Catchments as Reactors: Metabolism of Pollutants on the Landscape Scale
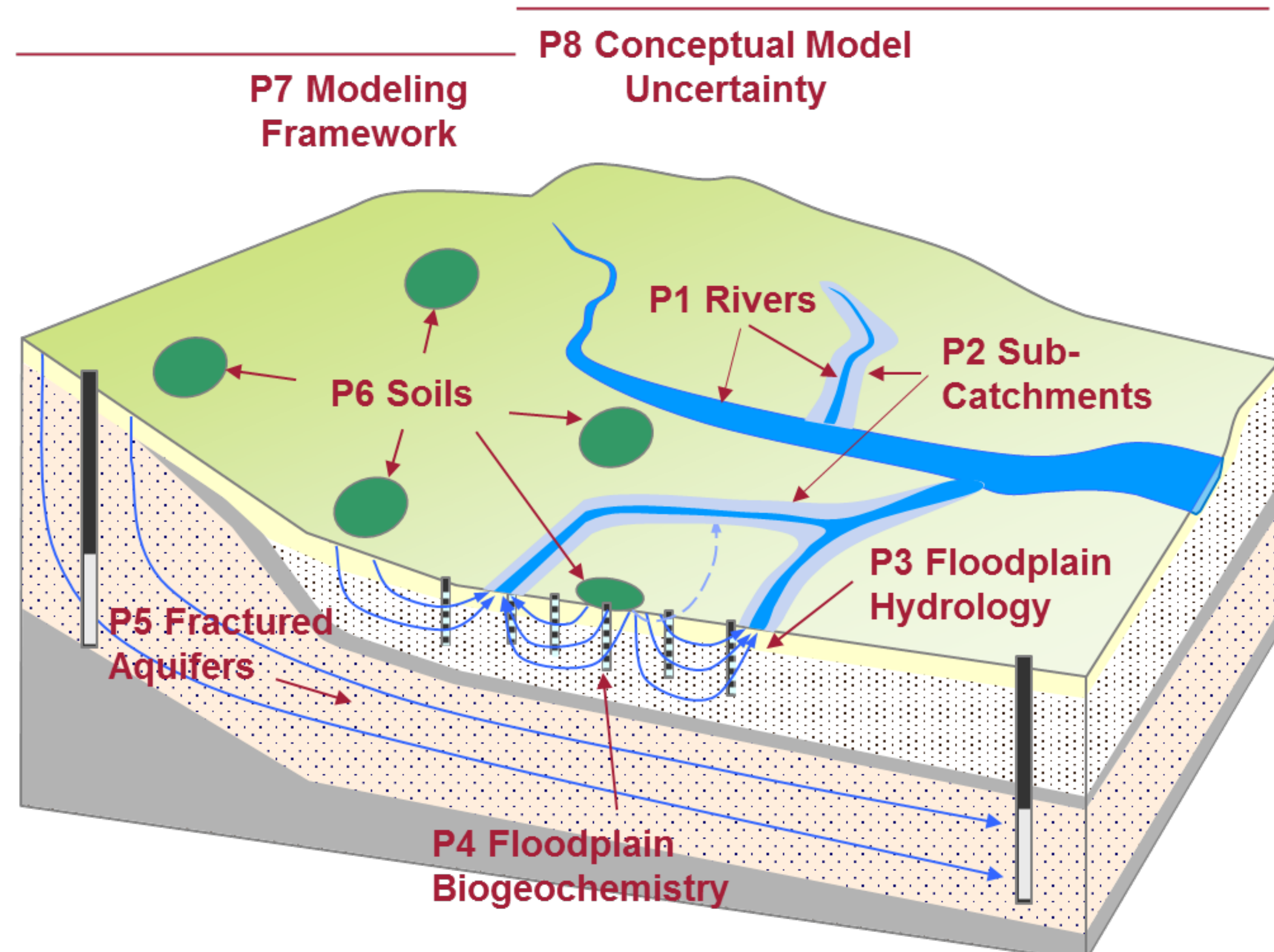
P. Grathwohl[1] (Speaker), O.A. Cirpka[1], P. Dietrich[1,2], M. Elsner[3], B. Escher[1,2], J.H. Fleckenstein[2], C. Griebler[4], S.B. Haderlein[1], C. Huhn[1], E. Kandeler[5], A. Kappler[1], S. Kleindienst[1], C. Leven[1], T. Lüders[6], W. Nowak[7], H. Pagel[5], C. Poll[5], H. Rügner[1], M. Schwientek[1], T. Streck[5], T. Walter[1], C. Zarfl[1], C. Zwiener[1]

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Objectives of CAMPOS

- Identify landscape elements which control storage, bio-geochemical transformation, and elimination of pollutants.

- Identify the processes and their dynamics responsible for relevant pollutant transformation in environmental compartments.

- Develop an innovative modeling framework to simulate and predict reactive transport and pollutant behavior on the landscape scale.

Projects: Landscape Elements & Modelling

P8 Conceptual Model Uncertainty
P7 Modeling Framework
P1 Rivers
P6 Soils
P2 Sub-Catchments
P3 Floodplain Hydrology
P5 Fractured Aquifers
P4 Floodplain Biogeochemistry

P1: Rivers: *Which riverine processes influence fluxes leaving the catchment?*

P2: Sub-Catchments: *Transformation potential at sub-catchment scale (where and when)?*

P3: Floodplain Hydrology: *Dynamics of flow paths and residence times?*

P4: Floodplain Biogeochemistry: *Dynamics of redox conditions, microbial activity and chemistry.*

P5: Fractured Aquifers: *Are slow pollutant transformations effective over large residence times?*

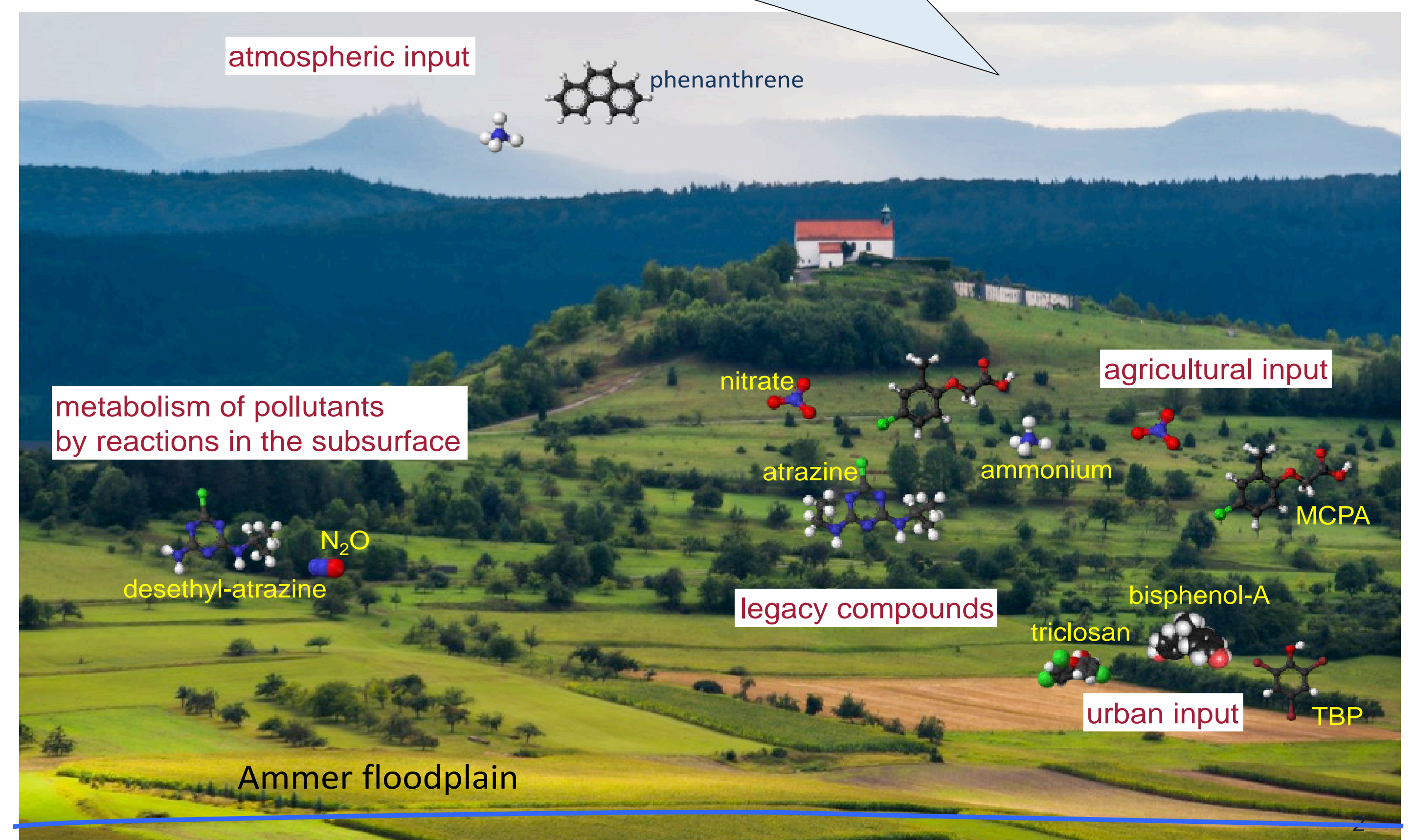**P6: Soils:** *Why are organic pollutants in soils so persistent?*

P7: Stochastic Modeling Framework: *Process-based numerical models of flow, transport, and reactive turnover.*

P8: Conceptual Model Uncertainty *Which model complexity is required?*

INF: Data Management: *Data visualization, additional value*

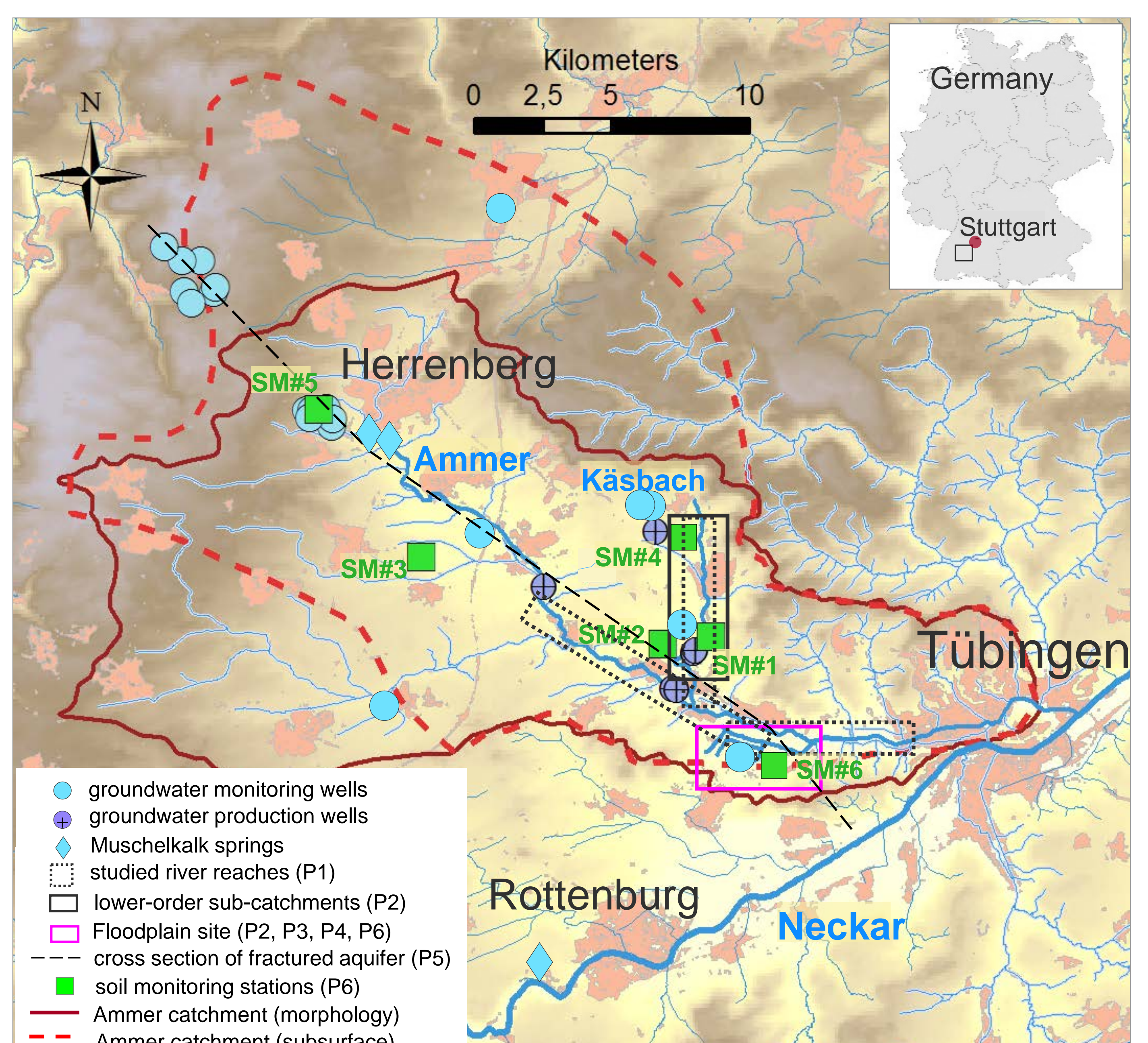**S1/S2: Support:** *Field work, analytics, basic modeling services*

How do catchments process diffuse pollutants?

atmospheric input — phenanthrene
metabolism of pollutants by reactions in the subsurface
nitrate — atrazine — ammonium — agricultural input — MCPA
N_2O — desethyl-atrazine — legacy compounds — triclosan — bisphenol-A — TBP — urban input
Ammer floodplain

Hypotheses

- Turnover rates in the lab are often much higher than in the field. Conversely, processes overlooked in the lab may be effective and controlling in the field.

- Efficient turnover takes place at steep dynamic gradients.

- Exposure to suitable conditions is more important than residence time.

Field Sites: The River Ammer Catchment

Kilometers
0 2,5 5 10
Germany — Stuttgart
N
Herrenberg
SM#5
Ammer
Käsbach
SM#3
SM#4
SM#2
SM#1
Tübingen
SM#6
Rottenburg
Neckar

- groundwater monitoring wells
- groundwater production wells
- Muschelkalk springs
- studied river reaches (P1)
- lower-order sub-catchments (P2)
- Floodplain site (P2, P3, P4, P6)
- cross section of fractured aquifer (P5)
- soil monitoring stations (P6)
- Ammer catchment (morphology)
- Ammer catchment (subsurface)

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