Investigating summer flow paths in a Dutch agricultural field using high frequency direct measurements

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Enabling Delta Life
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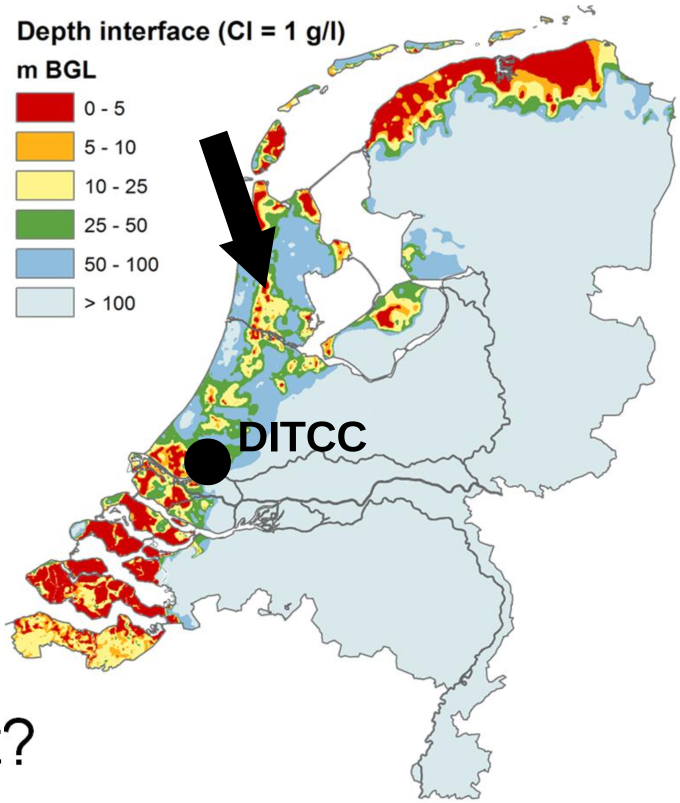
Knowledge for Climate

Background and research questions

- Netherlands: low-lying delta
- Shallow saline groundwater in coastal region (< 2 m)
- Saline exfiltration mitigated by diverted freshwater
- Global change: sustainable?



➔ What controls dynamics of surface water salinity?

➔ Implications for water management?

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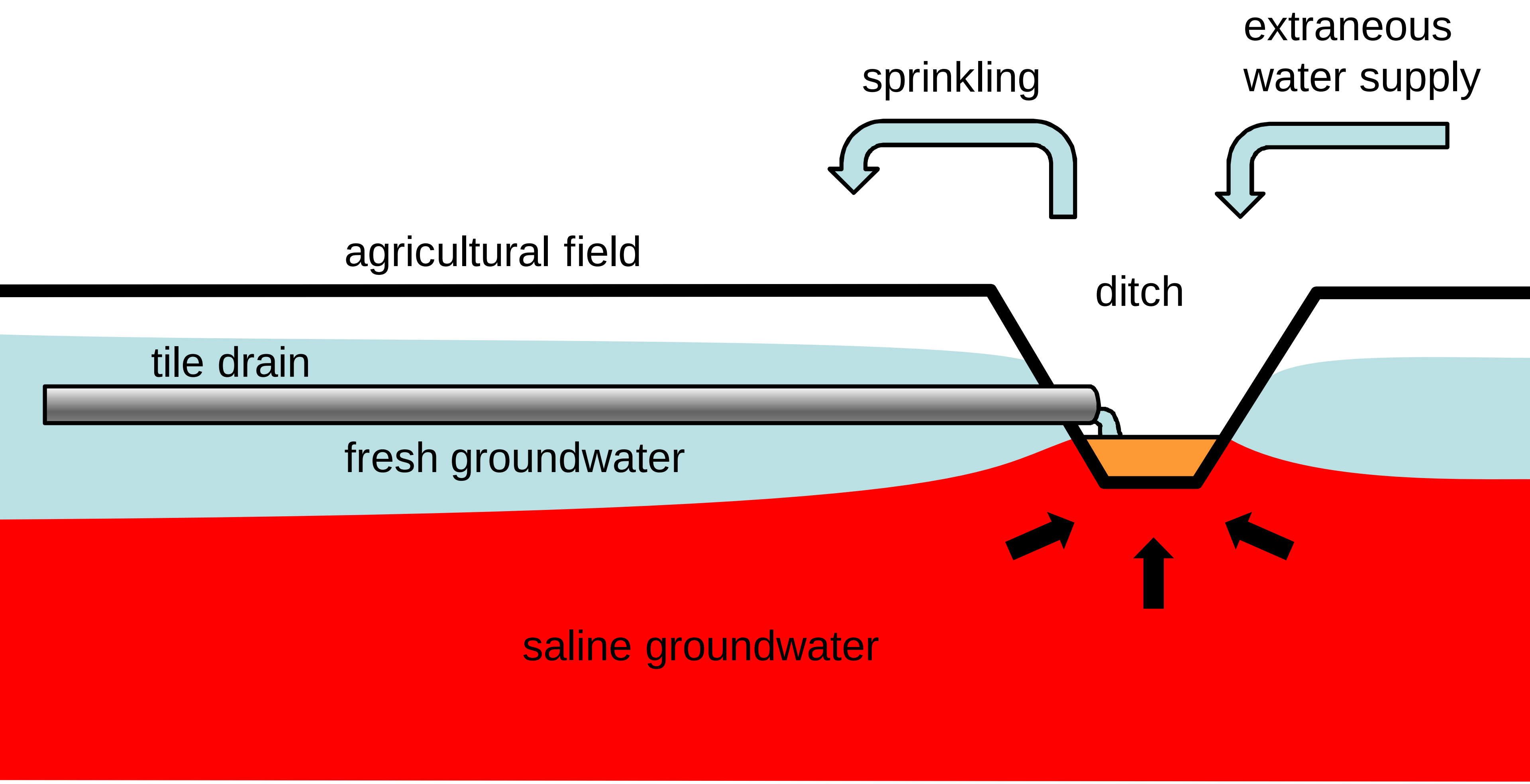
Schematic overview



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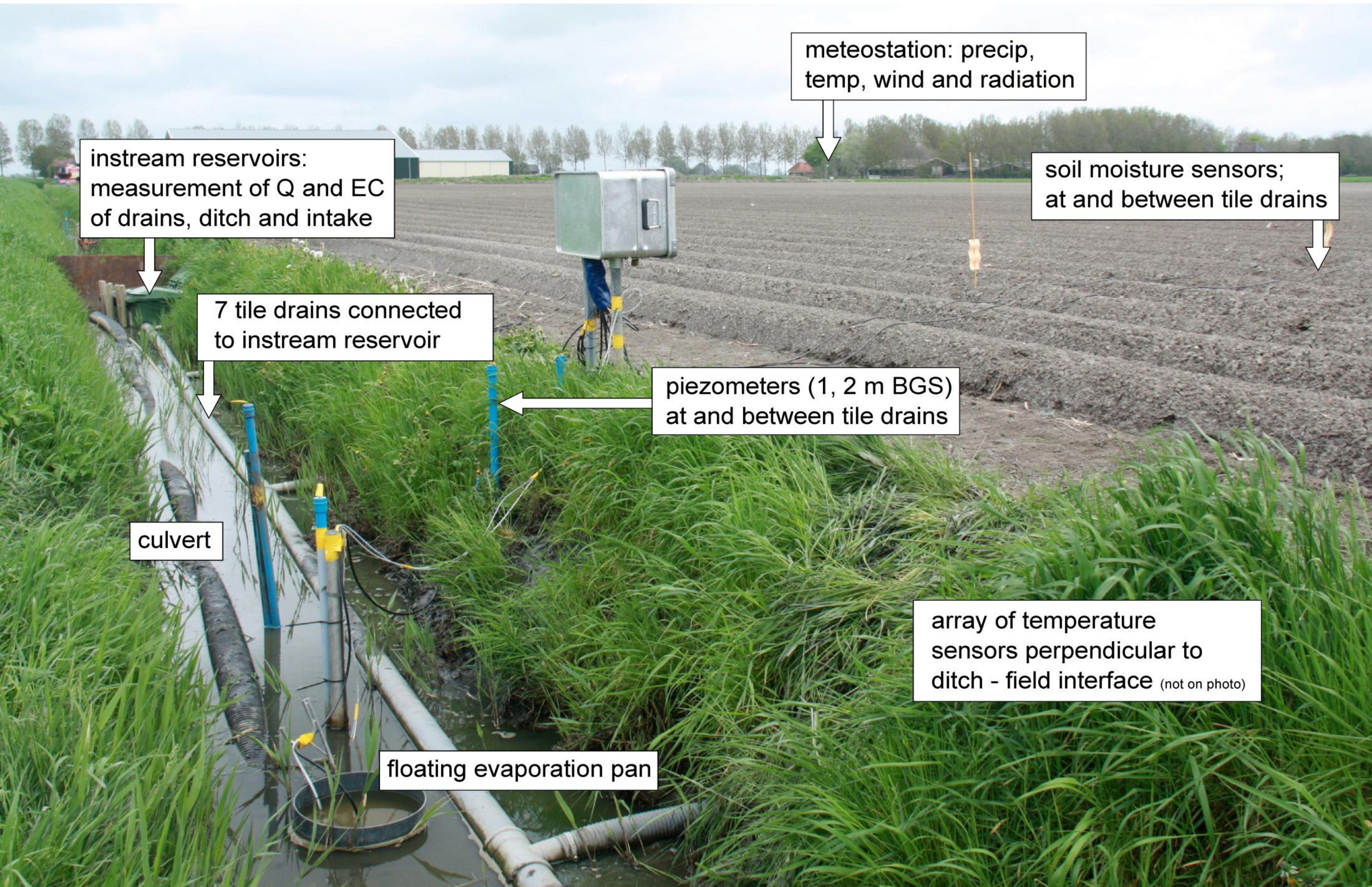
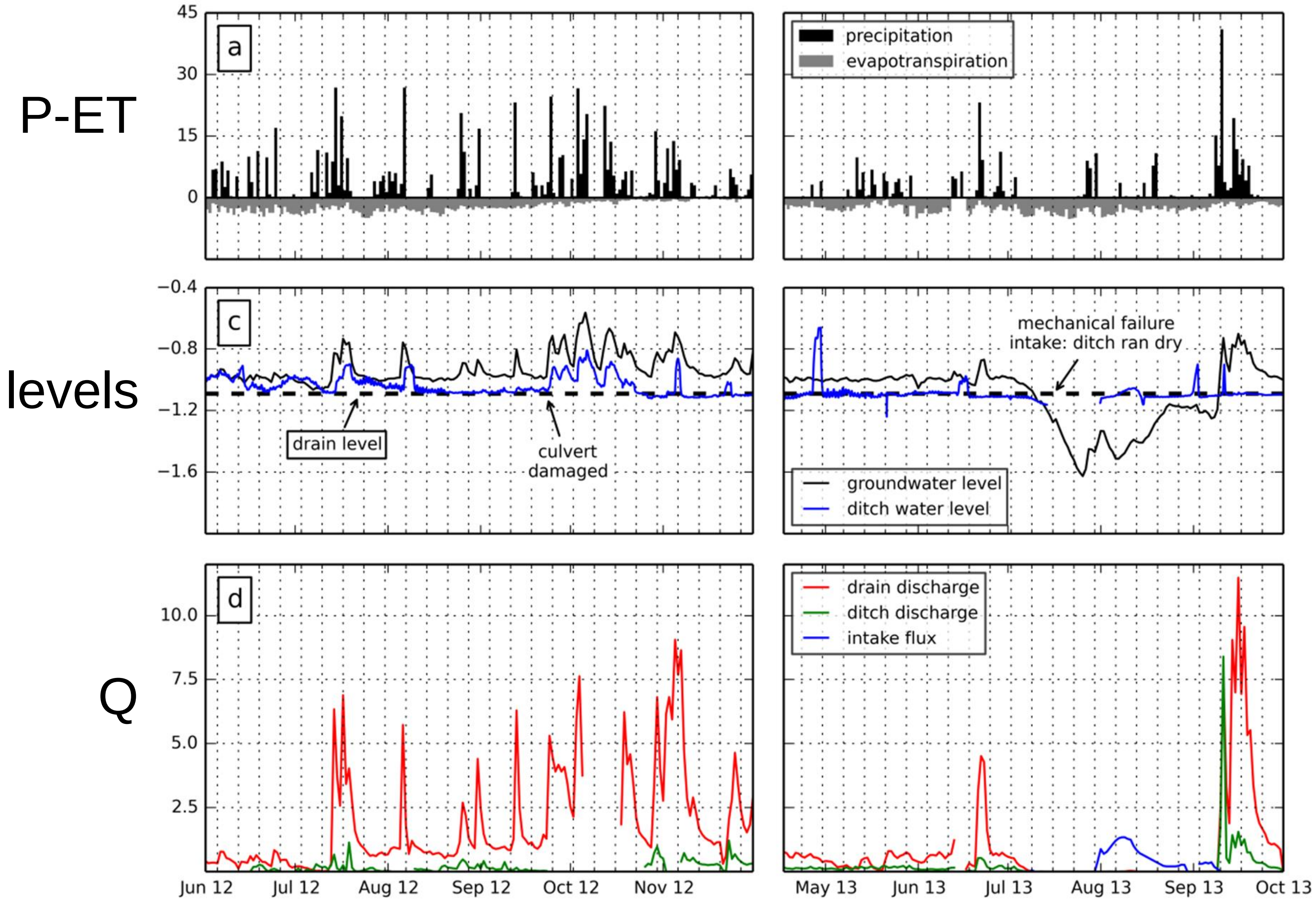
Measurement setup



Results



'wet' year

'dry' year

Flow path separation

- Separate measurement of tile drain and ditch discharge

- Ditch discharge =/= groundwater exfiltration to ditch
- Solved Q, TDS, H balance (+ uncertainty)
- Separated shallow and deep flow paths to ditch based on salinity and temperature

- Used TDS shallow (0.5 g/L) / TDS deep groundwater (15 g/L) to separate deep and shallow groundwater contribution tile drains

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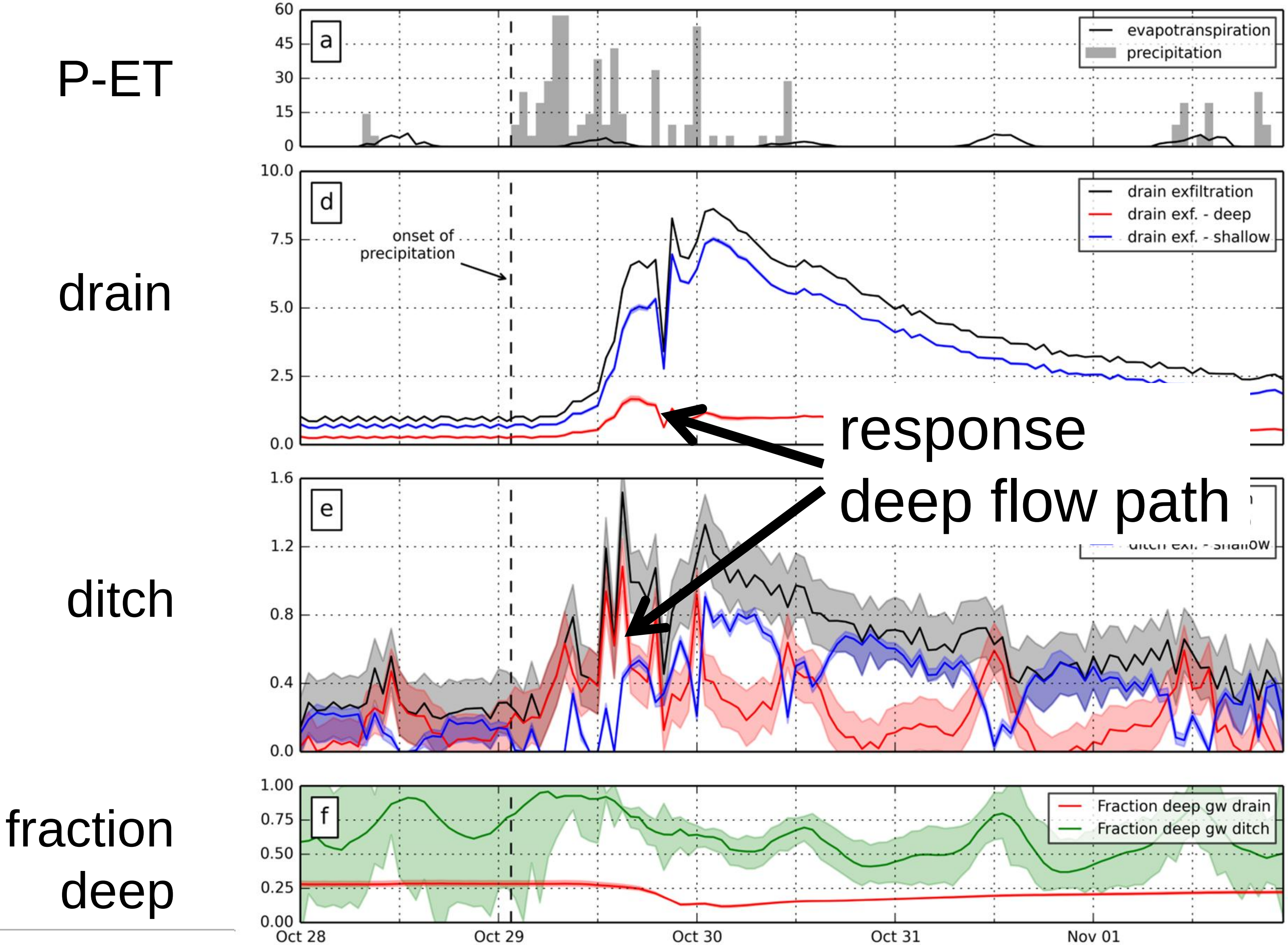
Precipitation event



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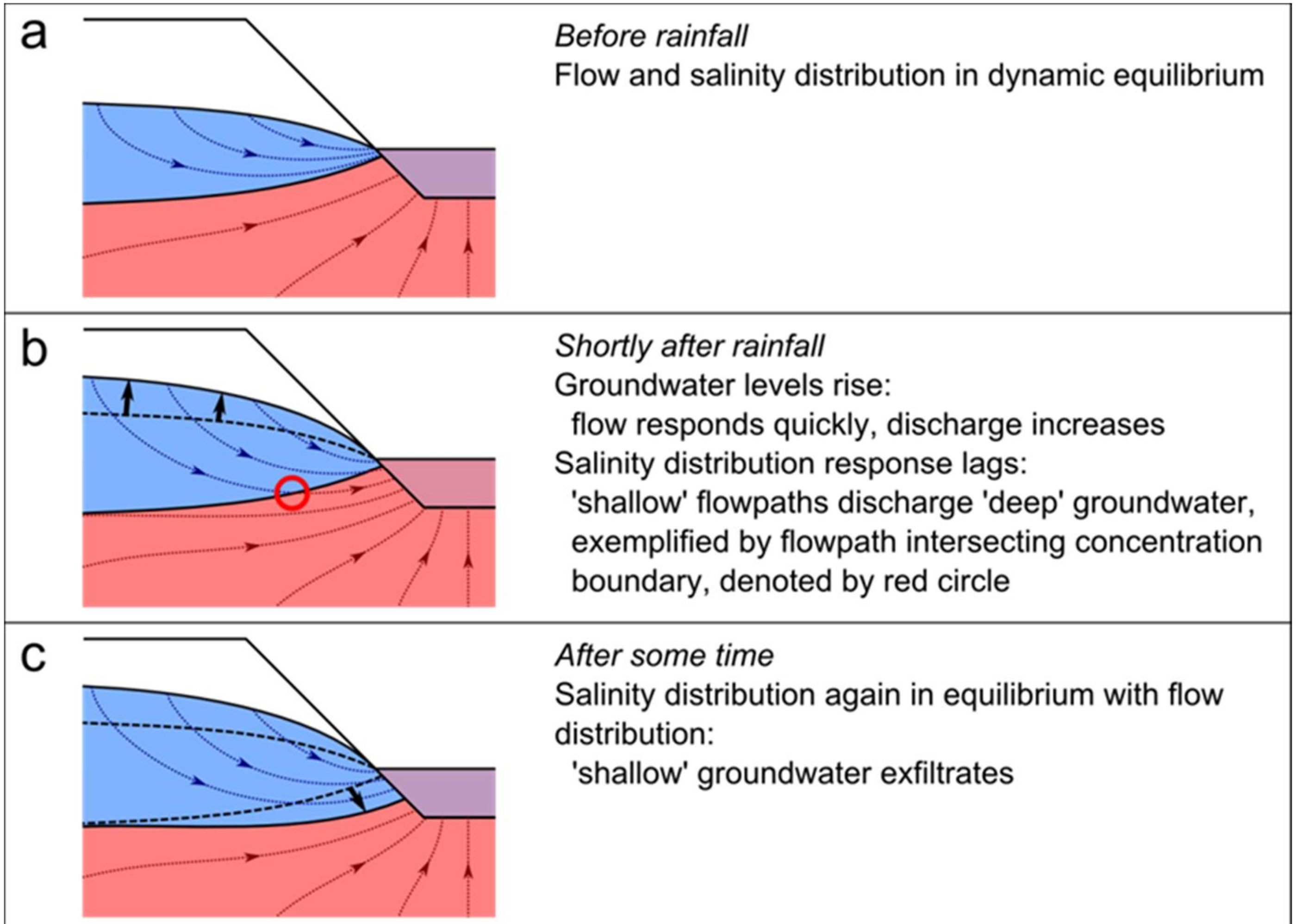
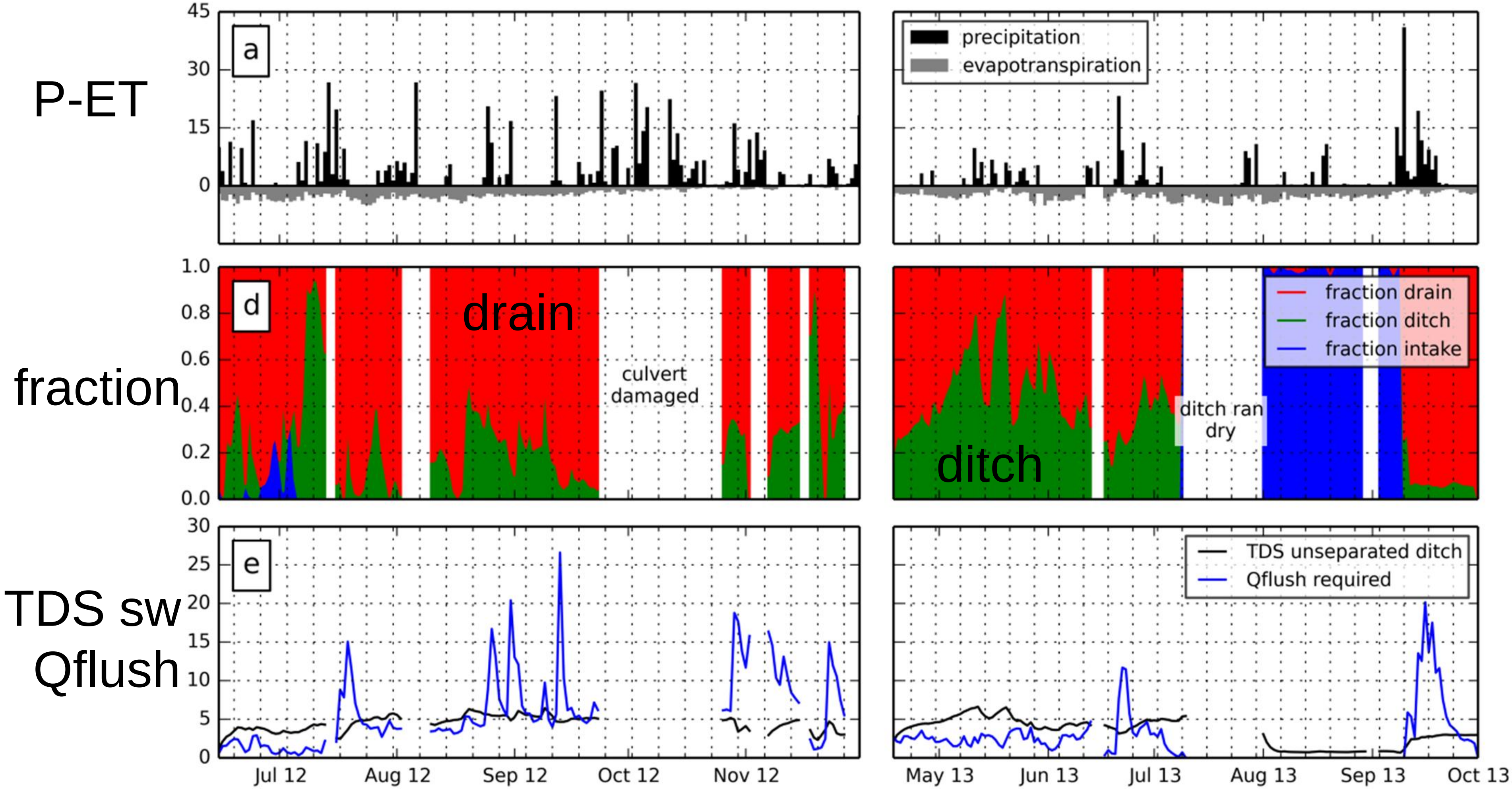
Flow paths and exfiltration salinity



Ditch salinity and flushing requirement

- Calculated surface water salinity if flows not separated
- Calculated flushing needed to keep ditch salinity below 1.5 g/L TDS (local salinity norm for growing potatoes) assuming complete mixing

Ditch salinity



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Conclusions

- Exfiltration salinity controlled by pressure wave celerity versus water velocity
- Salinity surface water also result of changing fractions drain / ditch
- Tile drains transport majority of salinity

- Water required to enable sprinkling far outweighs sprinkling demand (6x in dry year)
- Less water required in dry than wet periods for flushing: operational control could significantly decrease water demand


Questions?