TOXIC EUROPEAN SUMMER FLOOD

DISPERSION OF ORGANIC POLLUTANTS ALONG THE VICHT & INDE RIVERS, GERMANY

Teaching and Research Area Neotectonics and Natural Hazards

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Toxic European Summer Flood

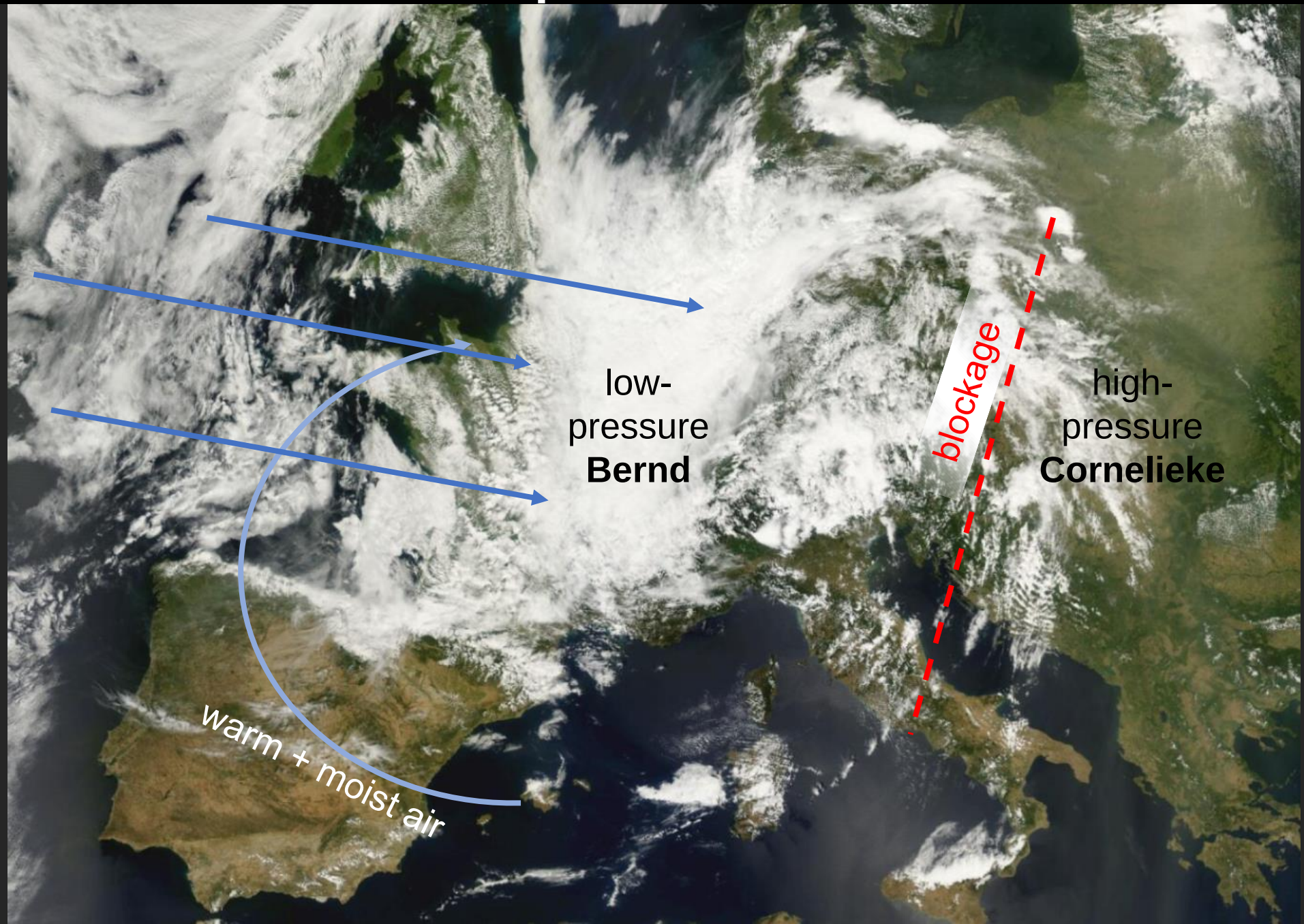
low-pressure **Bernd** **blocked** from moving eastward with westerlies

⬇

rotation over same area

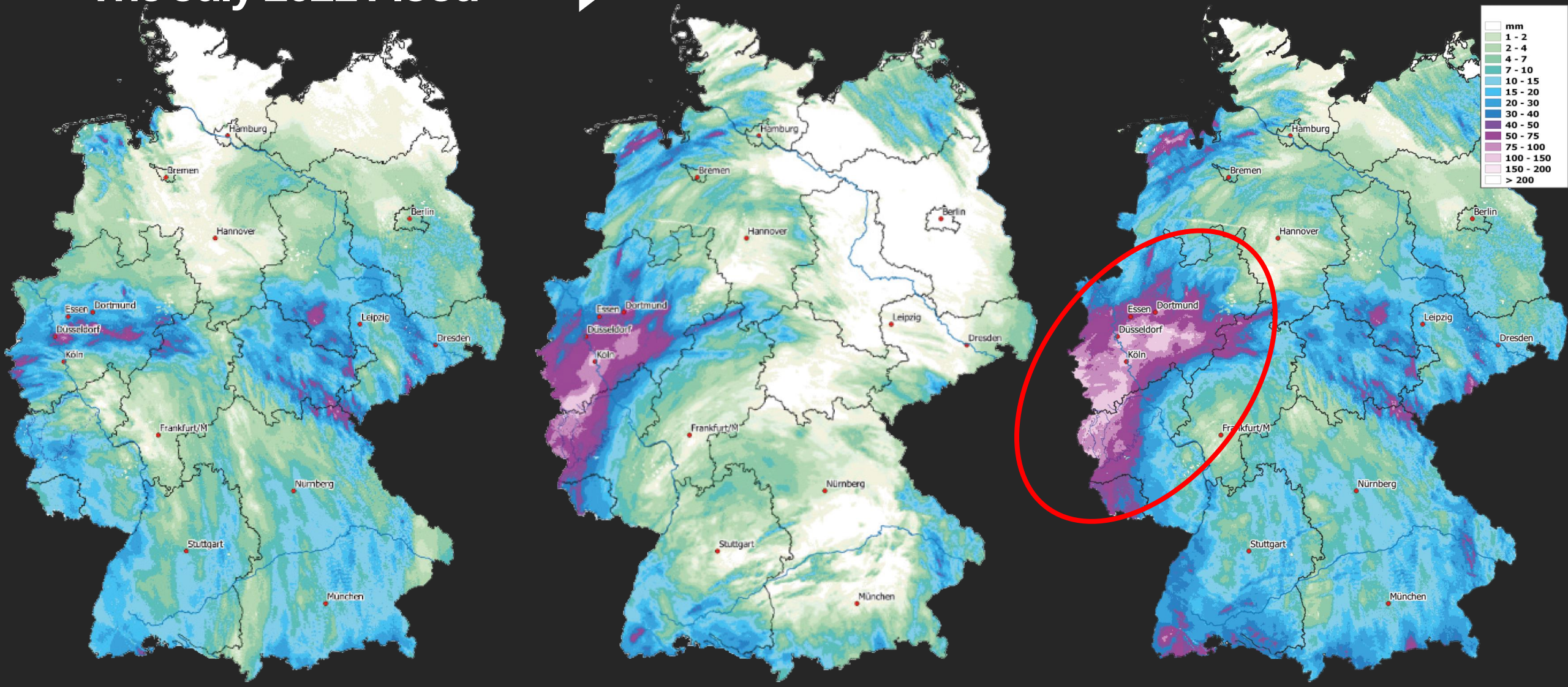
⬇

increased precipitation in this region



Toxic European Summer Flood

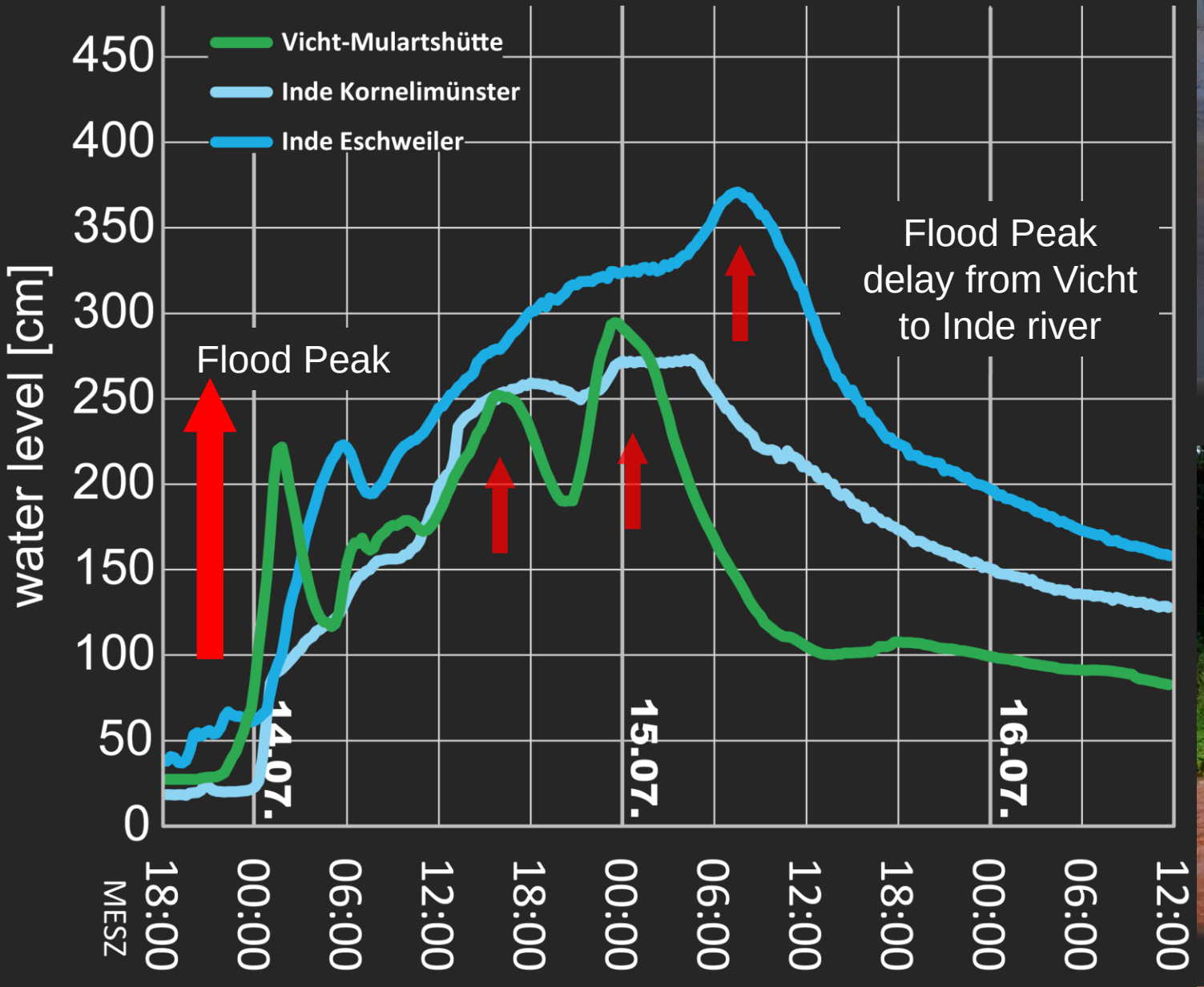
The July 2021 Flood → increased precipitation over several days



July 13th, 2021 | July 14th, 2021 | July 13th +14th, 2021

Toxic European Summer Flood

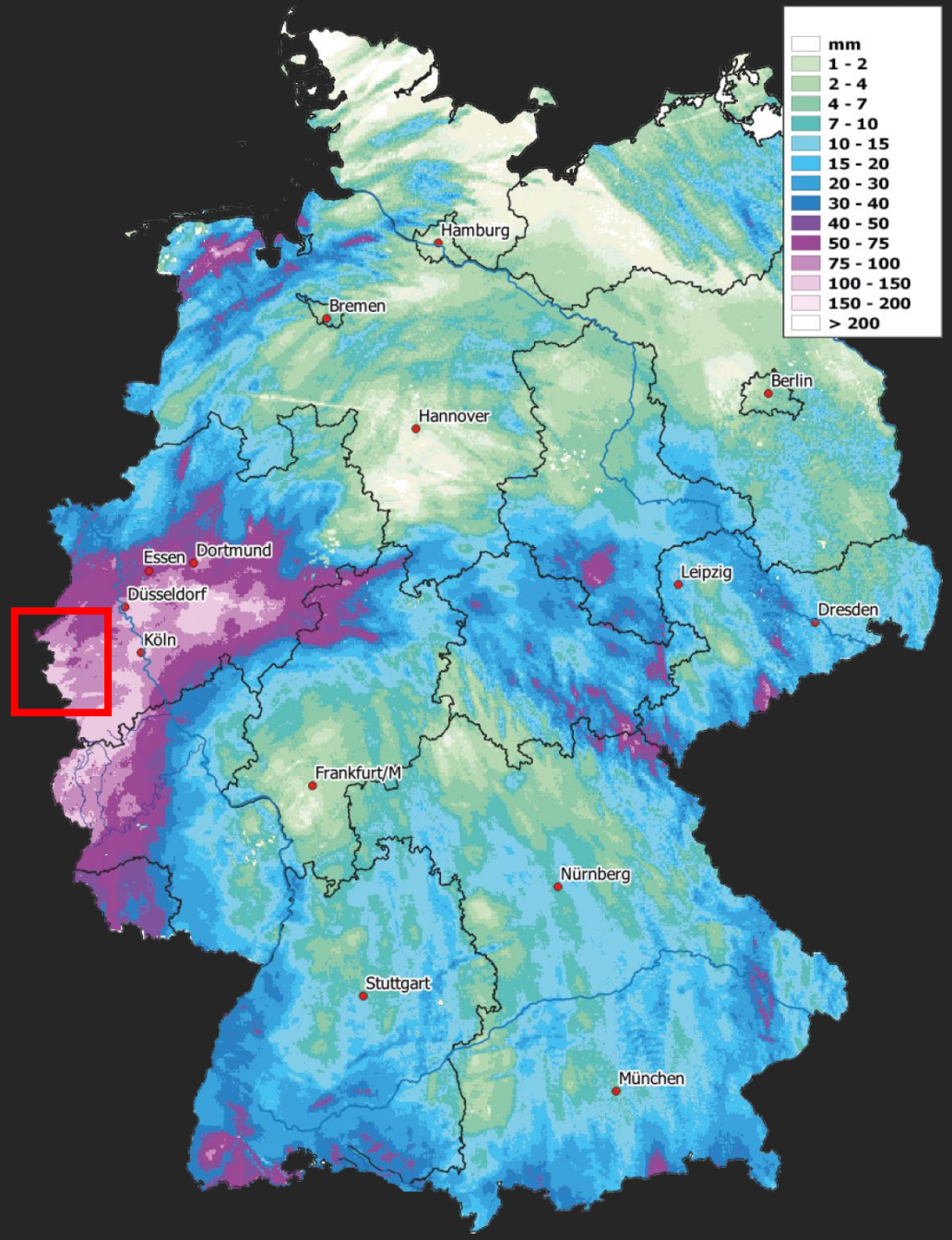
Water level at Vicht and Inde rivers

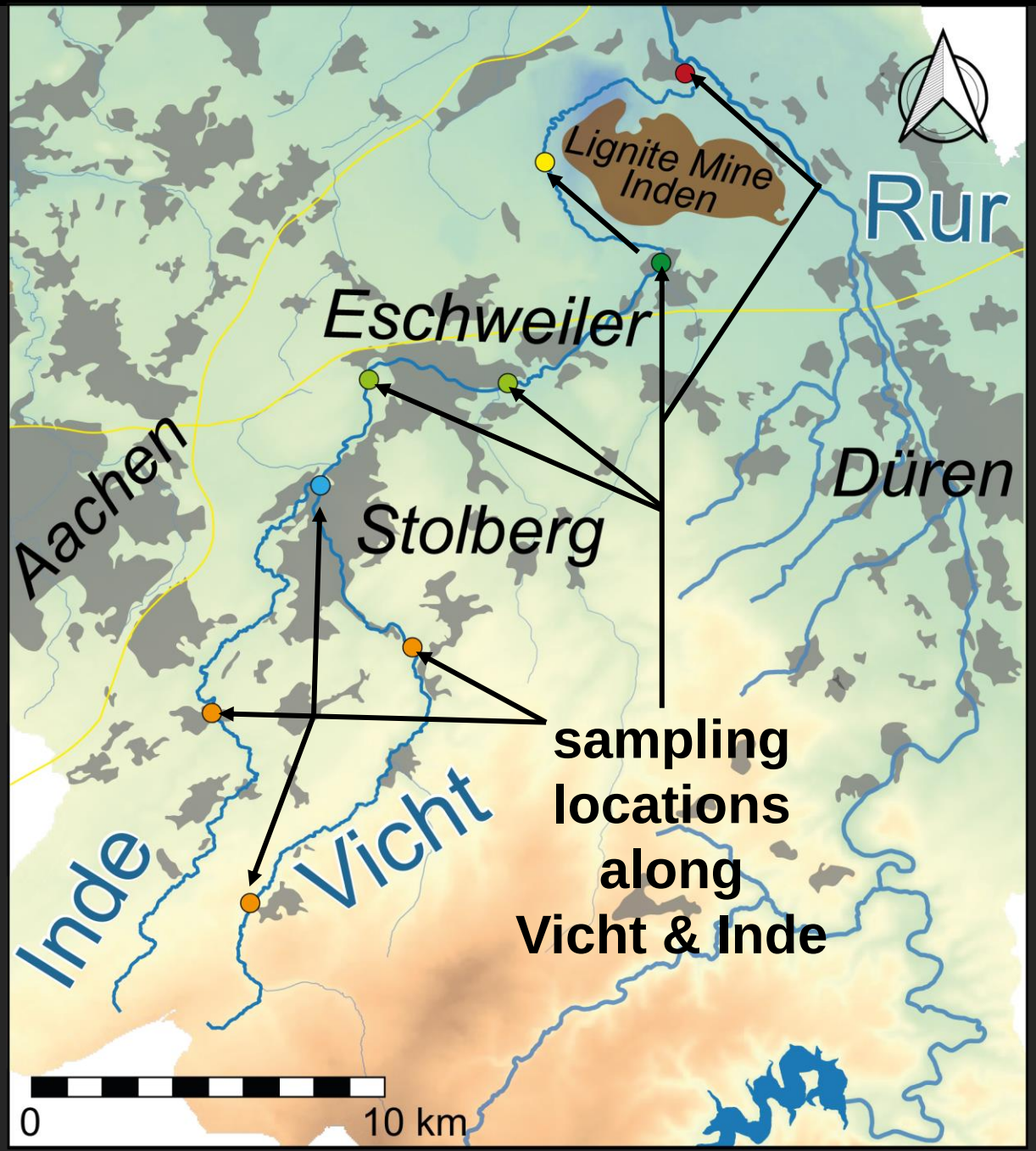


flood peak in Stolberg

increasing water level near Mechernich

Toxic European Summer Flood





Toxic European Summer Flood

damages due to water level

damages by impacts

Toxic Floods Effects in Europe

damages by water and impacts

Toxic Floods Effects in Europe

water damages

Toxic European Summer Flood

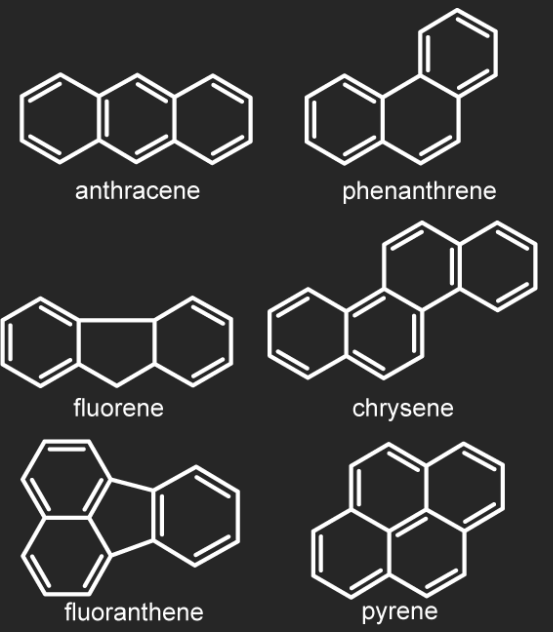
The July 2021 Flood

Stolberg during the flood 2021

Stolberg after the flood 2021

Toxic European Summer Flood

Polycyclic Aromatic Hydrocarbons (PAHs) → petrogenic pollutants

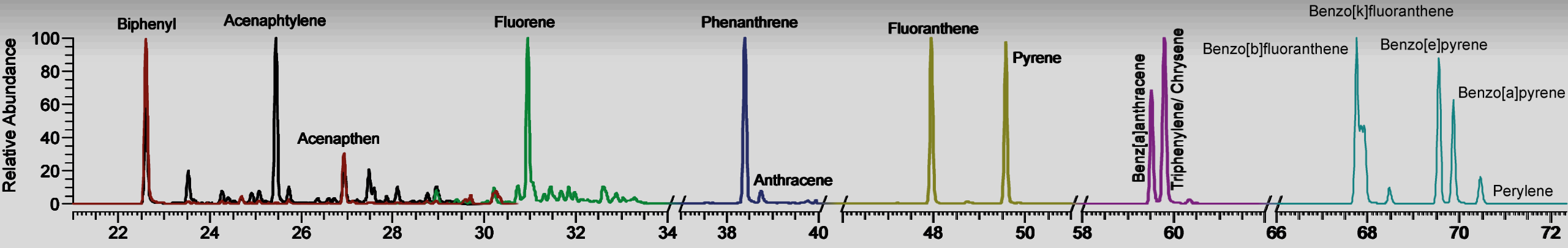


- non-polar + lipophilic → cancerogenic + genotoxic

→ originate from incomplete combustion

- natural fires → pyrogenic
- fossil fuels → petrogenic + pyrogenic

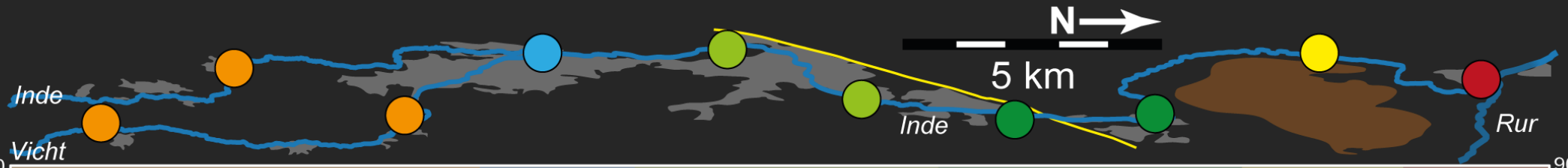
- compound specific mass to charge ratio (m/z):

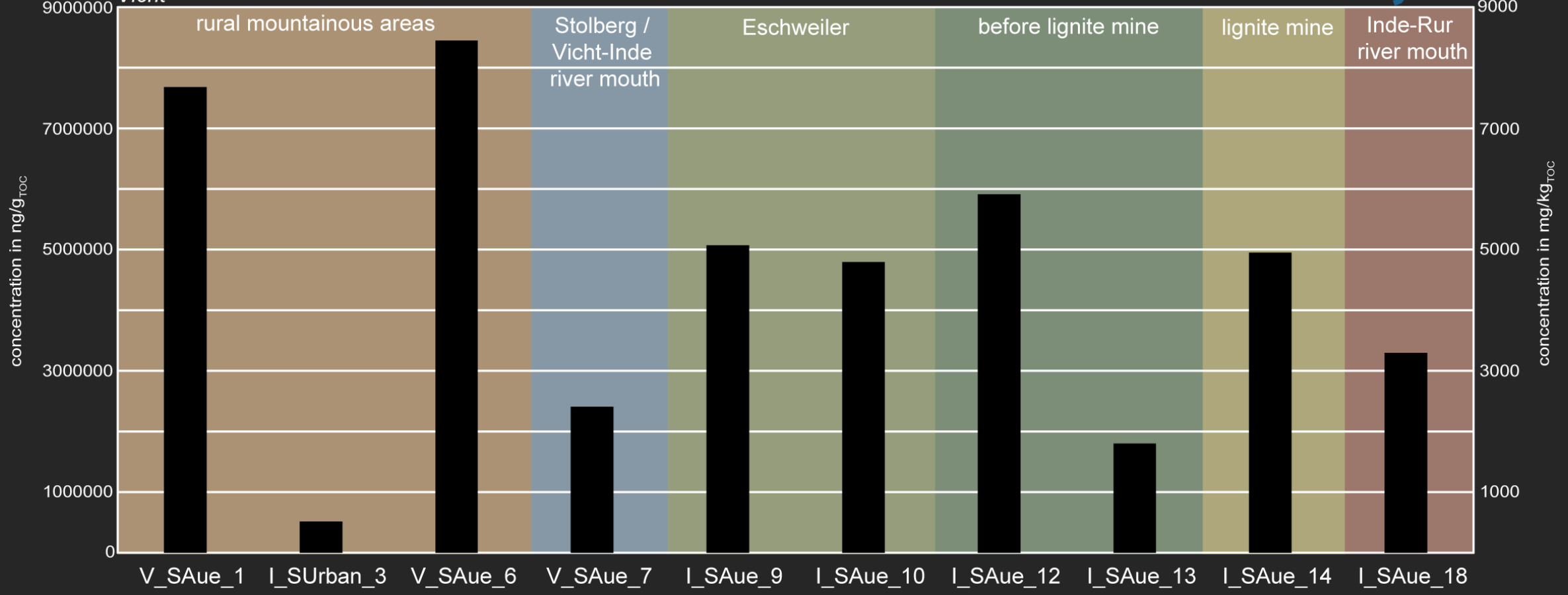


Toxic European Summer Flood

Polycyclic Aromatic Hydrocarbons (PAHs) → petrogenic pollutants

→ generally high pollution (mg/kg) → dynamic distribution → local urban sources (*e.g., oil heating systems*)





Toxic European Summer Flood

Linear Alkylbenzenes (LABs)

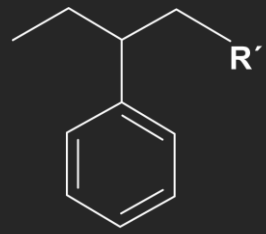
→ urban wastewater pollutants

→ typical urban/ household effluents

- systematic change in isomeric composition = I/E ratio

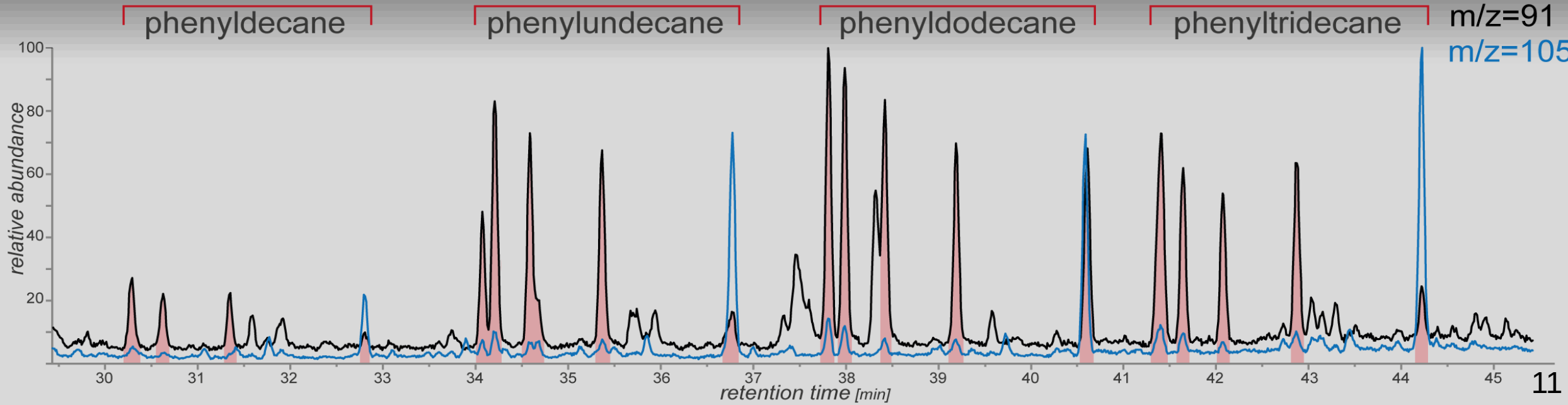
→ extent of microbial degradation

→ treatment status of wastewater



linear alkylbenzene

surfactants = detergent



Toxic European Summer Flood

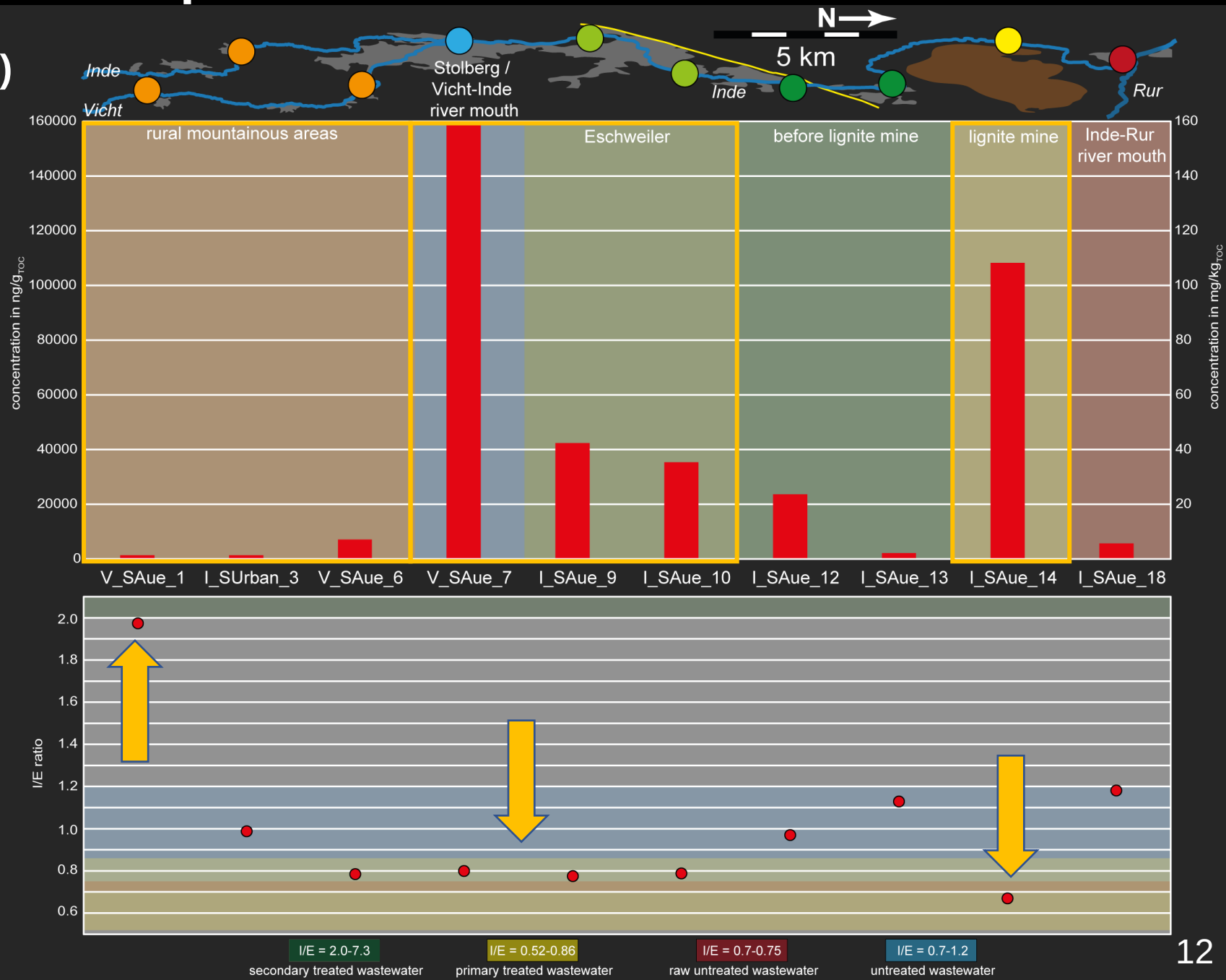
Linear Alkylbenzenes (LABs)

→ urban wastewater pollutants

- no pollution upstream of Stolberg
  → high I/E ratio

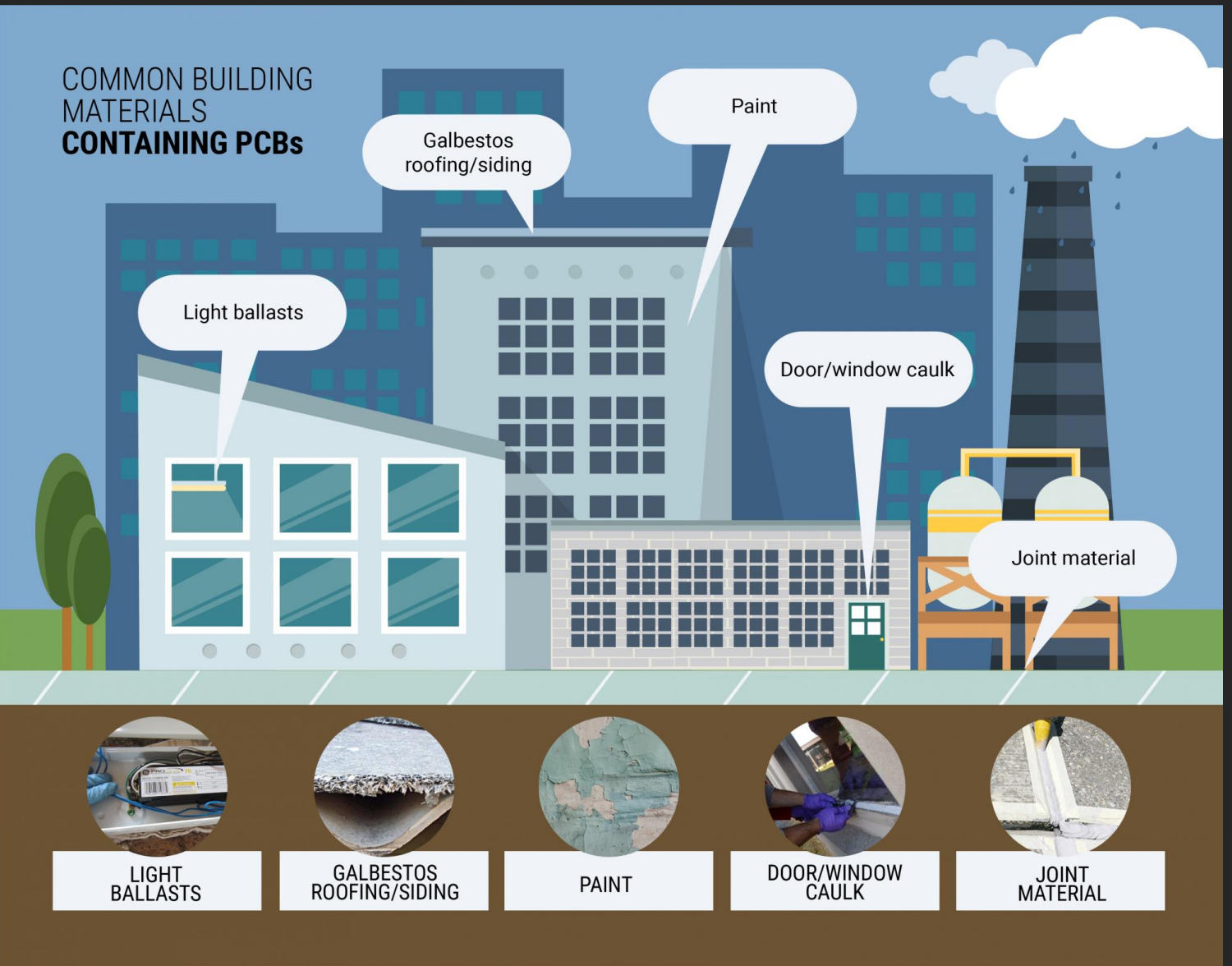
- main pollution after Stolberg
  → I/E ratio low = sewage emission

- local emission Inden / lignite mine
  → I/E ratio low = sewage emission



Toxic European Summer Flood

Polychlorinated Biphenyl's (PCBs) → industrial pollutants



→ environmental toxic

→ endocrine disruption

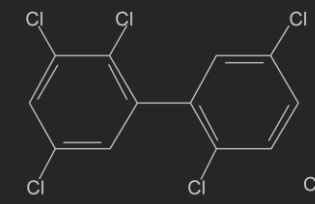
→ today ubiquitous in the environment

- longevity made it ideal for construction

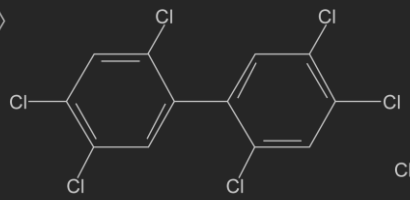
→ used as plasticizer

- banned 2004 (globally)

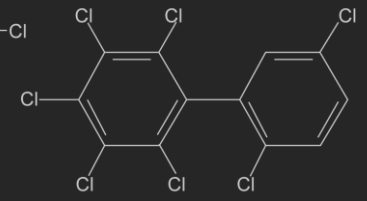
→ still in use today + old burdens



Pentachlorbiphenyl



Hexachlorbiphenyl

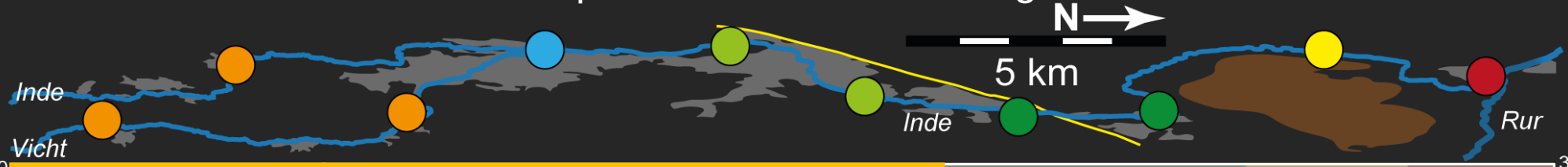


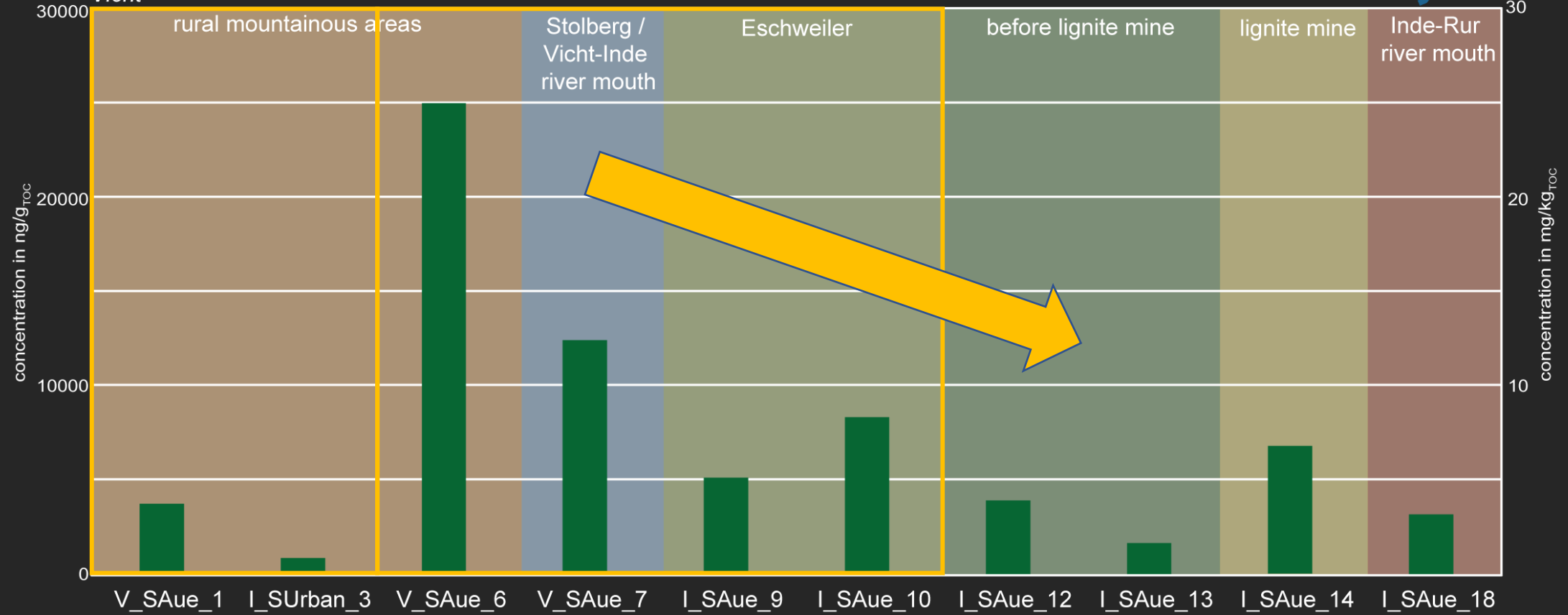
Heptachlorbiphenyl

Toxic European Summer Flood

Polychlorinated Biphenyl's (PCBs) → industrial pollutants

→ low pollution upstream of Stolberg → pollution starting with industrial point sources in Stolberg → continuous dilution / decline of pollution





Toxic European Summer Flood

Implications of the 2021 European flood

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Thank you!

(1) unprecedented weather condition

(2) small catchments with low prevention and retention measures in place

→ very quick water level rise → main difference to known large flood events

(3) anthropogenic influences result in a man-made **toxic flood**

→ landscape chances (reduction of natural floodplains)

→ land-use change (land sealing)

→ high pollution levels → remobilization + introduction of fresh pollution

→ dynamic pollution distribution → pollution linked to urban centers