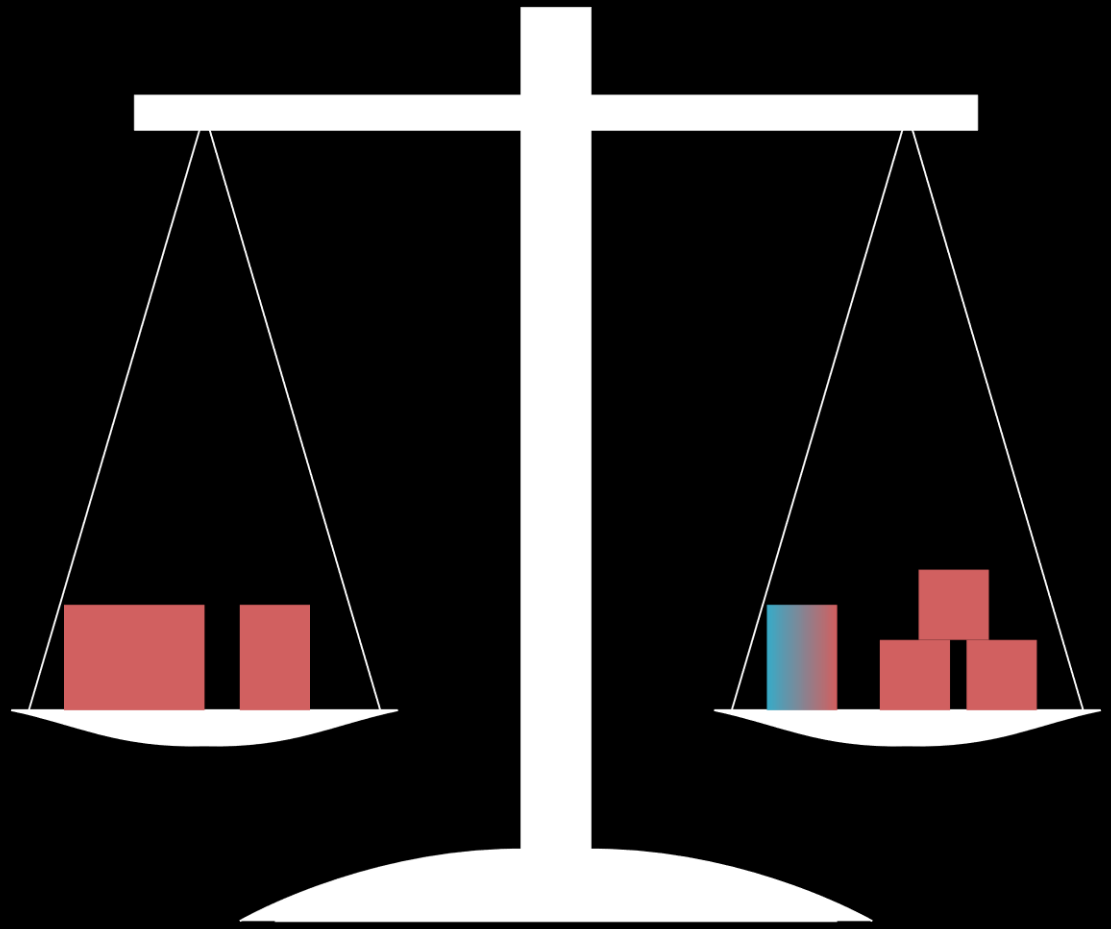
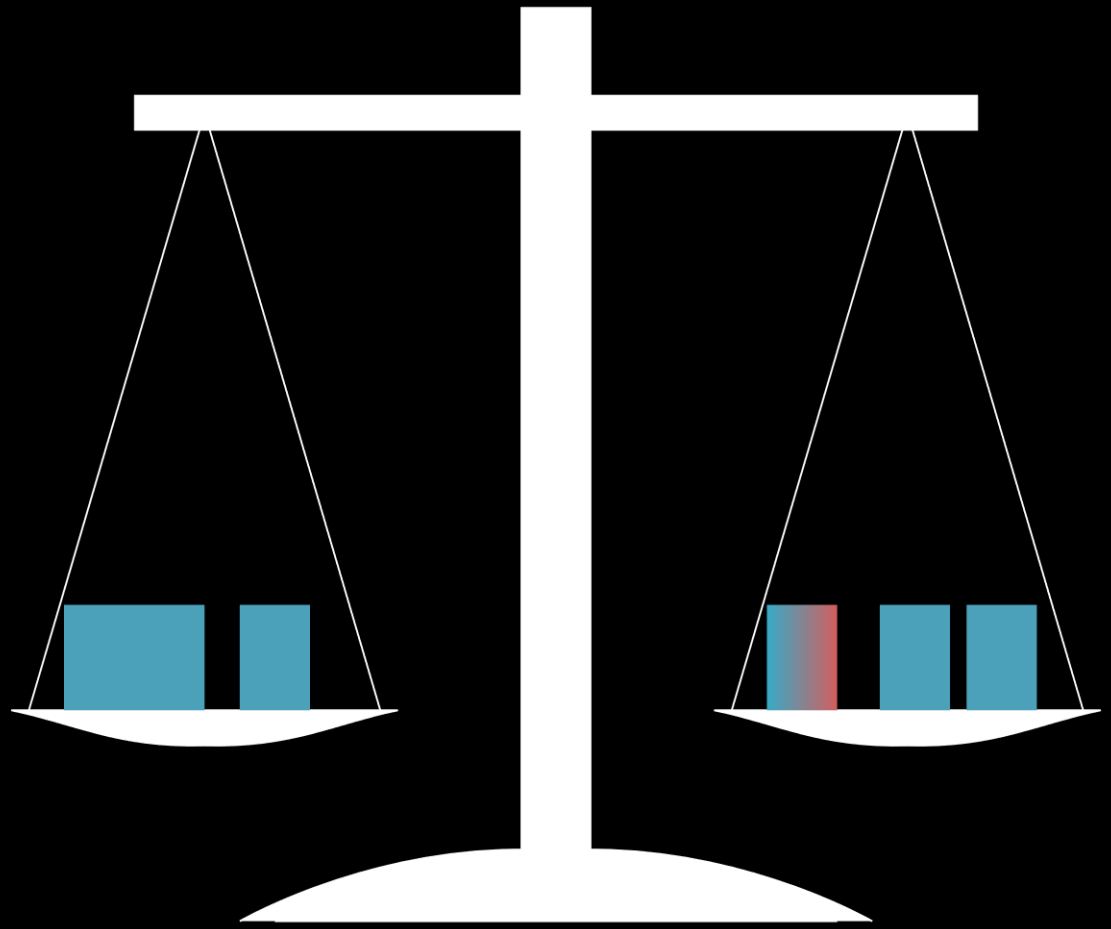
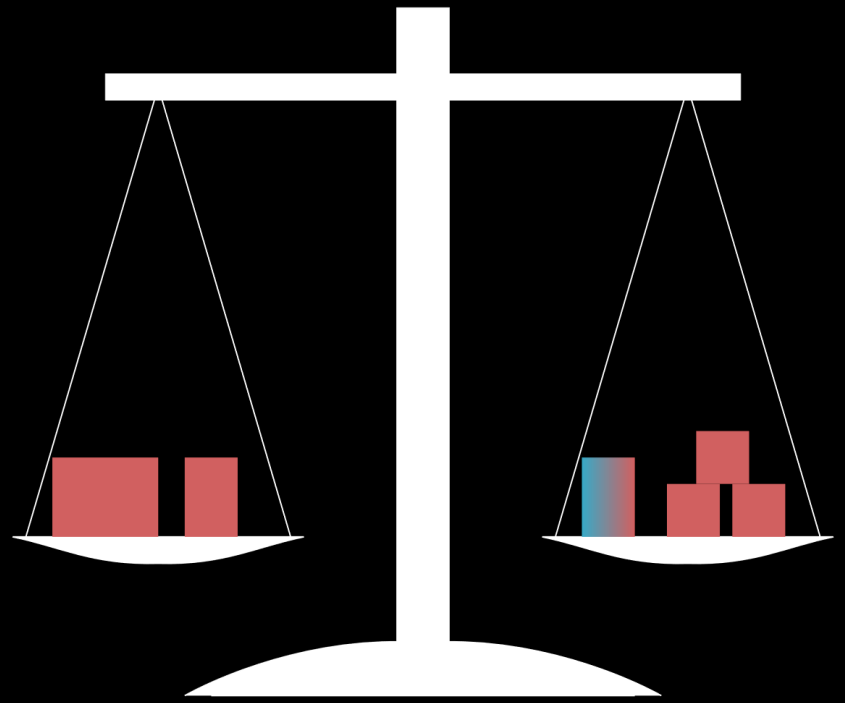






Crucial consistency

of the

water balance

in

urban land surface models

WAGENINGEN
UNIVERSITY & RESEARCH

$$P + I = R + ET + \Delta S$$

ET

Mass

$$ET$$

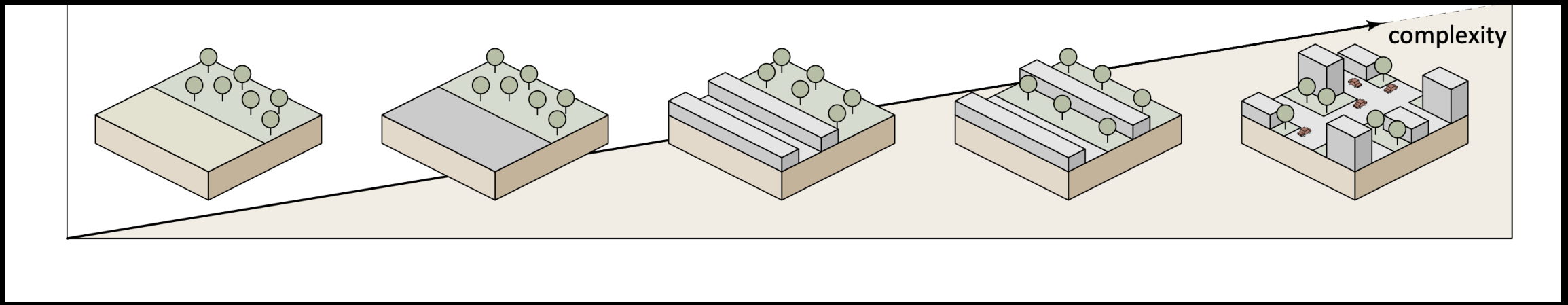
Mass

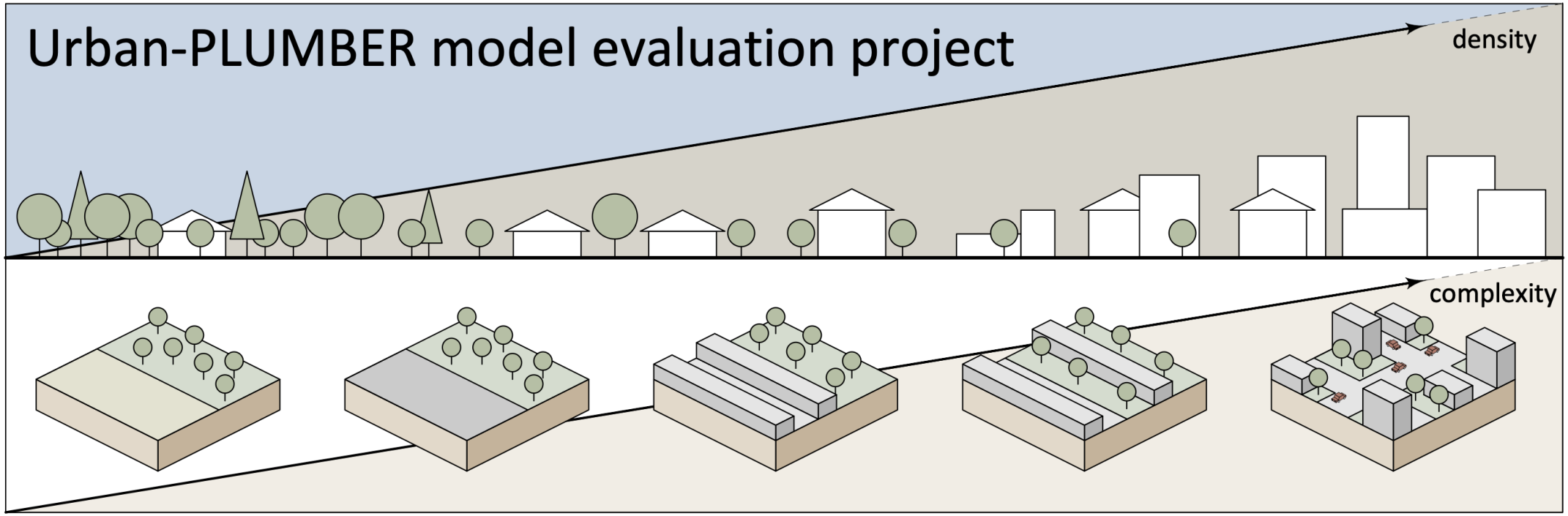
$$ET = Q_{le}$$

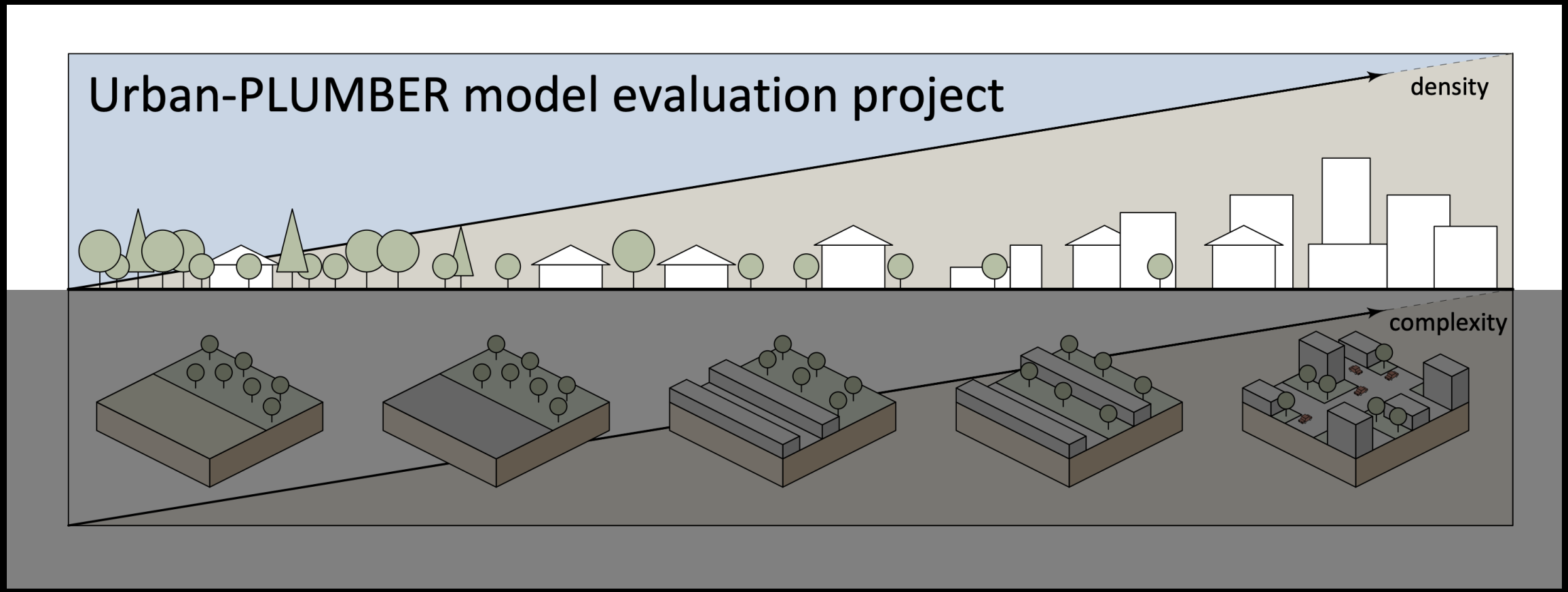
Mass Energy

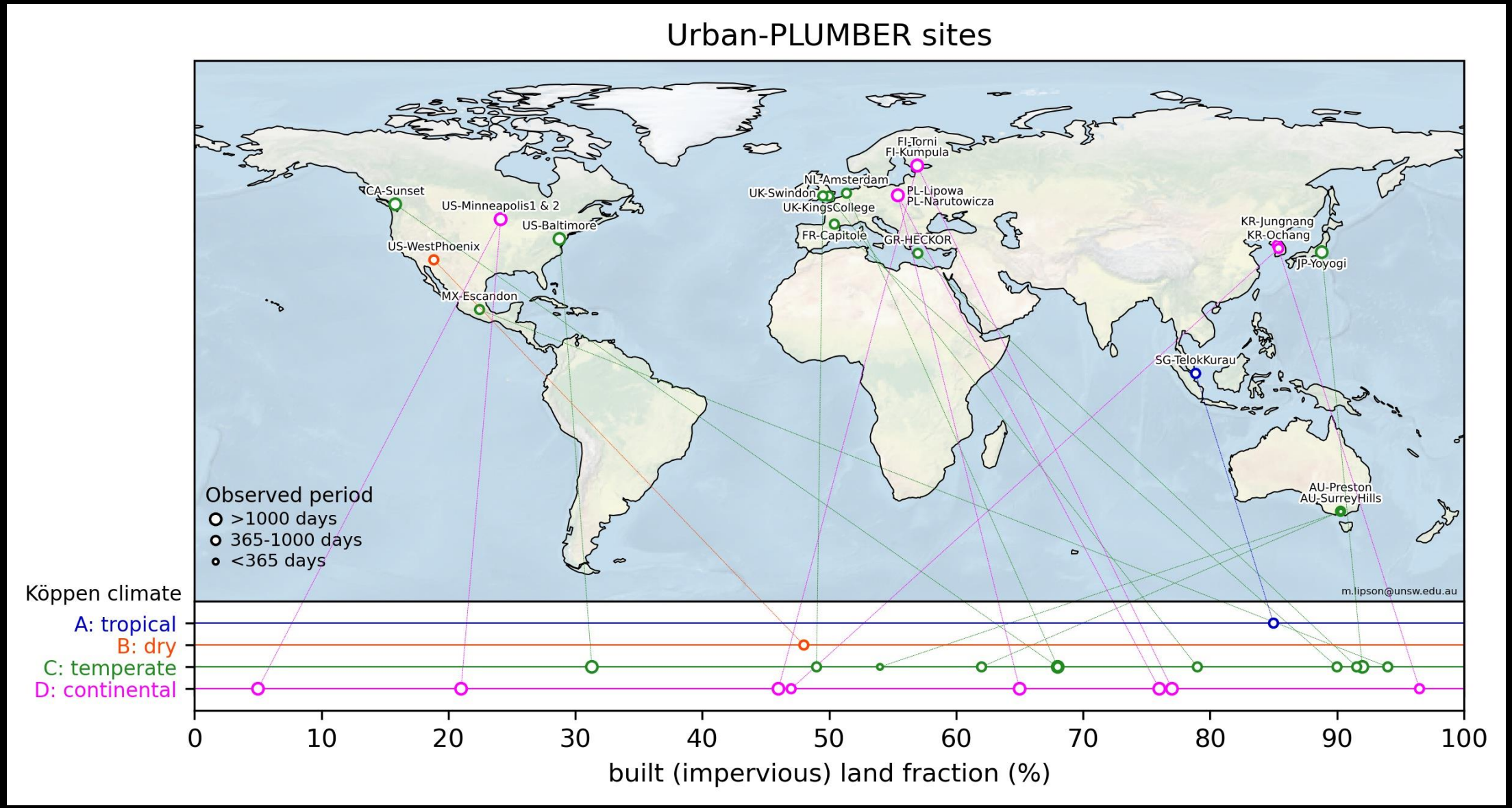
$$ET = Q_{le}$$

Urban land surface models



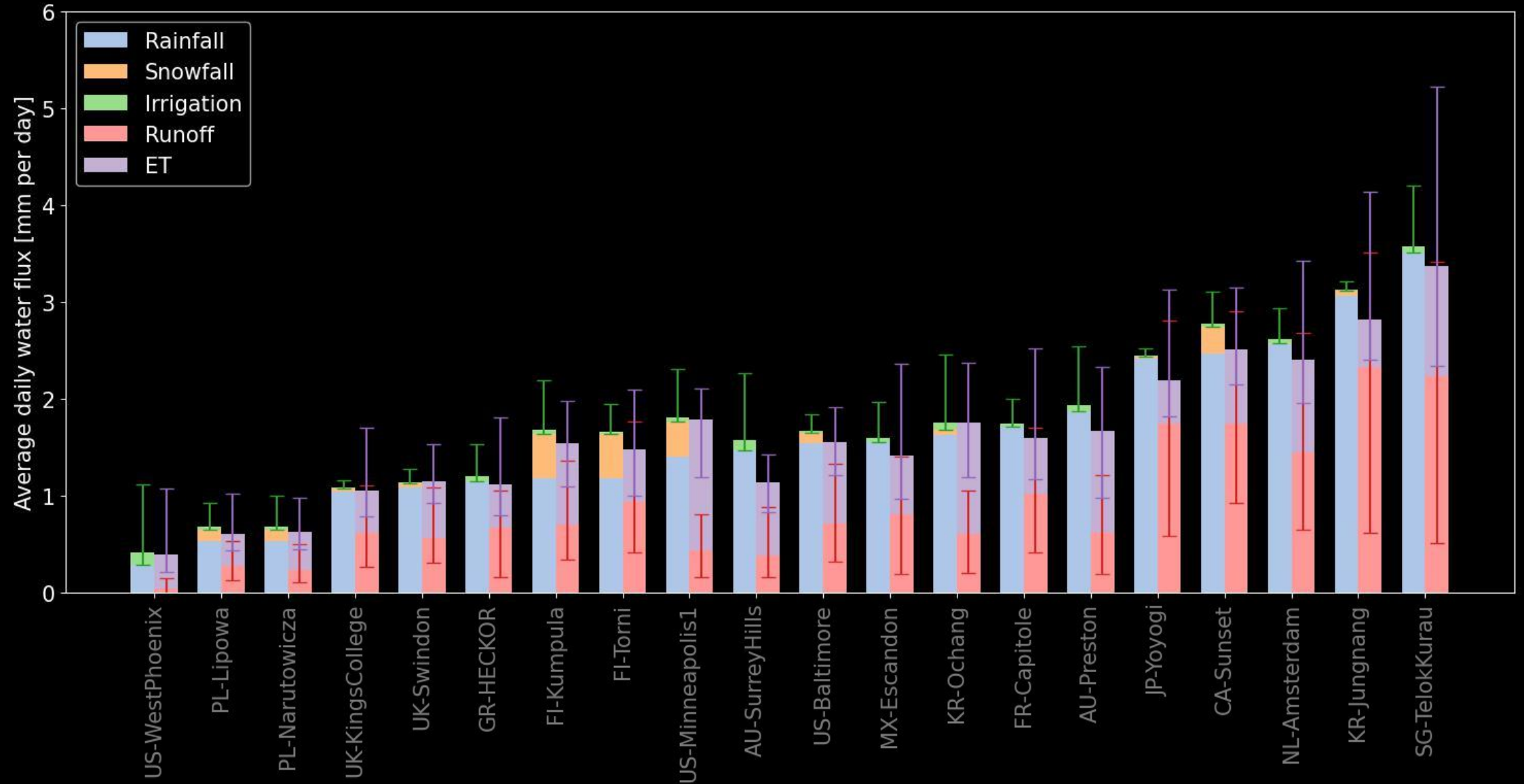

Urban-PLUMBER model evaluation project
density
complexity


Urban-PLUMBER model evaluation project
density
complexity


Urban-PLUMBER sites
CA-Sunset
US-Minneapolis1 & 2
US-Baltimore
US-WestPhoenix
MX-Escandon
FI-Torni
FI-Kumpula
NL-Amsterdam
UK-Swindon
PL-Lipowa
PL-Narutowicza
UK-KingsCollege
FR-Capitole
GR-HECKOR
KR-Jungnang
KR-Ochang
JP-Yoyogi
SG-TelokKurau
AU-Preston
AU-SurreyHills
Observed period
>1000 days
365-1000 days
<365 days
m.lipson@unsw.edu.au
Köppen climate
A: tropical
B: dry
C: temperate
D: continental
0
10
20
30
40
50
60
70
80
90
100
built (impervious) land fraction (%)

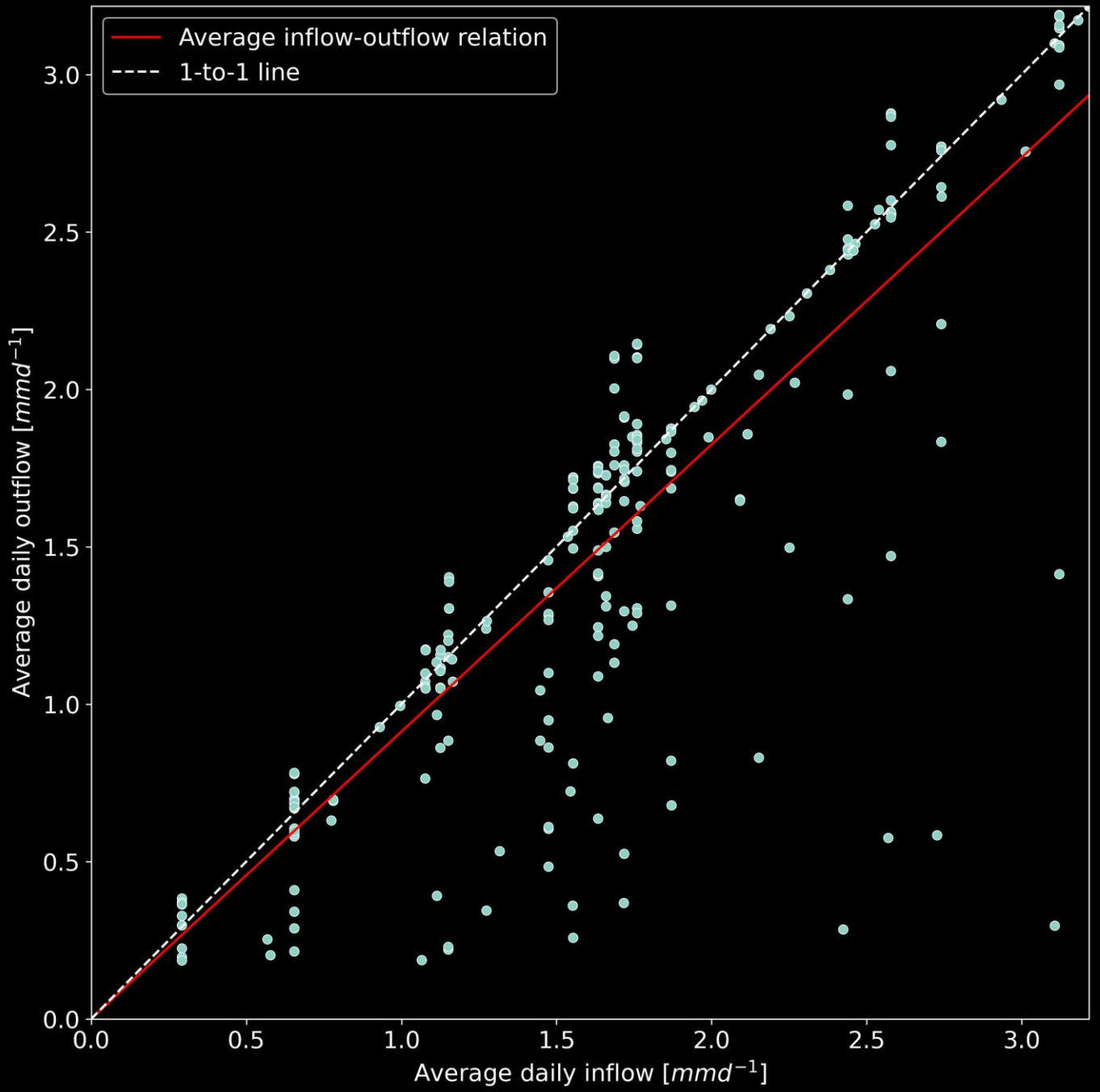
20 sites

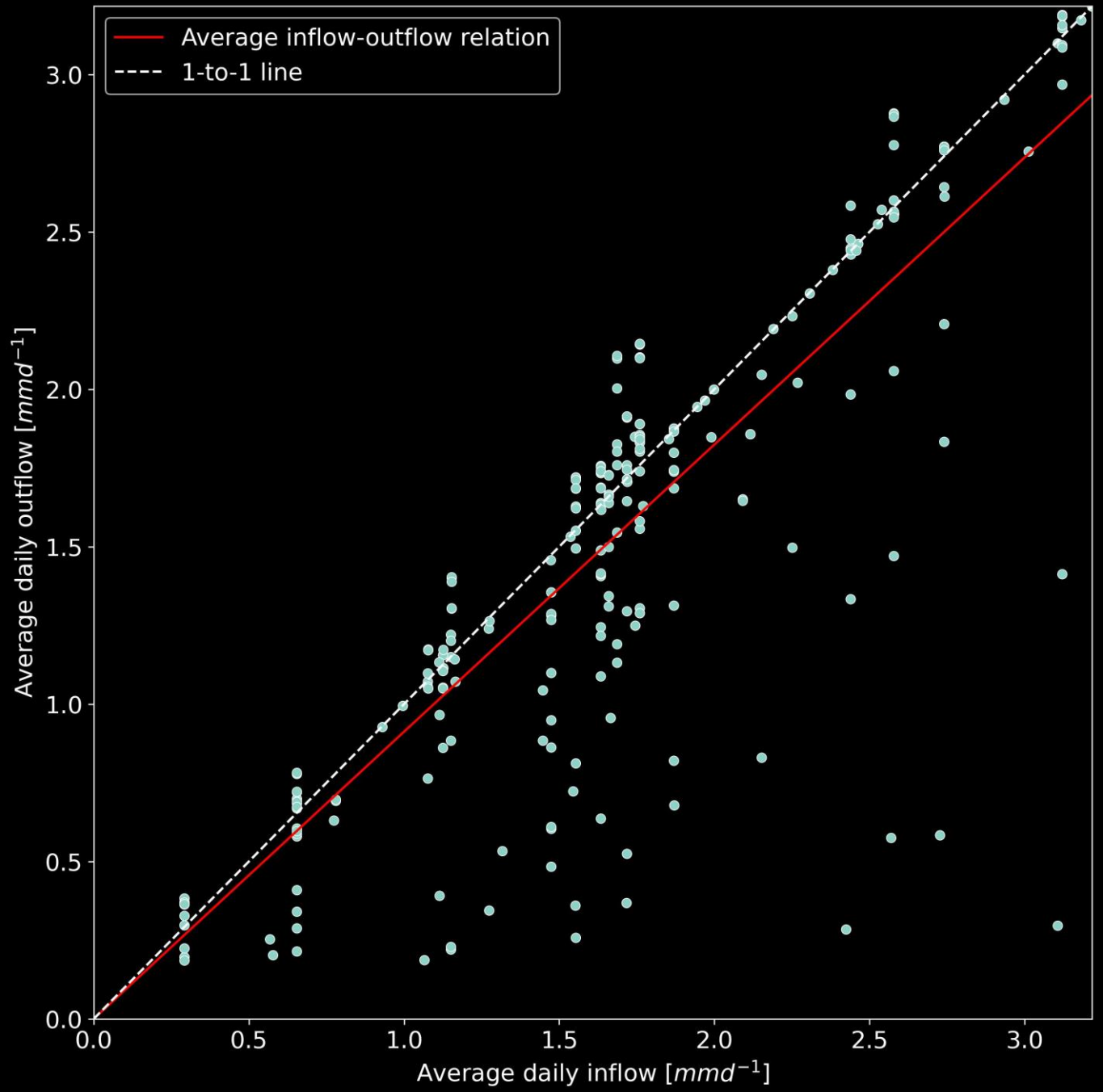
$$P + I = R + ET + \Delta S$$


Rainfall
Snowfall
Irrigation
Runoff
ET
Average daily water flux [mm per day]
0
1
2
3
4
5
6
US-WestPhoenix
PL-Lipowa
PL-Narutowicza
UK-KingsCollege
UK-Swindon
GR-HECKOR
FI-Kumpula
FI-Torni
US-Minneapolis1
AU-SurreyHills
US-Baltimore
MX-Escandon
KR-Ochang
FR-Capitole
AU-Preston
JP-Yoyogi
CA-Sunset
NL-Amsterdam
KR-Jungnang
SG-TelokKurau

14 models

280 runs

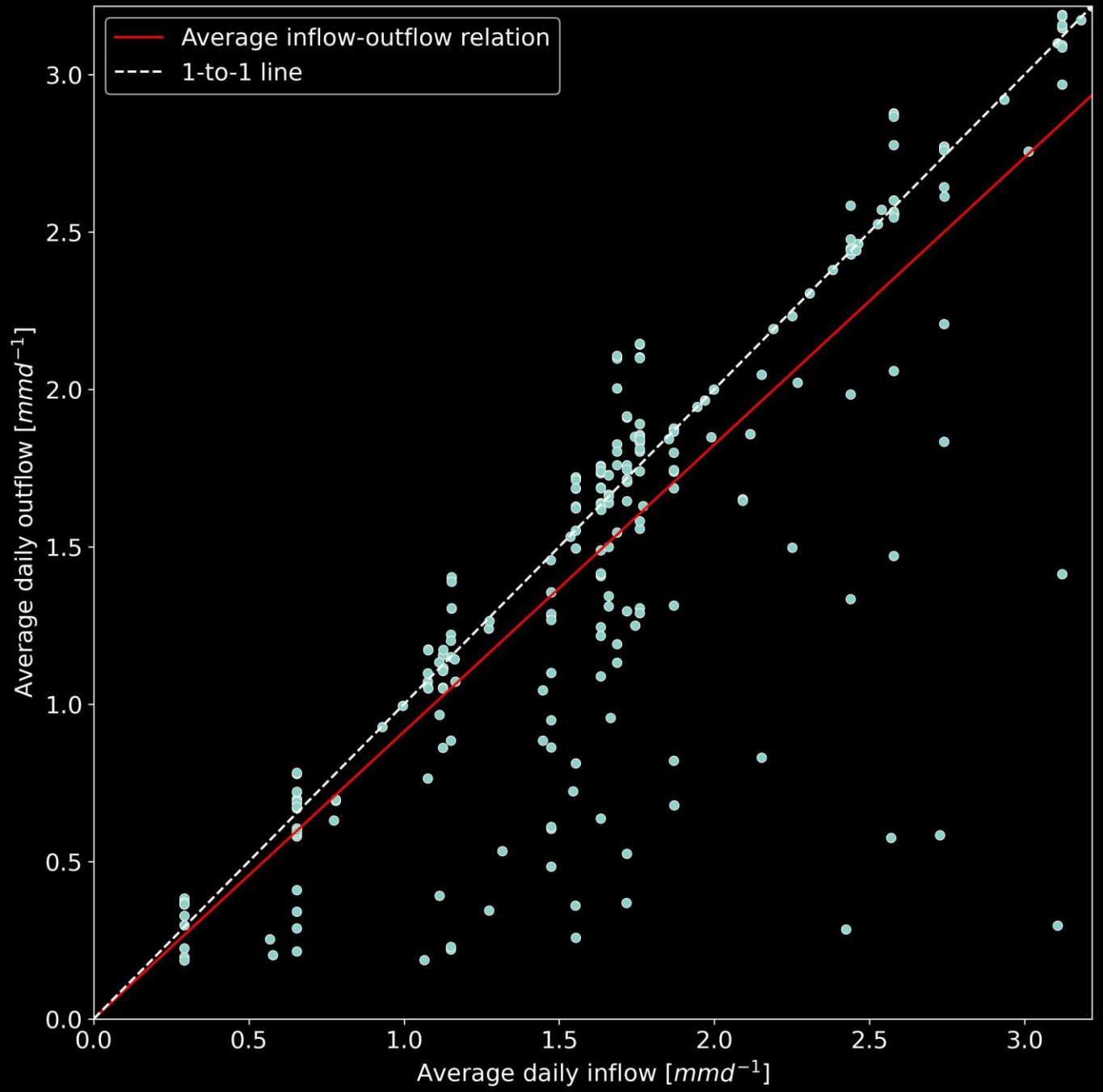

Average inflow-outflow relation
1-to-1 line
Average daily outflow [mmd^{-1}]
Average daily inflow [mmd^{-1}]
0.0
0.5
1.0
1.5
2.0
2.5
3.0



Outflow > inflow:
40%

Outflow < inflow:
43%

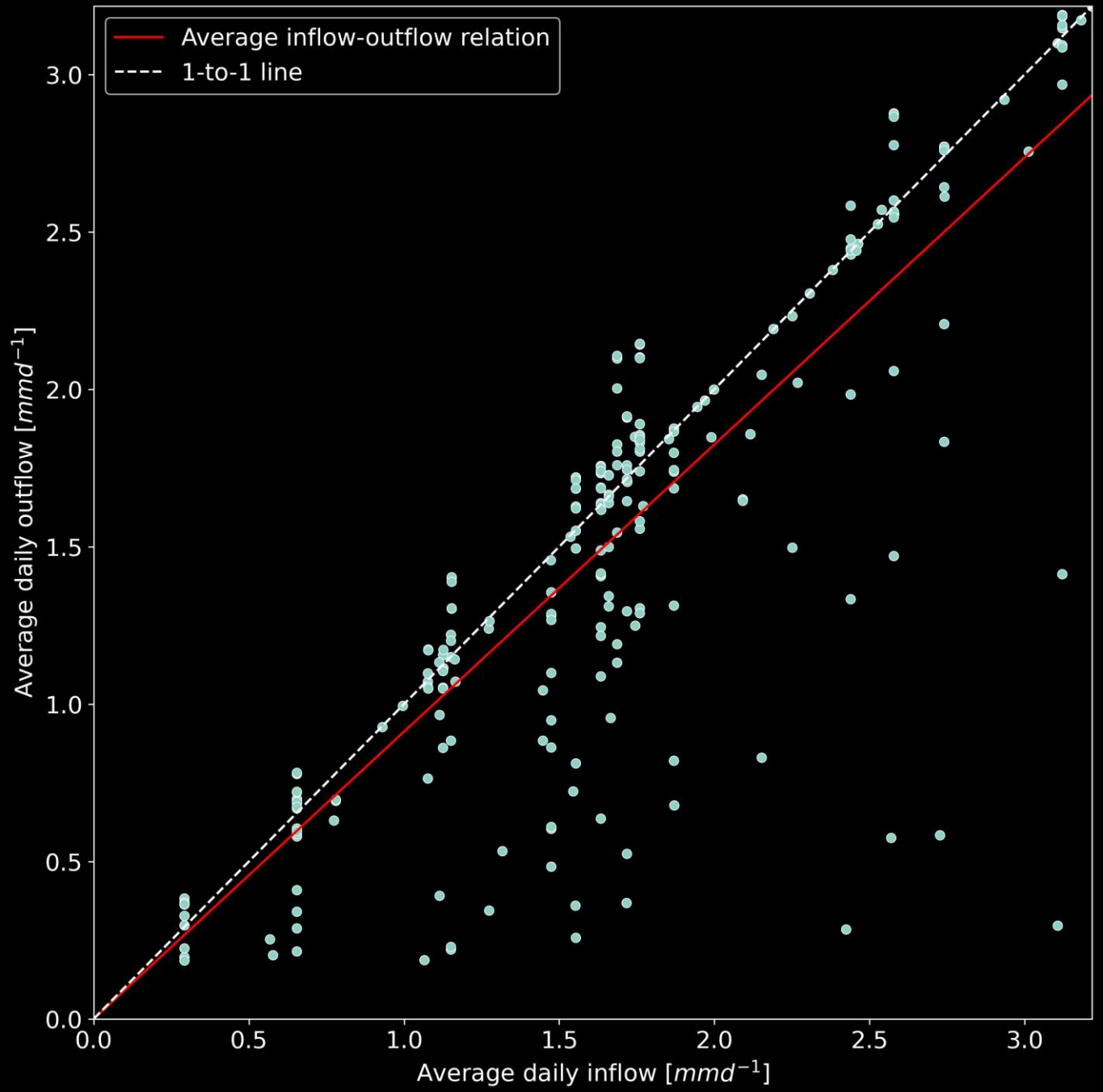
Outflow = inflow:
17%



Outflow > inflow:
40%

Outflow < inflow:
43%

Outflow = inflow:
17%

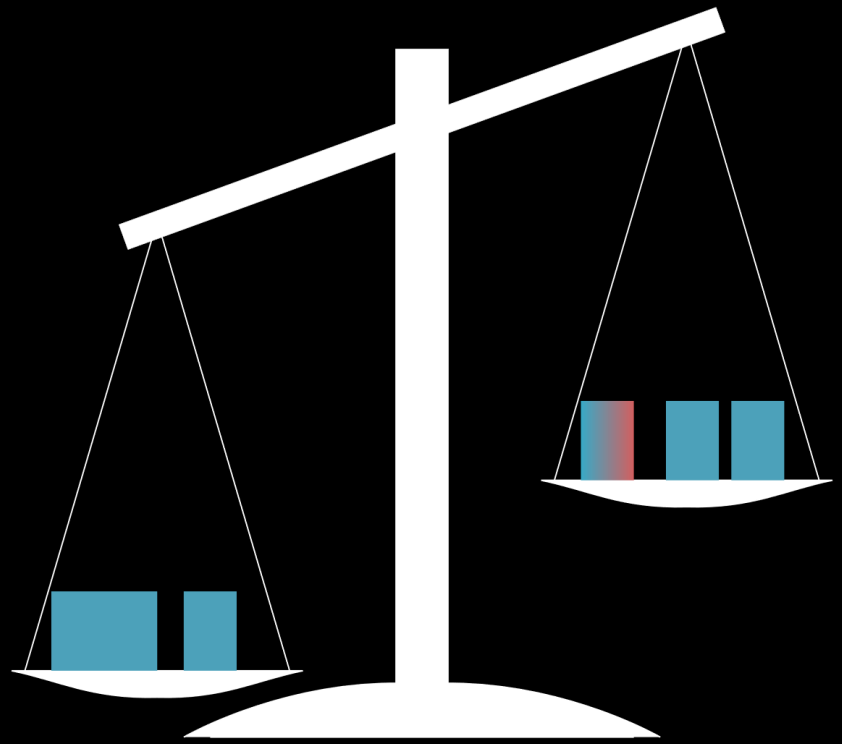


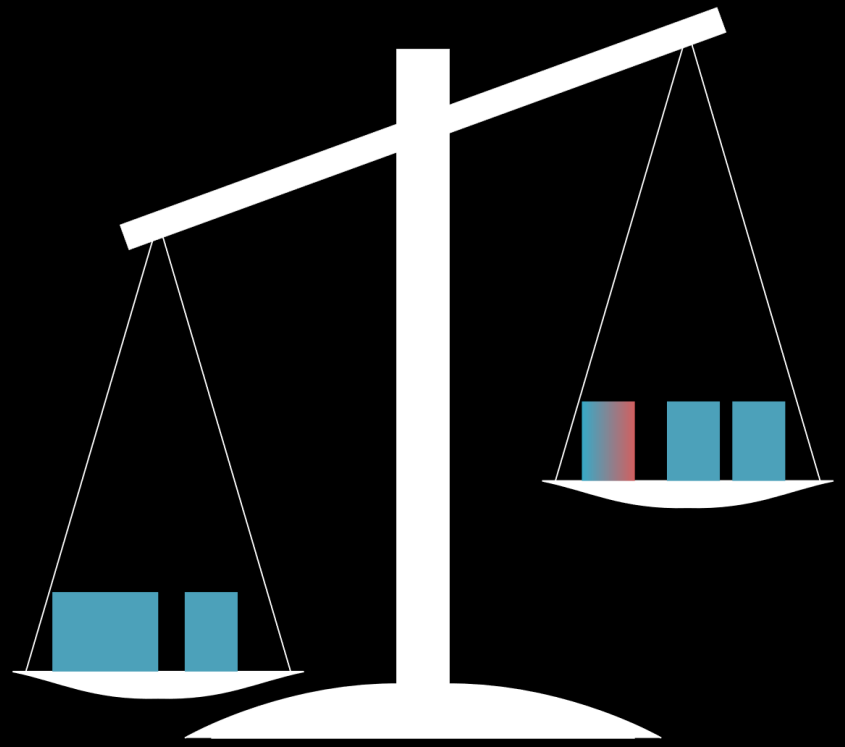
Outflow > inflow:
40%

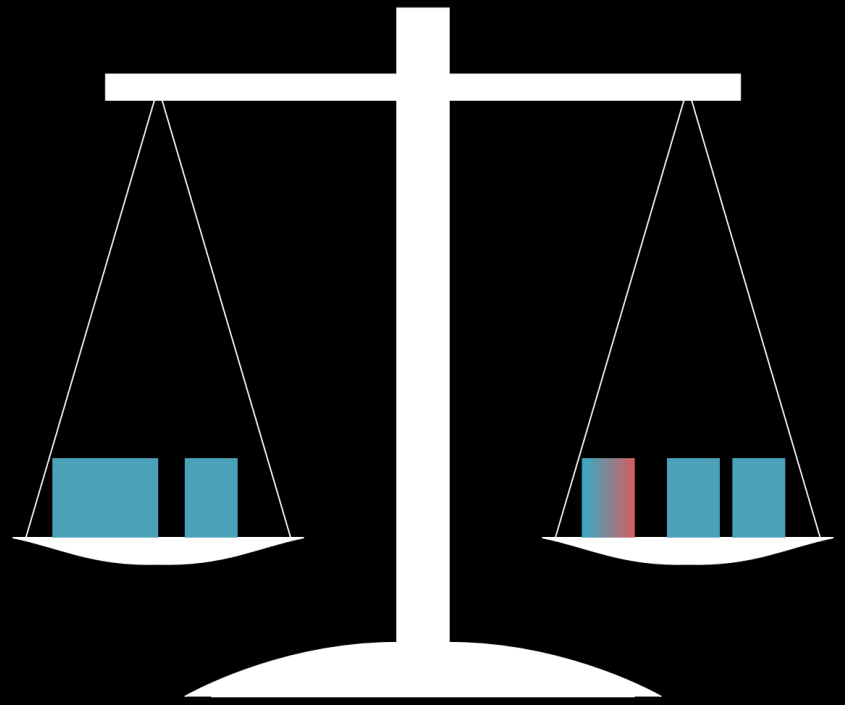
Outflow < inflow:
43%

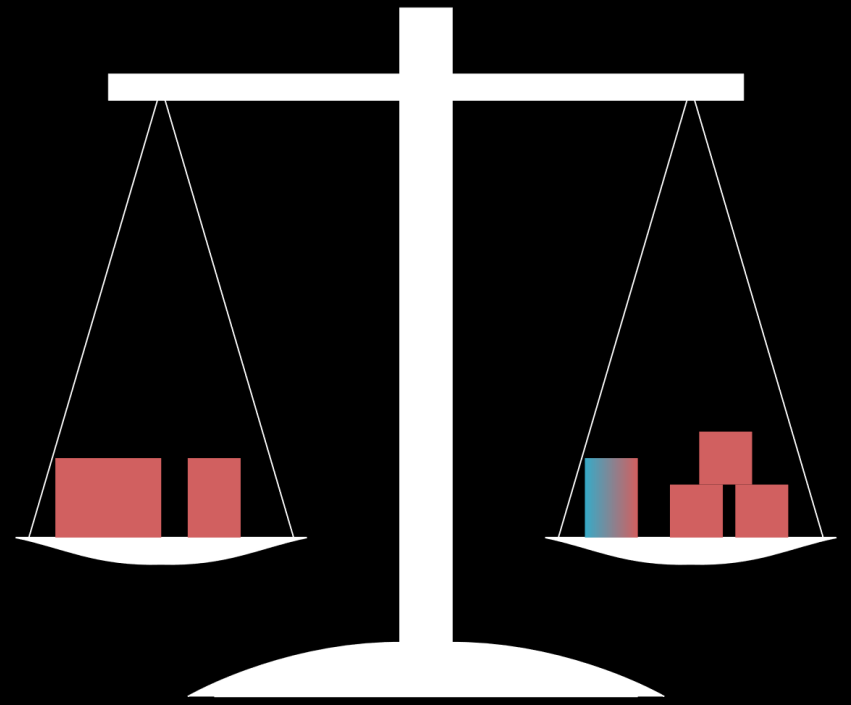
Outflow = inflow:
17%

83%









WAGENINGEN
UNIVERSITY & RESEARCH

harro.Jongen@wur.nl