Seasonal and long-term variation of stream water chemistry at Bear Brook Watershed, Maine - USA

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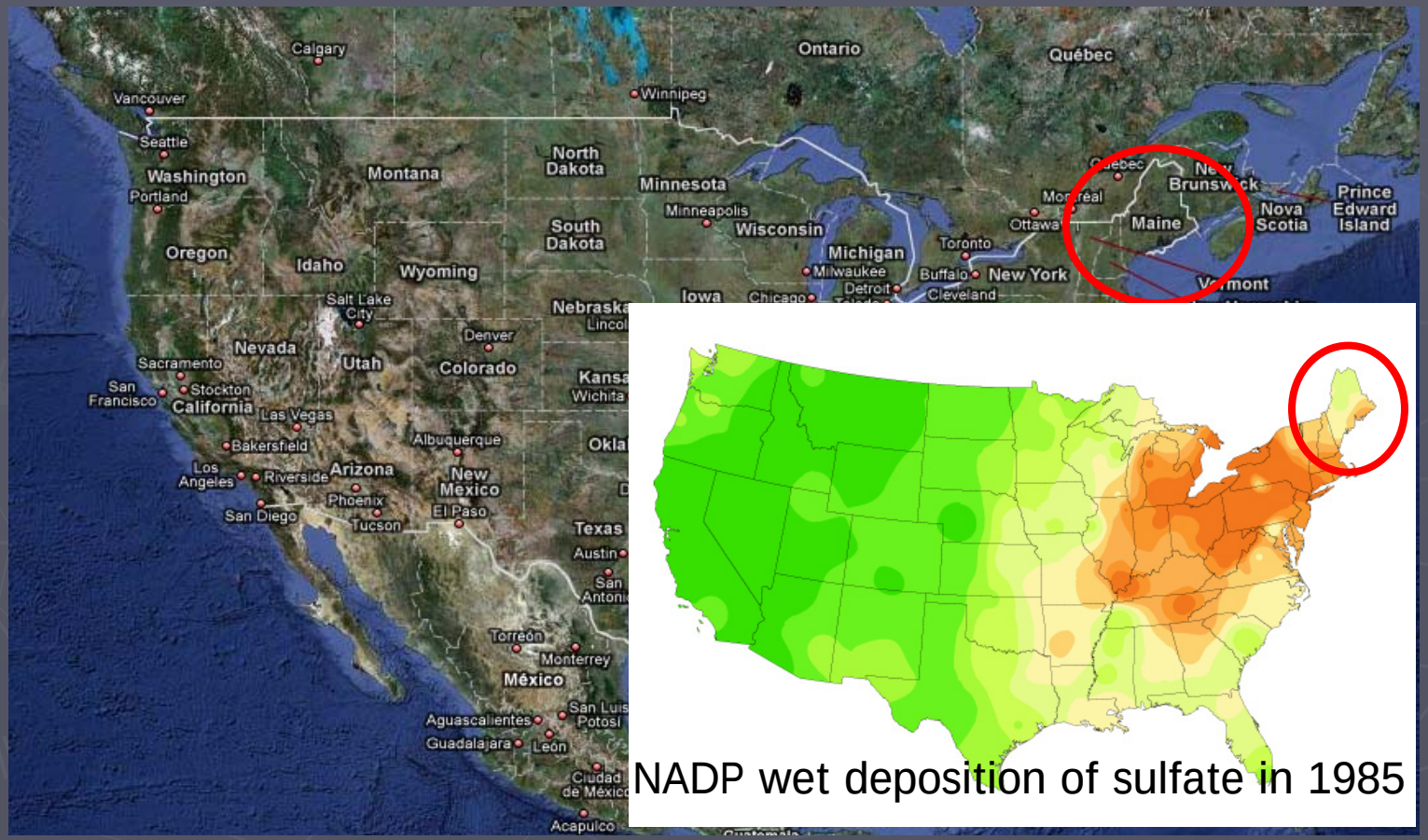
Sarah Nelson
and many others....

Institute of Geology
Academy of Sciences

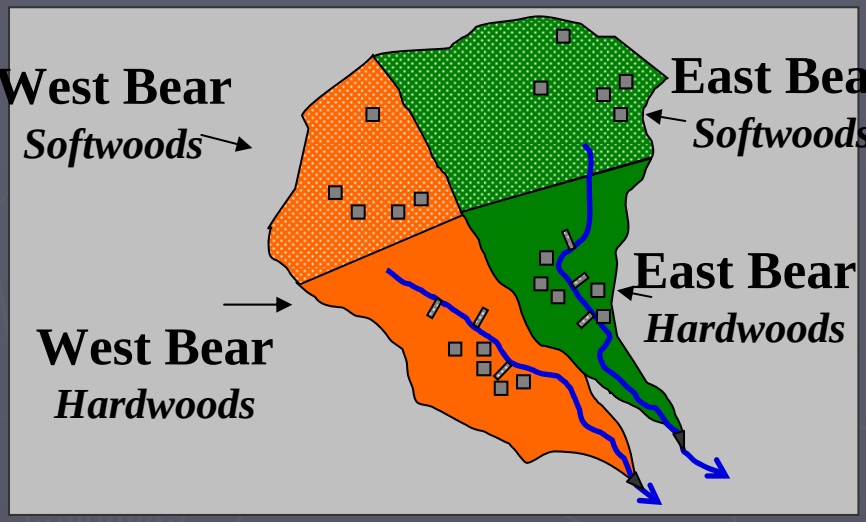
1919
CZECH GEOLOGICAL SURVEY

Bear Brook Watershed Maine

- Maine
- paired experimental watershed in USA, Maine



Site description & Manipulation

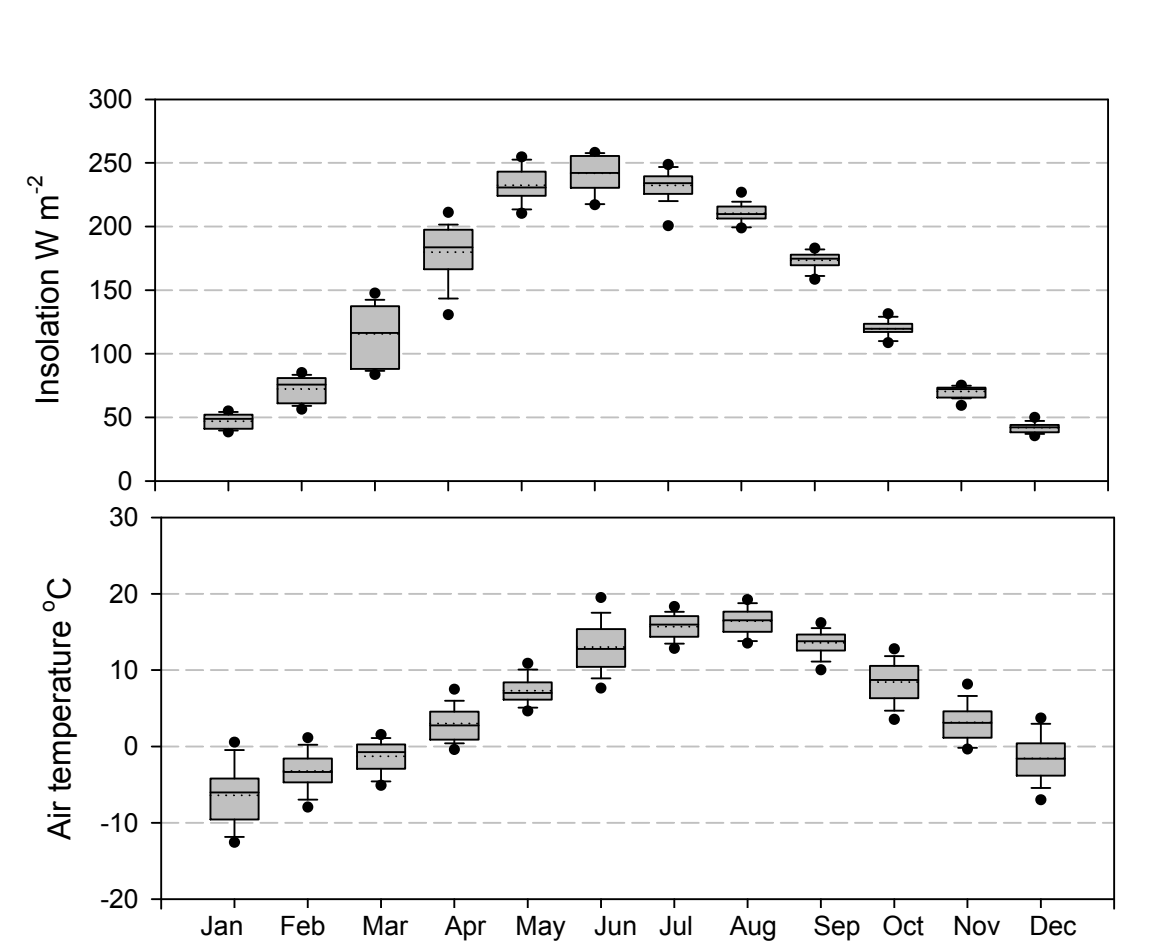


- paired experimental watershed
- 60km away from Gulf of Maine
- maximal elevation 475 m
- each watershed ~10 ha

- mixed vegetation
- avg. annual temperature 4.9°C
- avg. annual precip. ~1400 mm
- avg. annual runoff ~930 mm
- soils derived from glacial till

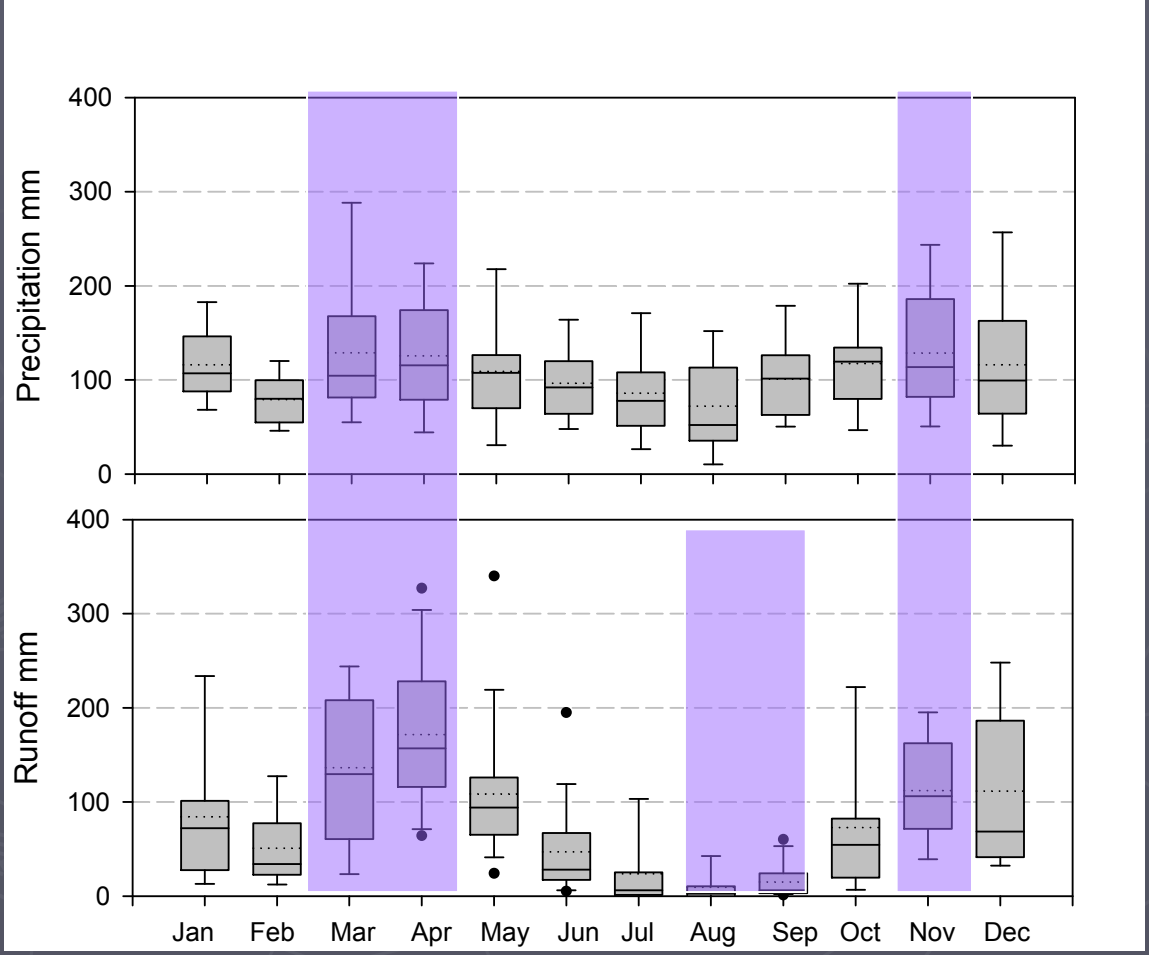
- WB manipulated by addition of $(NH_4)_2SO_4$ - 1800 eq ha^{-1} yr^{-1}

Solar insolation & Air temperature



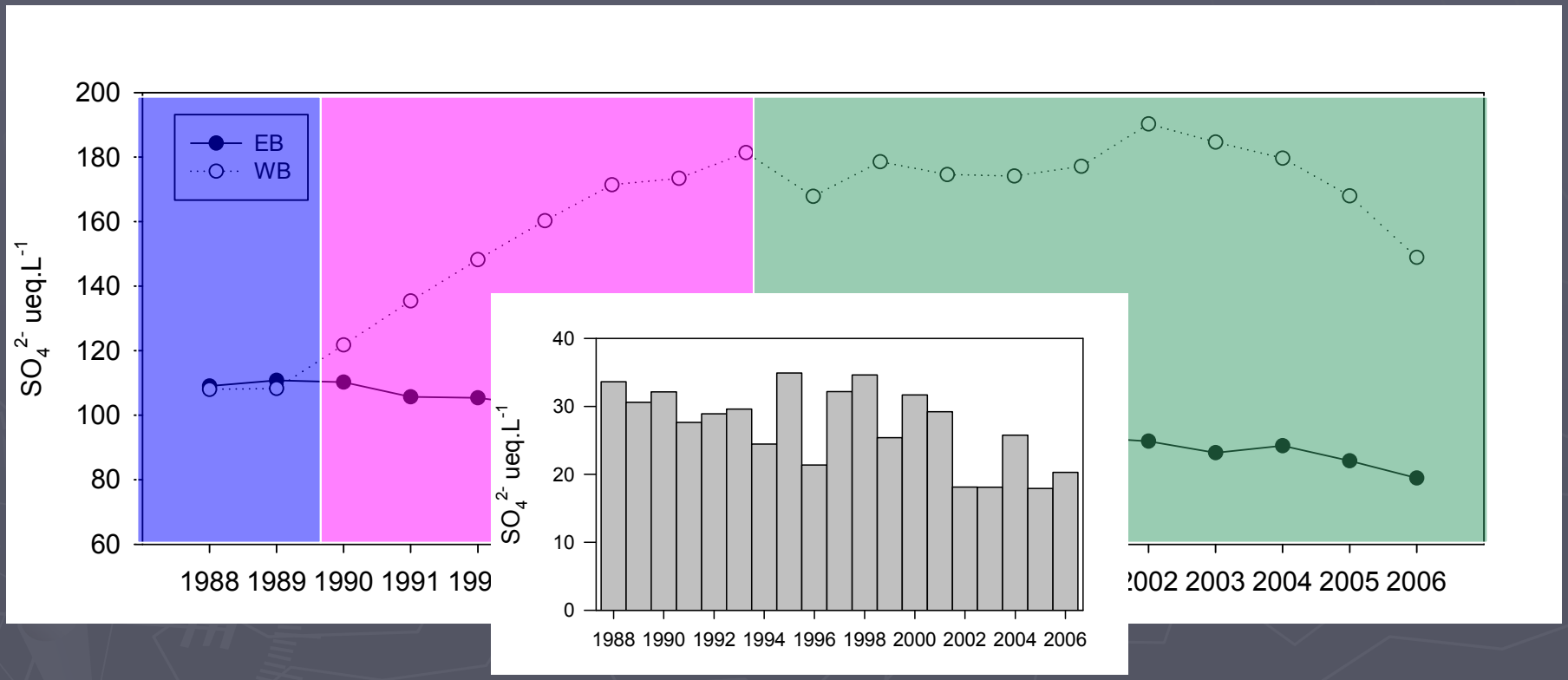
- 1987 – 2006 data from National Atmospheric Deposition Program (NADP)

Precipitation & Runoff



All data presented in this study cover period 1987 - 2006

Consecutive periods of experimental manipulation



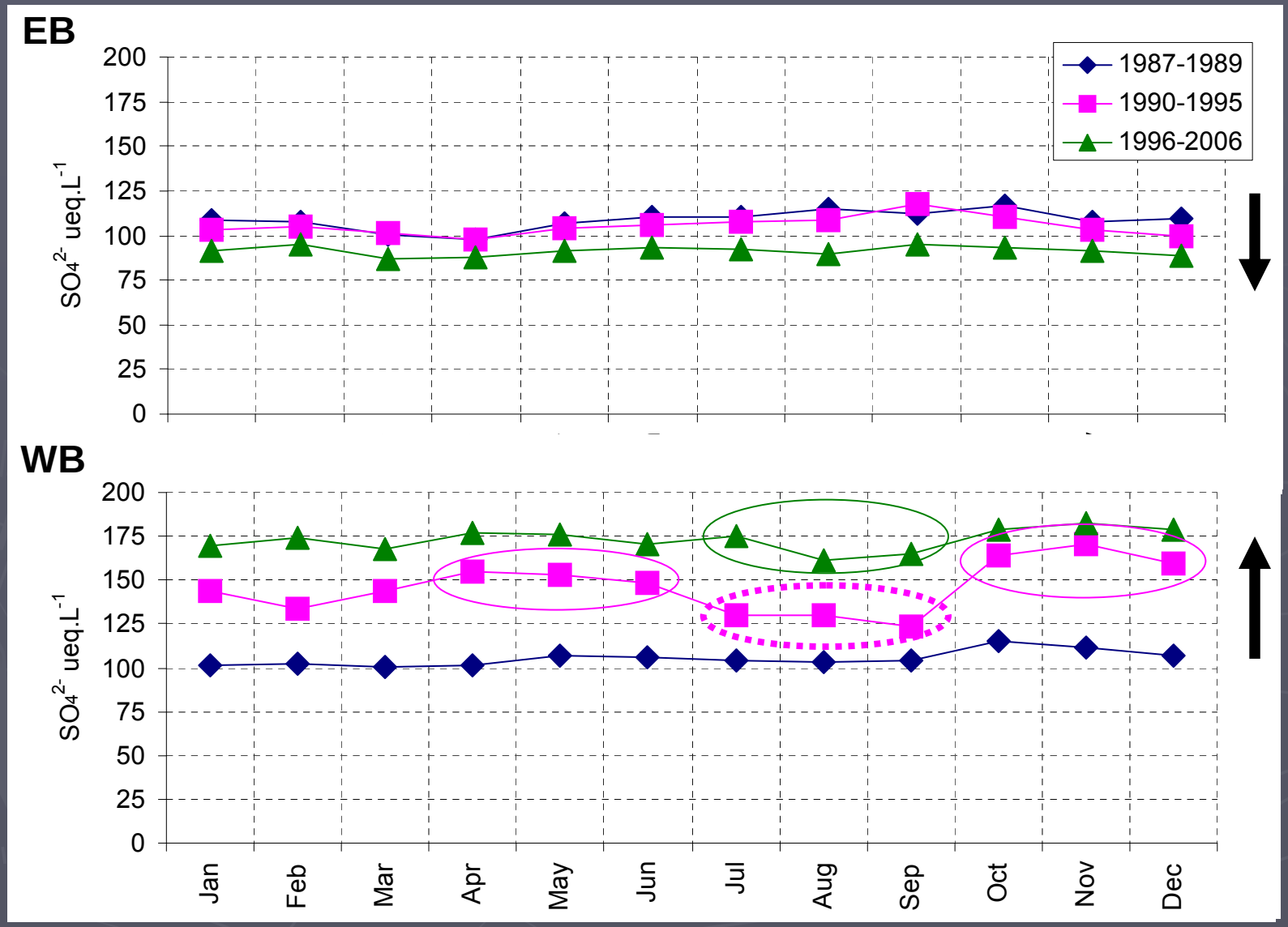
Pre-treatment

1987-1989

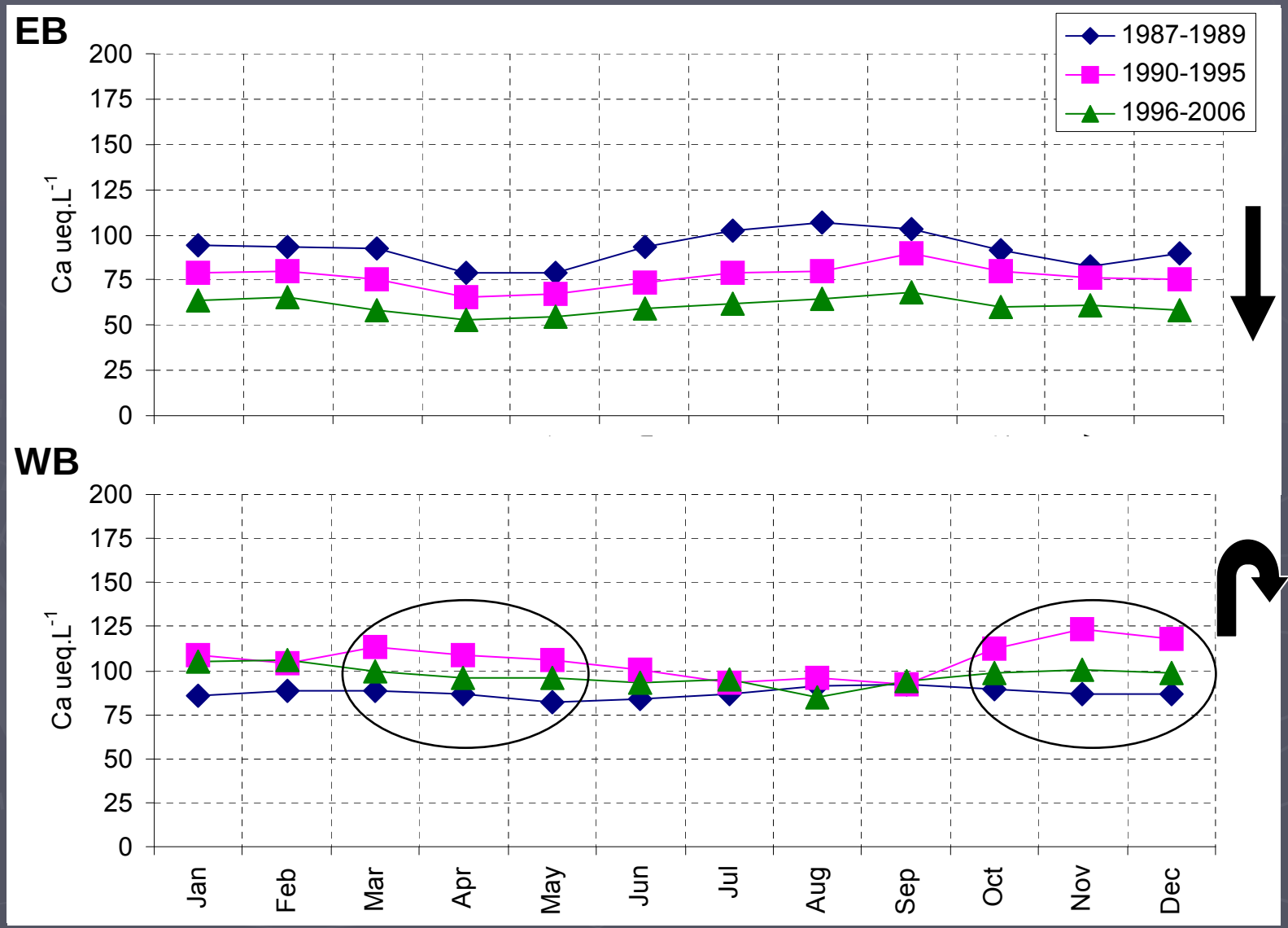
1990-1996

1997-2006

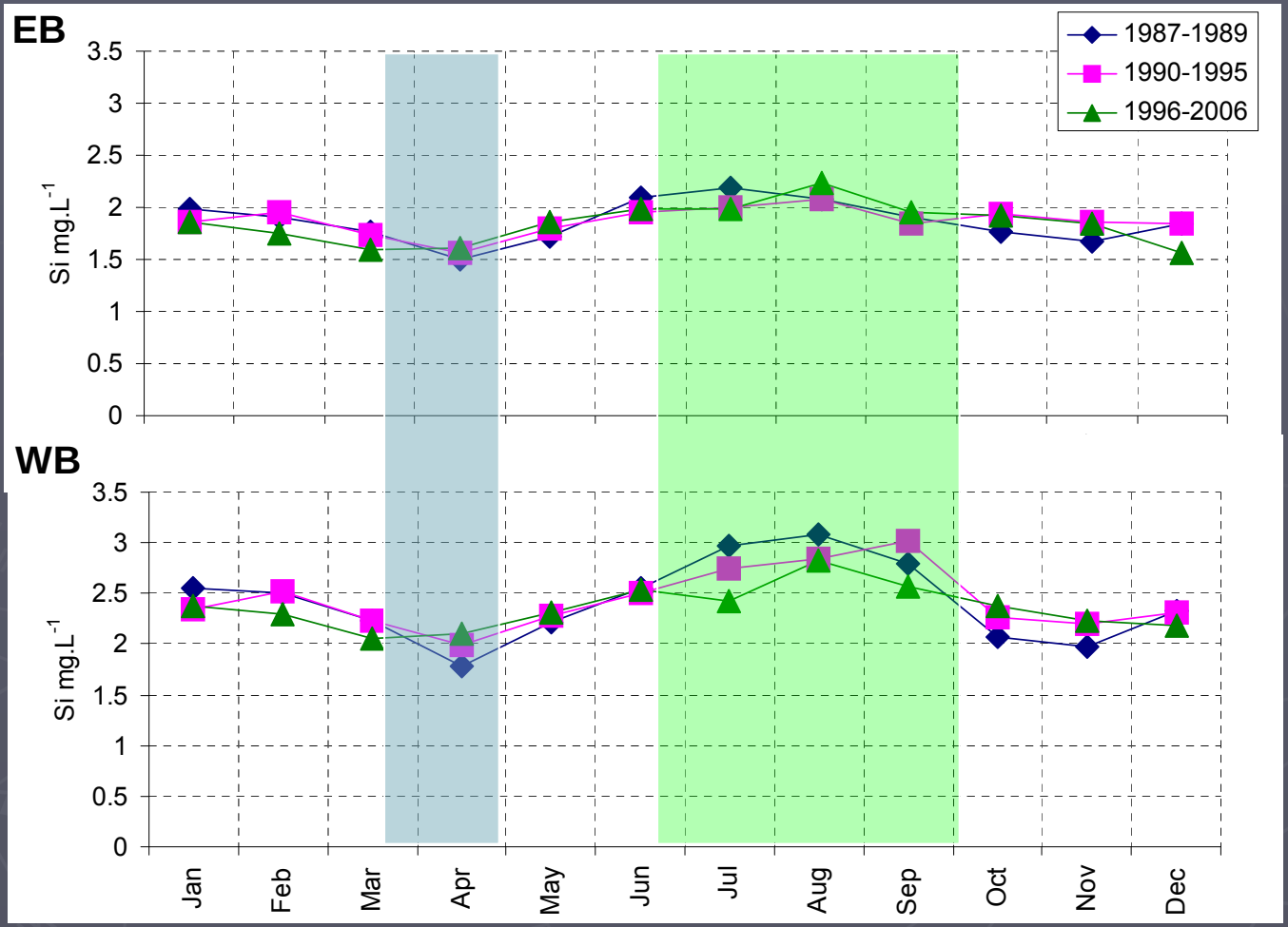
Sulfate concentrations



Calcium

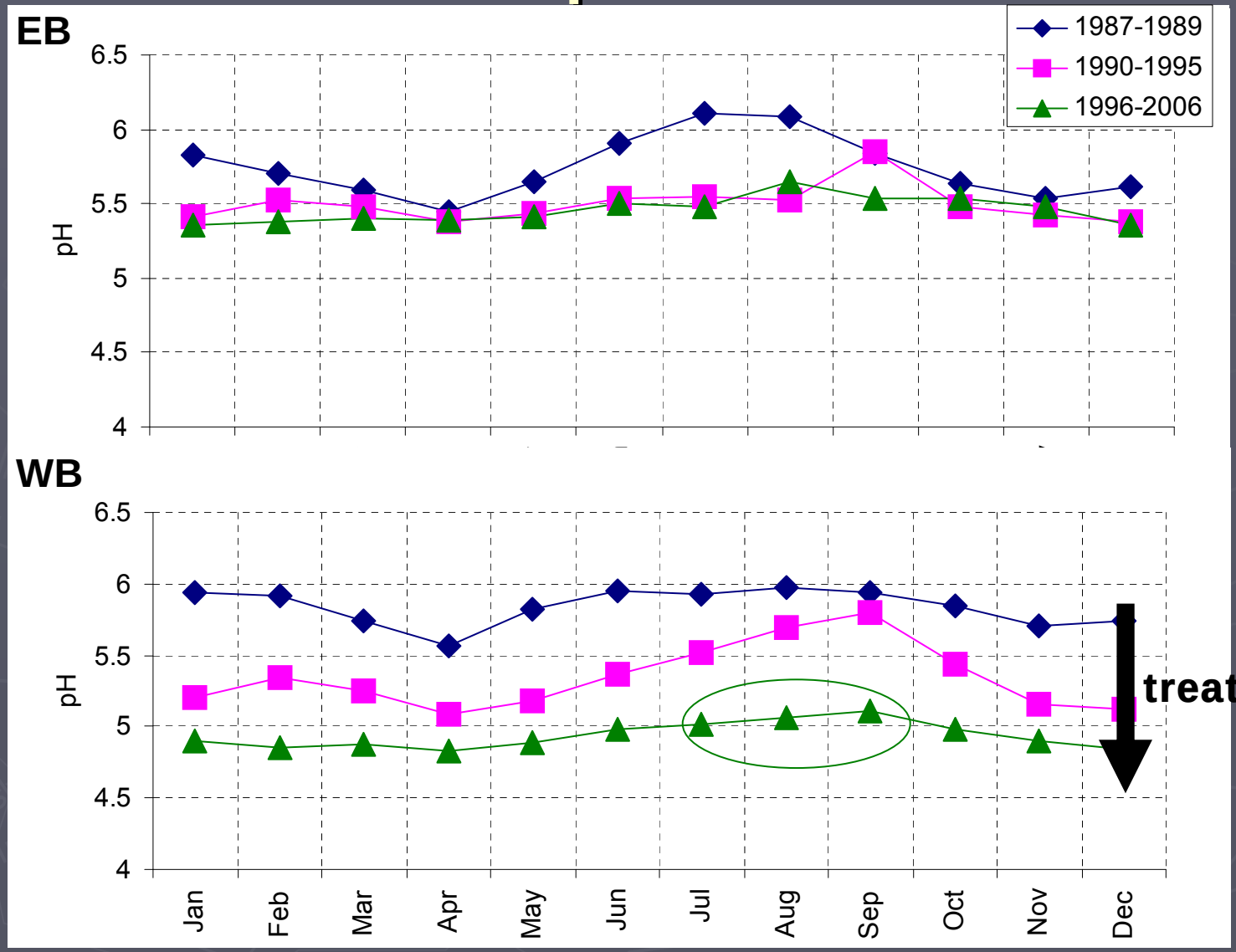

EB
1987-1989
1990-1995
1996-2006
Ca ueq.L-1
200
175
150
125
100
75
50
25
0
WB
Ca ueq.L-1
200
175
150
125
100
75
50
25
0
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec

Silica

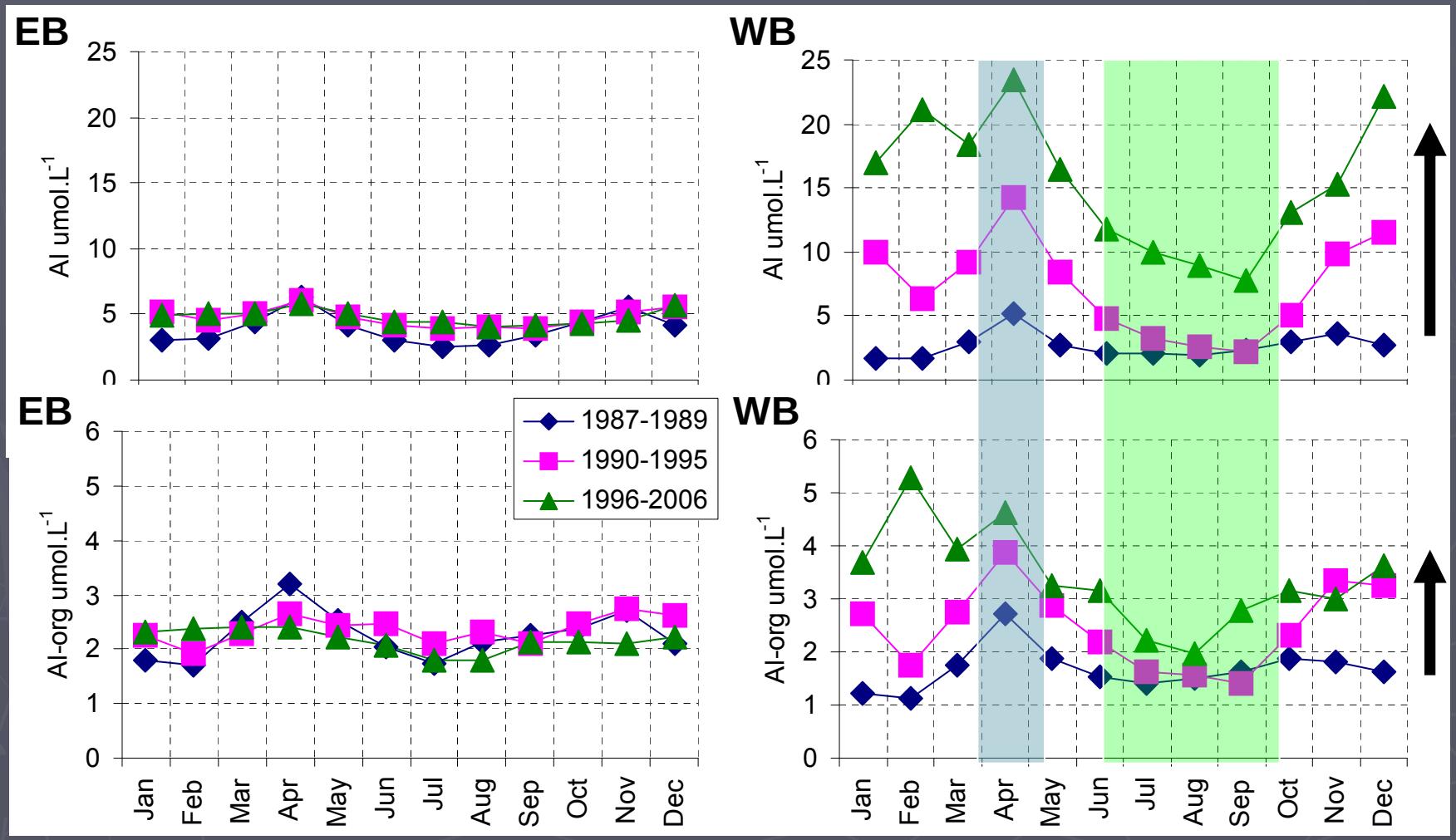


- dilution by snowmelt waters – April
- greater signal of groundwater in streams – from Jul to Sep
- summer months + increased pH, ANC and NM Na

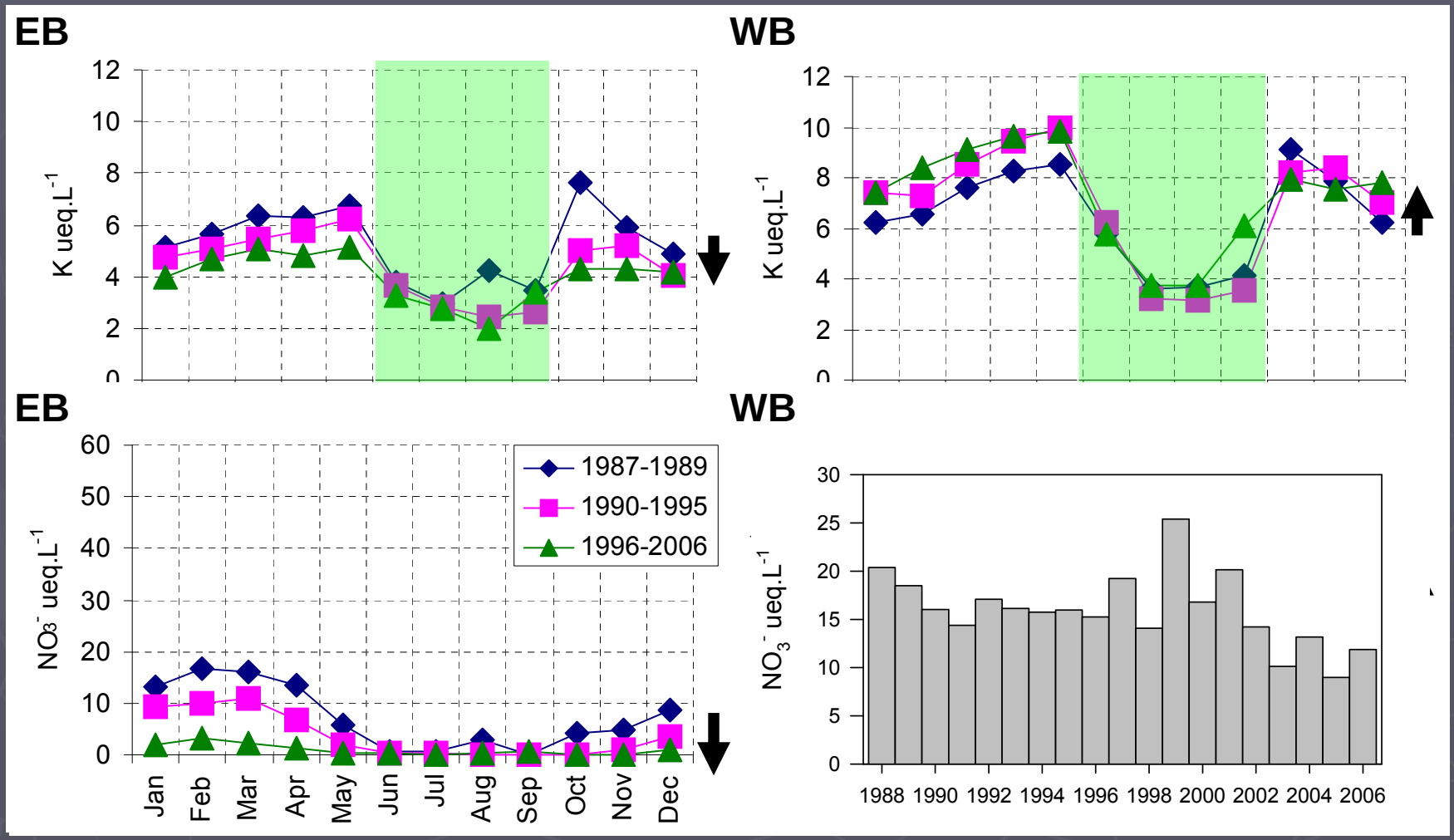
pH


EB
1987-1989
1990-1995
1996-2006
pH
6.5
6
5.5
5
4.5
4
WB
pH
6.5
6
5.5
5
4.5
4
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
treatment

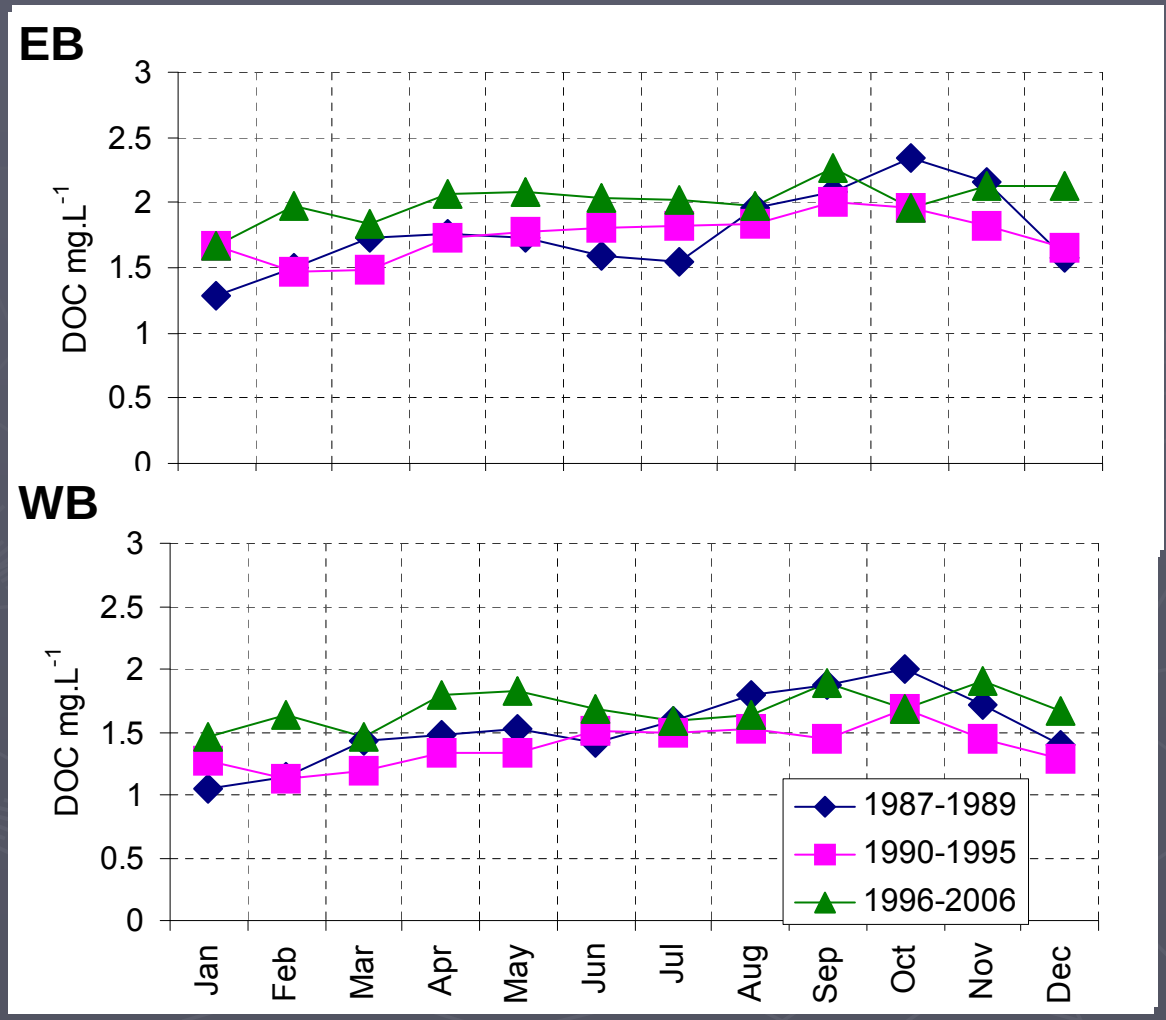
Inorganic & organic aluminum



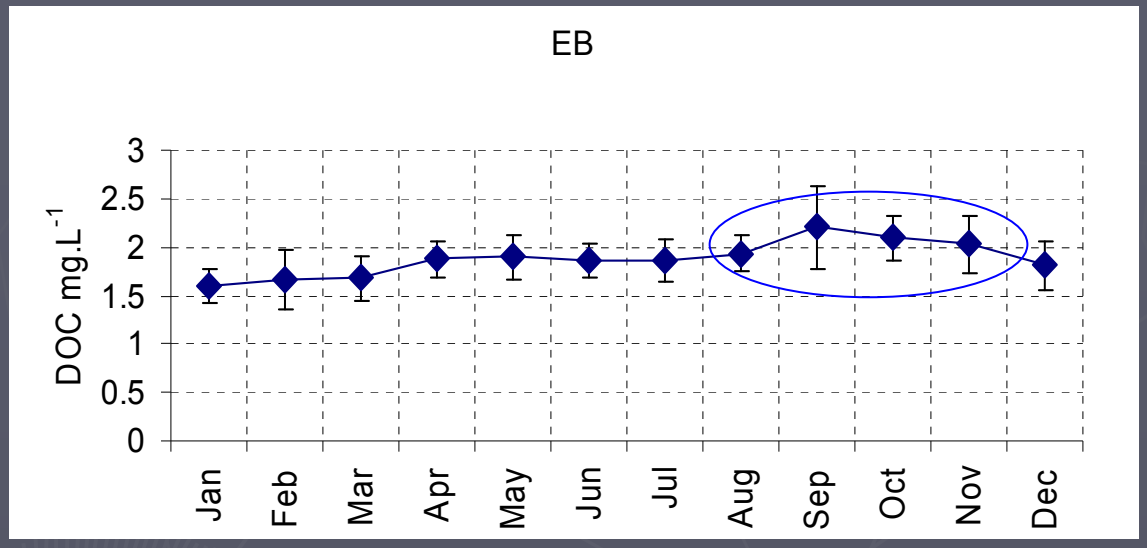
Potassium and nitrates

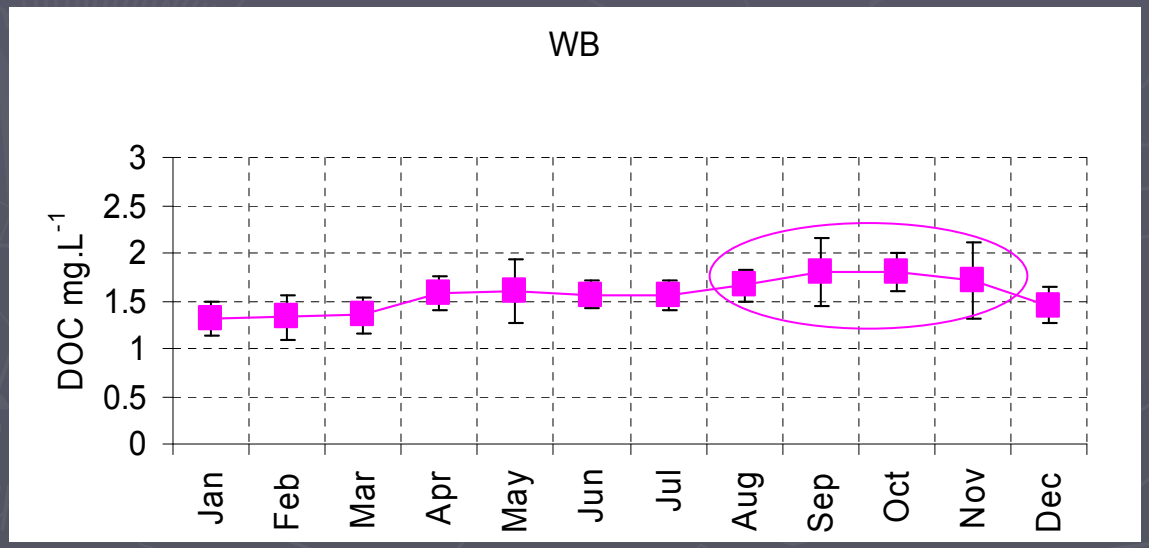


DOC


EB
WB
DOC mg.L-1
3
2.5
2
1.5
1
0.5
0
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
1987-1989
1990-1995
1996-2006

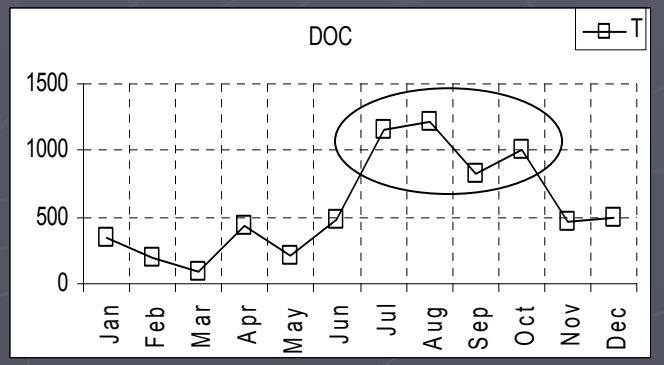
DOC – no stages





- monthly averages of data 1987-2006

Soil solution



Conclusions

- most solutes in streams at BBWM have seasonal patterns

- major drivers on seasonality are:
- Hydrology – (dilution)
- Vegetation activity - (uptake of K & NO_3)
- Temperature – (evapo- and transpiration)

Acknowledgments

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