How deep do signals of surface conditions extend into the subsurface Critical Zone?

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The Critical Zone extends from vegetation into groundwater. In AquaDiva we are concerned with how water (Aqua) and gas transport links surface and subsurface life, chemistry and molecular diversity (Diva).

How deep do surface 'signals' penetrate into the subsurface?

What is more important to subsurface life - land cover or geology?

Filtering and transformation of surface signals

- **Surface as the source of groundwater microbial life**: Ultra-small bacteria of class *Cand*. Patescibacteria are easily mobilized from soil and make up a large portion of groundwater bacteria. (Hermann et al. 2019)
- Fresh plant compounds are mostly transformed by microbes in the soil and **DOM in shallow groundwater reflects microbial properties** (Roth et al. 2019; Benk et al. 2018)
  - Though a few compounds do make it into groundwater unchanged, especially in recharge zones with good surface/subsurface connections
- **Carbon in groundwater DOM is older than fresh plant C sources**, reflecting that the main source of C introduced to groundwater is likely deeper soil horizons (Benk et al. 2018, 2019)

Importance of geologic setting:

- Local hydrochemical and environmental controls create differentiation in groundwater communities (Yan et al. 2019)
- Bacterial and fungal communities are distinct from seepage water, indicating selection with hydrochemical conditions (especially e- acceptor availability). (Schwab et al. 2017)
- Molecular composition of groundwater DOM also covaries with hydrochemistry (Benk et al. 2019)
- Groundwater DGDT Microbial markers reflect predominantly groundwater community sources (Ding et al. 2017)
- C Isotopes in groundwater organisms indicate the **importance of chemolithoautotrophy and rock-derived organic C** for sustaining groundwater communities (less dependence on surface energy sources) (Nowak et al. 2017, Benk et al. 2019; Schwab et al. 2019)

References – https://www.aquadiva.uni-jena.de

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