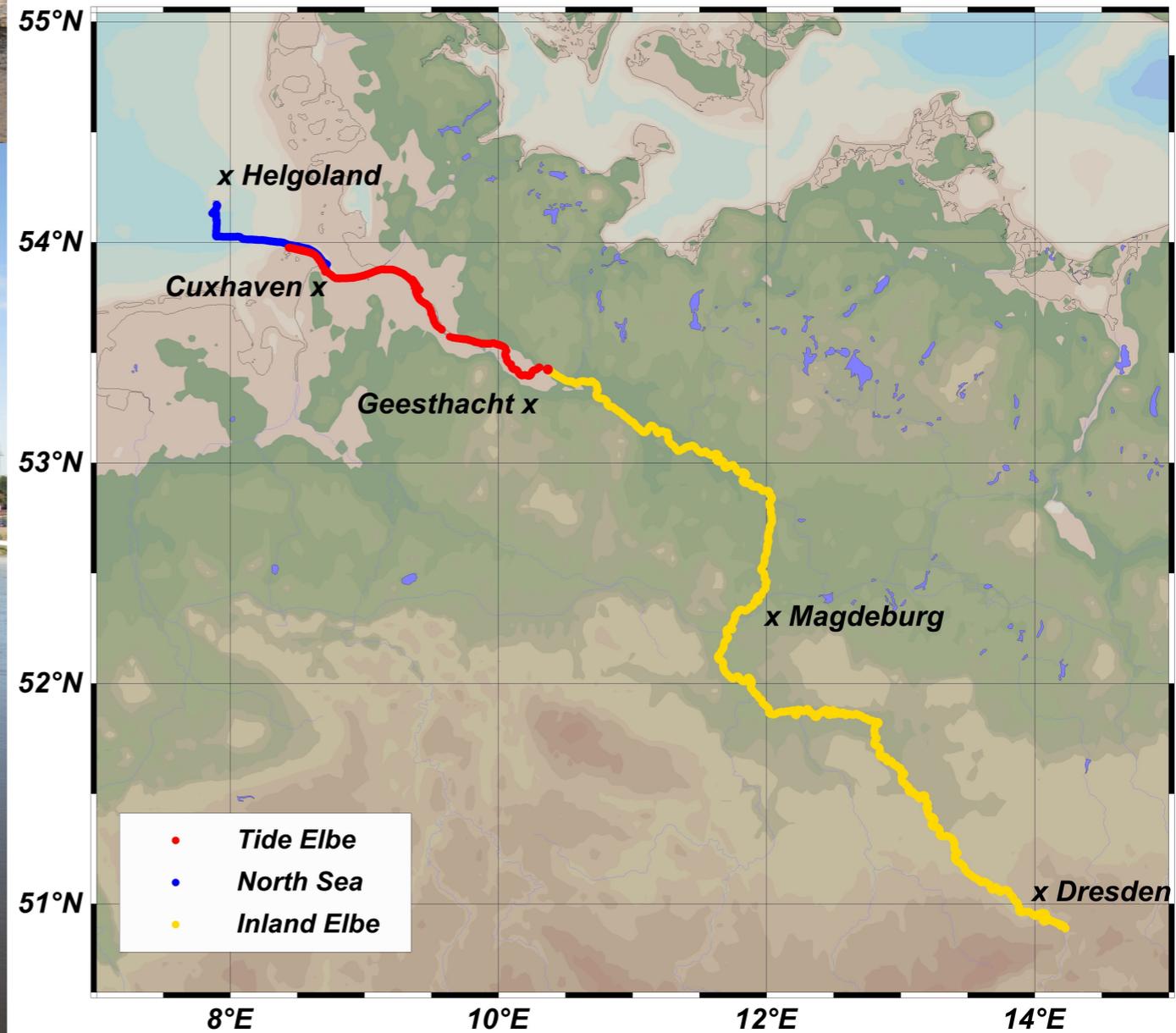


Dissolved and atmospheric methane concentrations along a freshwater - seawater transect from the River Elbe into the North Sea

Bussmann, I., Brix, H., Kamjunke N., Ködel, U., Koschorreck, M., Schütze, C.



Inland Elbe cruise, 4. – 12. Aug 2020
Tide Elbe cruise, 25. -26. Aug 2020
Part of Sternfahrt 5, 31.8 – 3.9 2020

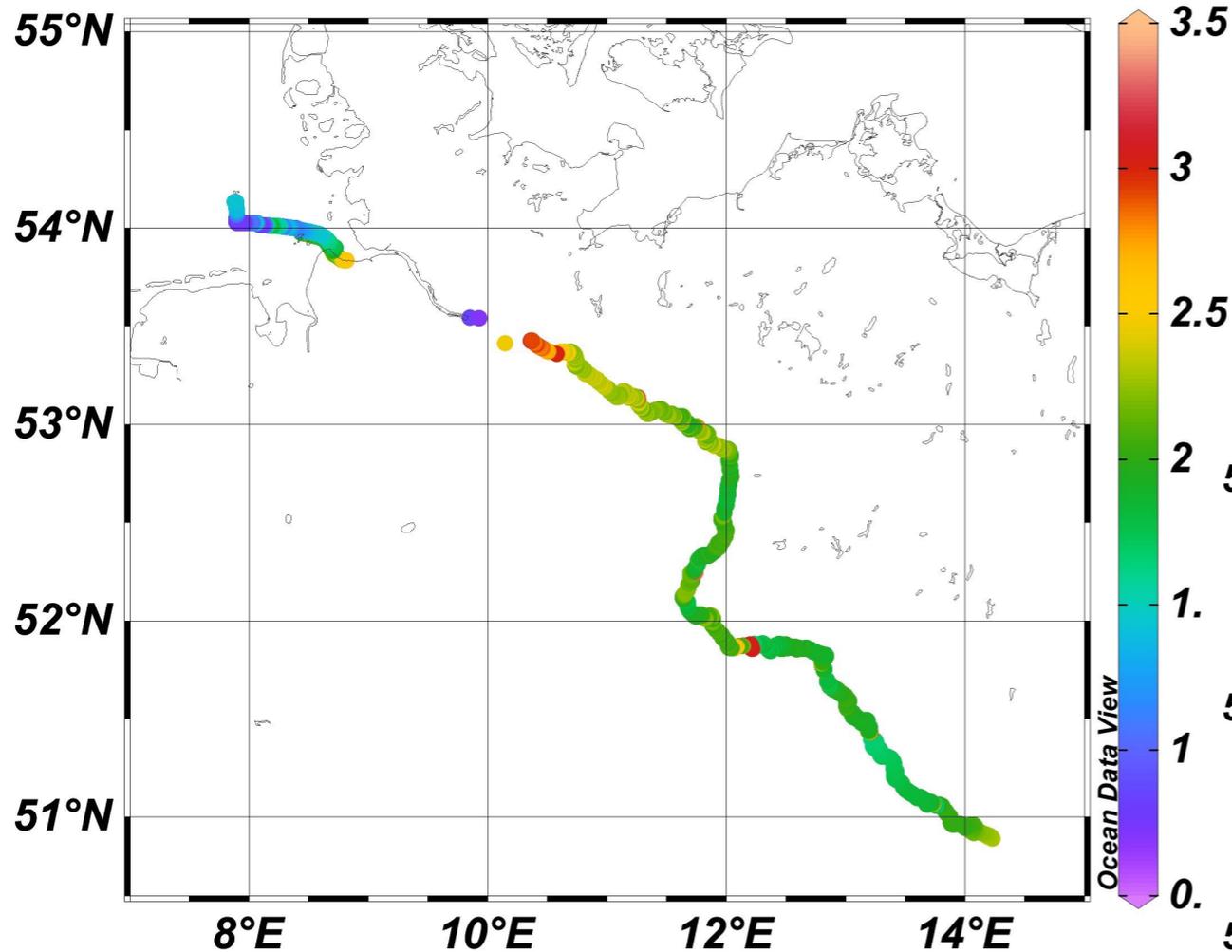


- Continuous, underway measurements of
 - hydrographic parameters (Ferry Box)
 - **Dissolved CH₄ & CO₂** (Degasser + Greenhouse Gas Analyzer, LosGatos), Calibration with water samples analyzed with head space and GC)
 - **Atmospheric CH₄ & CO₂** (Licor)
- Discrete water samples for prim. production, chlorophyll, (see presentation vEGU-8721)

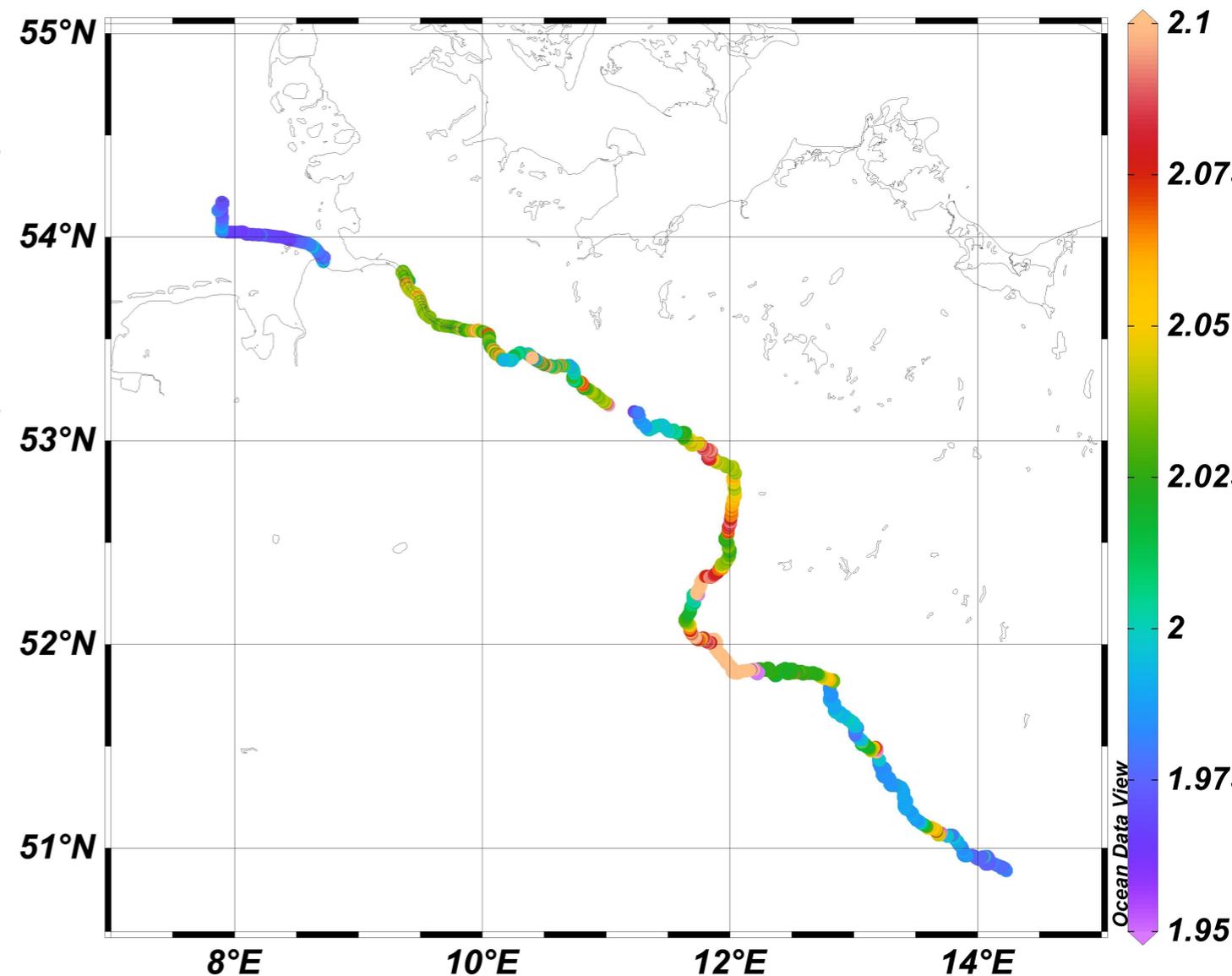
- Focus on the Elbe river
 - Influence of tributaries?
 - Several hotspots, where and why?
 - extension and influence of hotspots?
- Lagrangian sampling
 - Does the dissolved CH_4 influence the atmospheric CH_4 ?
 - Does the ratio of CH_4/CO_2 give more insights?

Overall Distribution of CH₄

Dissolved CH₄ (log scale, nmol/L)



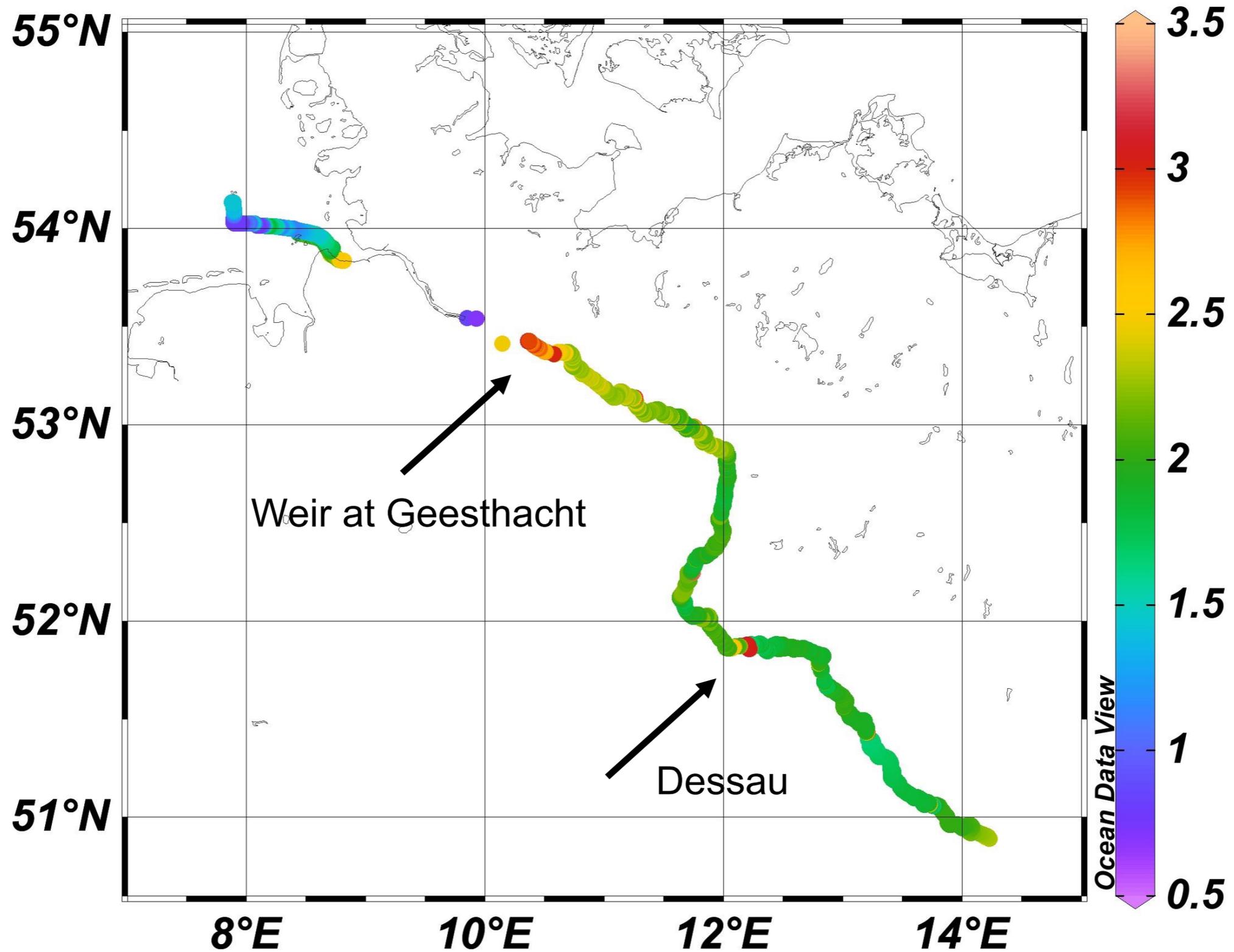
Atmospheric CH₄ (ppm)



- diss. CH₄ ranges of 3 orders of magnitude with some hotspots
- Atmos. CH₄ low values at beginning of cruise and in marine area, in between some hotspots

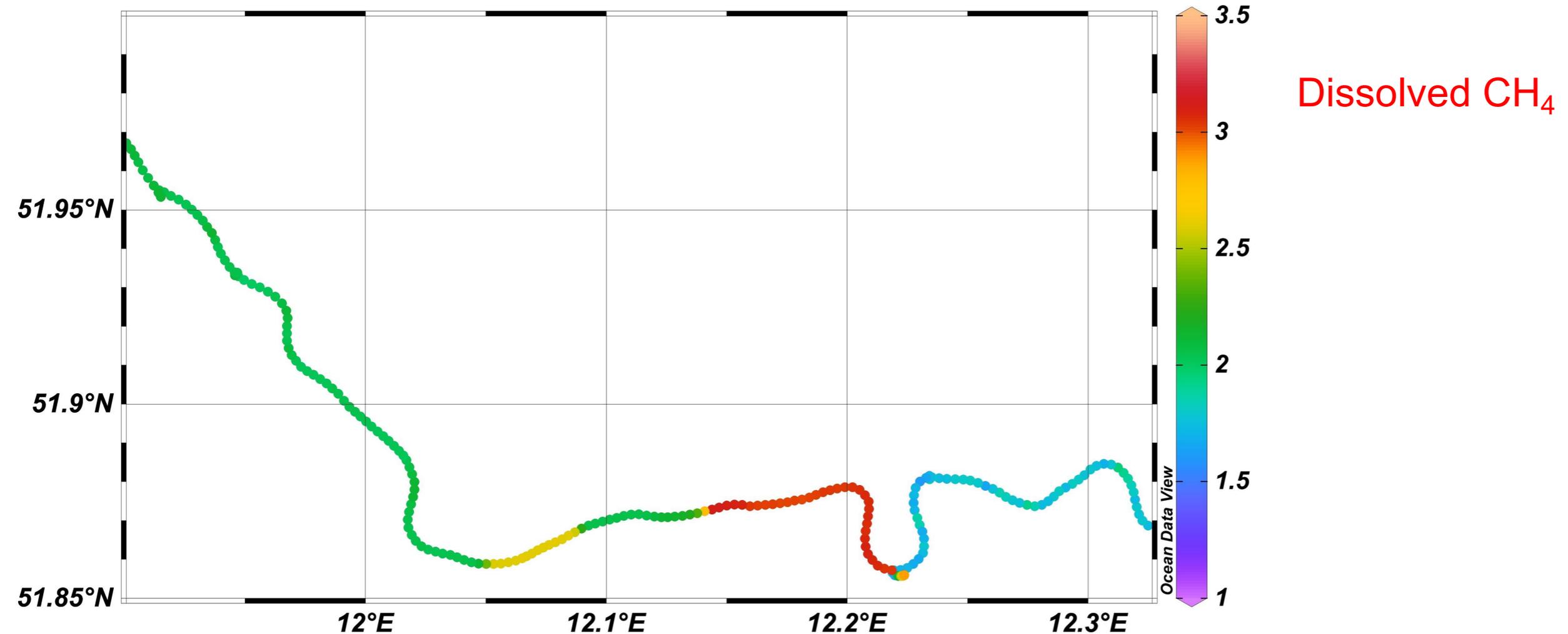
Overall Distribution of CH₄

Dissolved CH₄ (log scale, nmol/L)



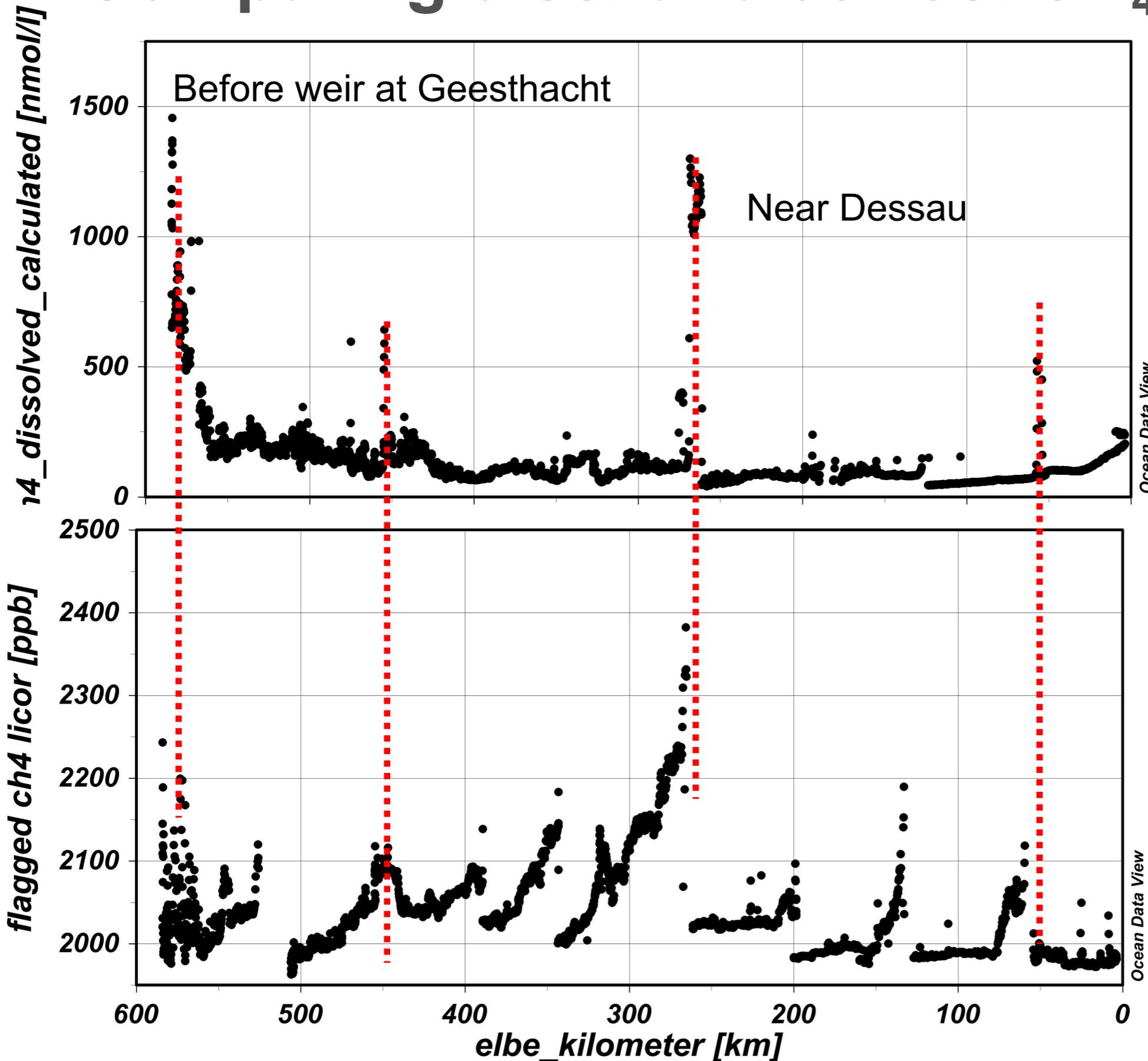
Close up “near Dessau”

log CH₄ [nM] @ depth [m]=first



- Locally very steep increase of diss. & atmos. CH₄
- Hydrographic parameters (temp, cond, ph, O₂, chl-a, turb) do not explain the CH₄ increase
- Probably due to a lateral input of CH₄-rich water from near by natural reserve area

Comparing **diss.** and **atmos.** CH₄

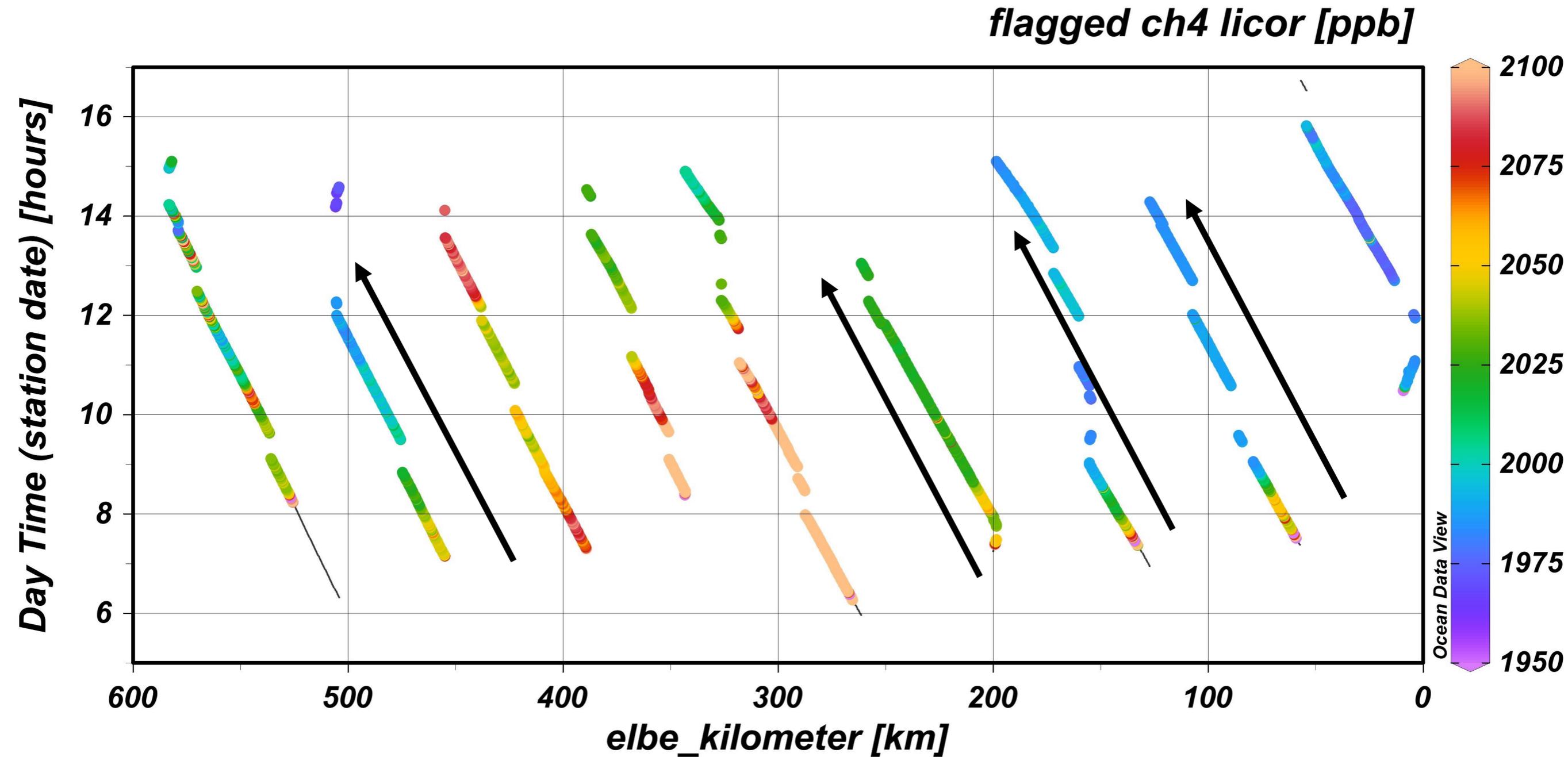


Dissolved CH₄

- distinct pattern of atmosph. + diss. CH₄
- Increase near Dessau for both
- Slight increase of atmosph. CH₄ near the weir

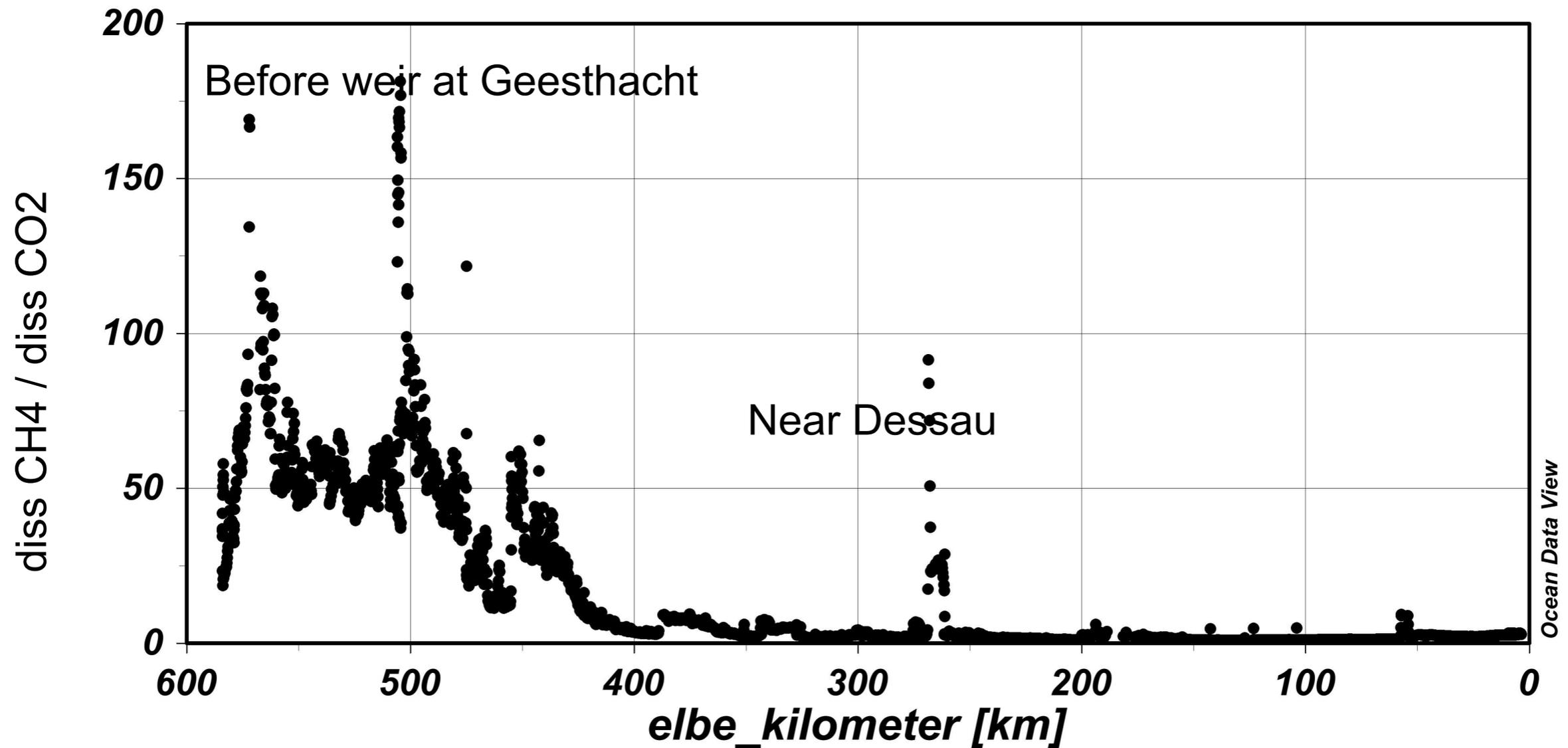
Atmospheric CH₄

Diurnal pattern for atmos. CH₄



- Higher values in the morning, decreasing towards afternoon

Ratio of diss CH₄ / diss CO₂

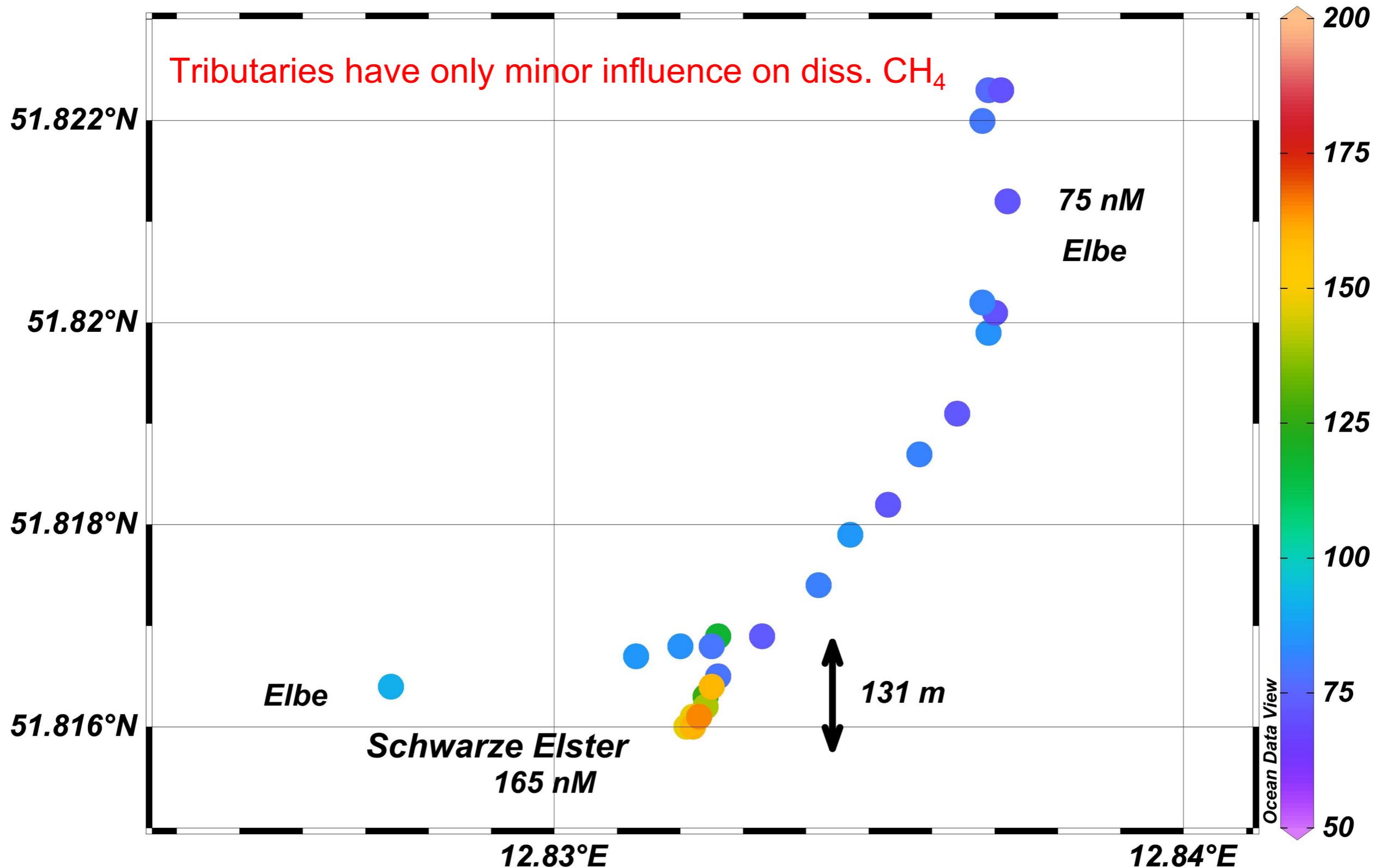


- Low ratios until km 400
- Clear peak near Dessau
- At km 500 ratio is influenced by CO₂ decrease by increased primary production (previous presentation)
- Increase of ratio towards weir due to increase in CH₄

- High diss. CH_4 correlates with
 - \uparrow diss. CO_2 , \uparrow conductivity, \uparrow turbidity, \downarrow Chlorophyll, \uparrow atmos. CH_4 , \uparrow atmos. CO_2
- Decrease in flow velocity
 - \Rightarrow sedimentation of phytoplankton
 - See also previous presentation, EGU21-8721
 - \Rightarrow increase of atmos. + diss CH_4
 - \Rightarrow reduced gas transfer coefficient, may be ebullition

Influence of tributaries

ch4_dissolved_calculated [nmol/l] @ depth [m]=first



Conclusions

- We identified several hot spots for diss. CH_4 , which often are mirrored by atmospheric CH_4 hotspots
- Reason for hotspots:
 - Influence of primary production, flow velocities and not yet specified ones
- Spatial patterns of atmos. CH_4 are overlain by diurnal patterns
- Tributaries have only minor influence on diss. CH_4 , within 100 m, increased concentrations return to background values

Thank you for your attention !