



# Balancing the water budget of the Whillans Ice Plain: Implications for the nature of the subglacial hydrologic system



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*Photo: Subglacial Lake Whillans by Slawek Tulaczyk*

West Antarctic Ice Sheet meeting – September 2011



# Active lakes under ice streams



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Glaciologists use seismic waves to survey of Lake Ellsworth. Scientists can determine the depth, length, width and position of subglacial lakes from seismic waves caused by the explosions. Copyright BAS.

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West Antarctic Ice Sheet meeting – September 2011





# WISSARD Team (19 PIs, 9 institutions)

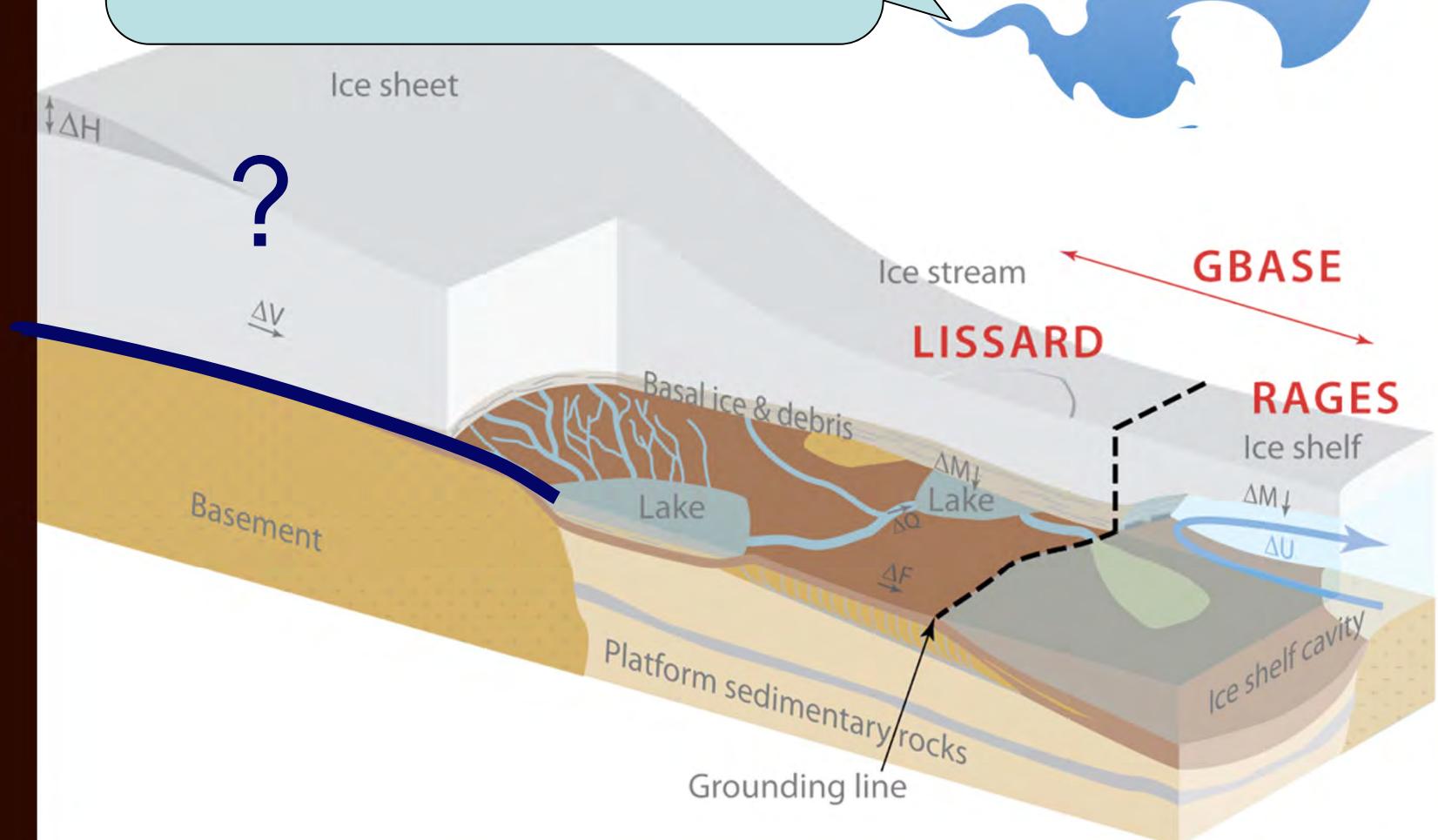


PROJECT	PI	INSTITUTION
GBASE	John Priscu (lead PI) Brent Christner Jill Mikucki Andrew Mitchell	Montana State University (MSU) Louisiana State University (LSU) Dartmouth College (DC) Montana State University (MSU)
LISSARD	Slawek Tulaczyk (lead PI) Sridhar Anandakrishnan Andrew Fisher Helen Fricker Robert Jacobel Ross Powell Reed Scherer Jeff Severinghaus	University of California, Santa Cruz (UCSC) Pennsylvania State University (PSU) University of California, Santa Cruz (UCSC) University of California, San Diego (UCSD) St. Olaf College (SOC) Northern Illinois University (NIU) Northern Illinois University (NIU) University of California, San Diego (UCSD)
RAGES	Ross Powell (lead PI) Sridhar Anandakrishnan Andrew Fisher David Holland Robert Jacobel Reed Scherer Slawek Tulaczyk Helen Fricker	Northern Illinois University (NIU) Pennsylvania State University (PSU) University of California, Santa Cruz (UCSC) New York University (NYU) St. Olaf College (SOC) Northern Illinois University (NIU) University of California, Santa Cruz (UCSC) University of California, San Diego (UCSD)



Where does my  
water come from?

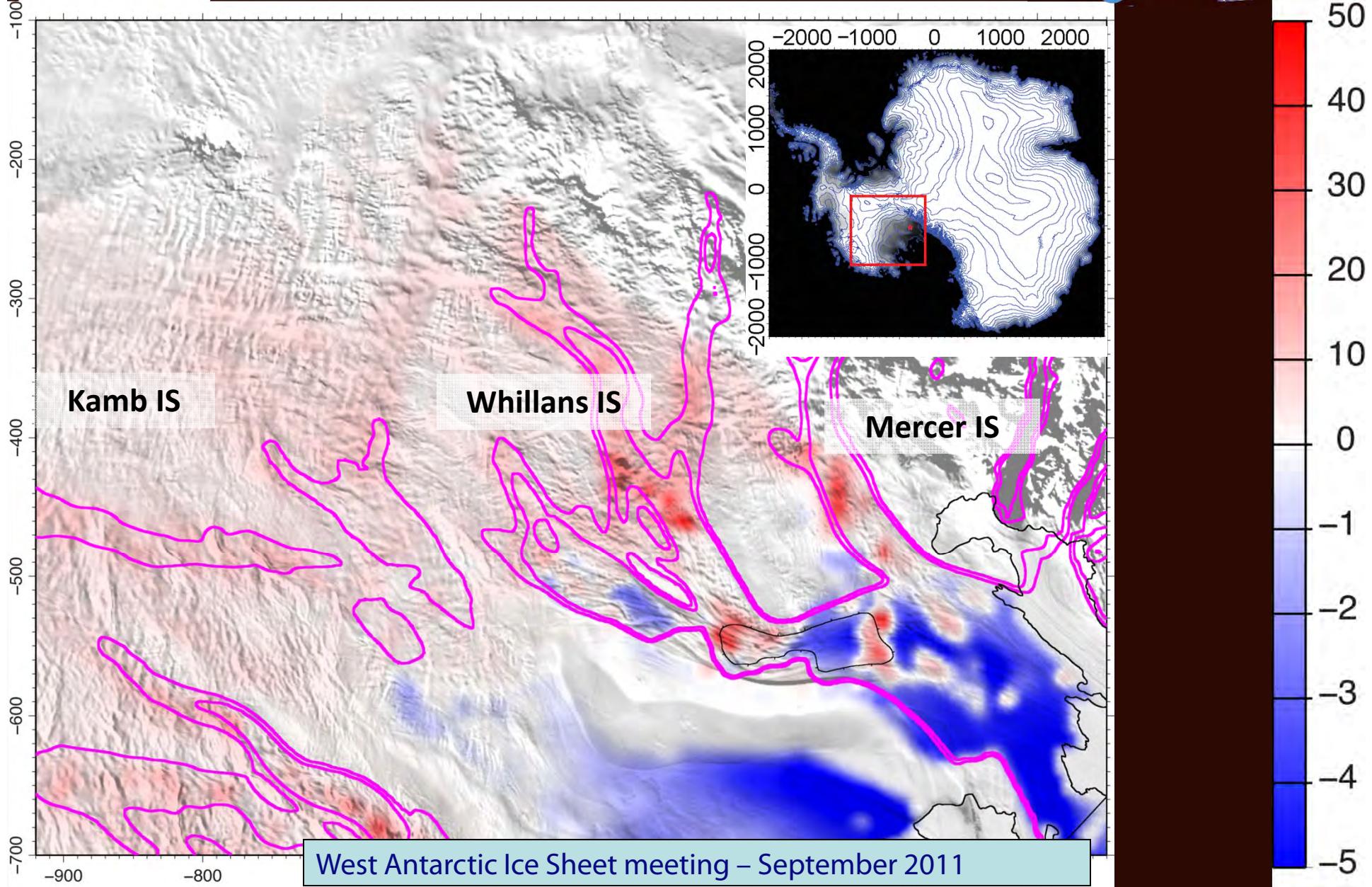
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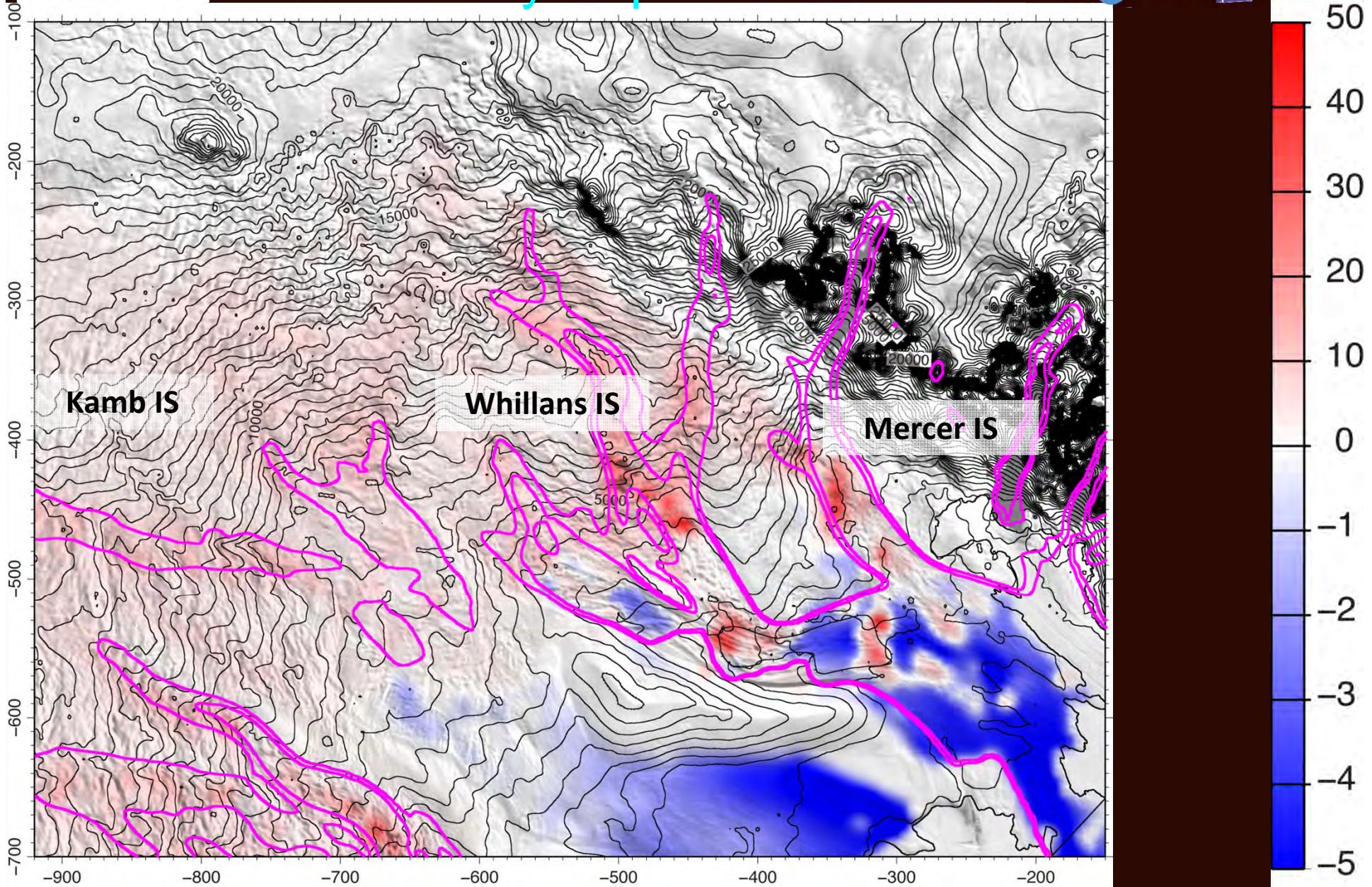
# Basal Melt Rate (mm/a)

(Joughin et al., 2004)



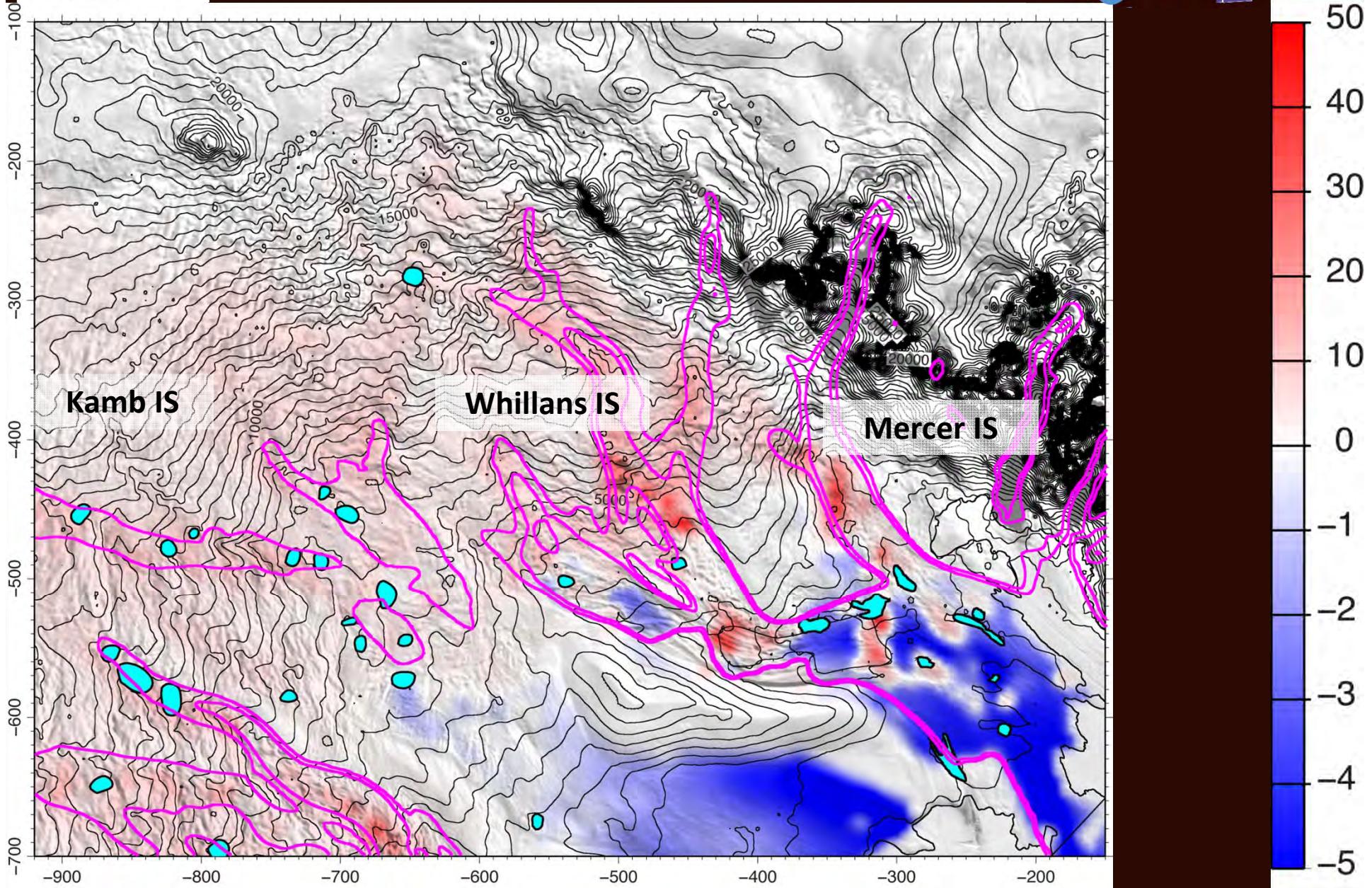


# Water is routed down the hydropotential



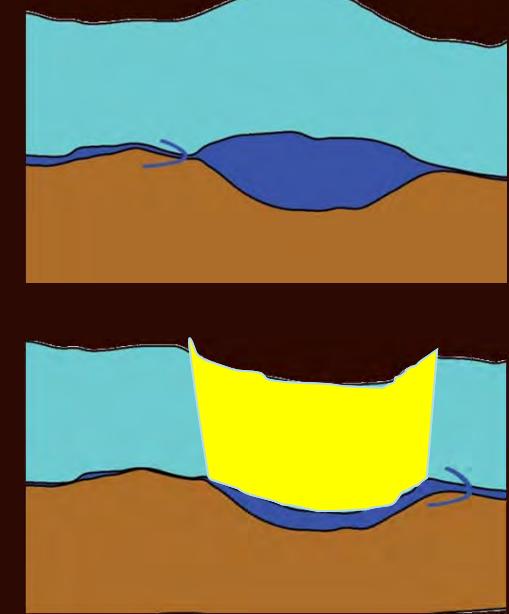
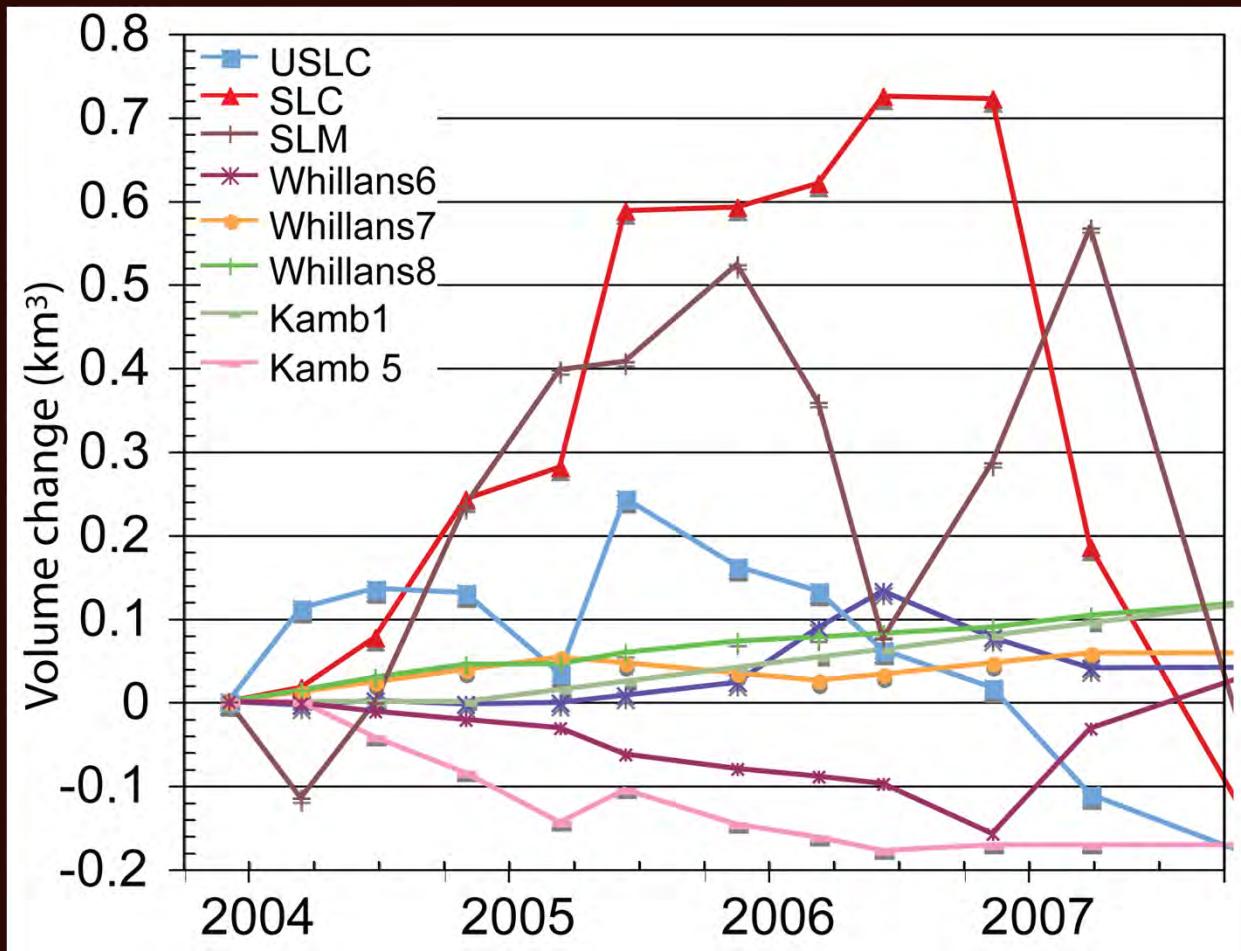
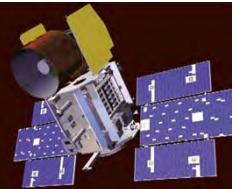


# Lakes complicate the picture

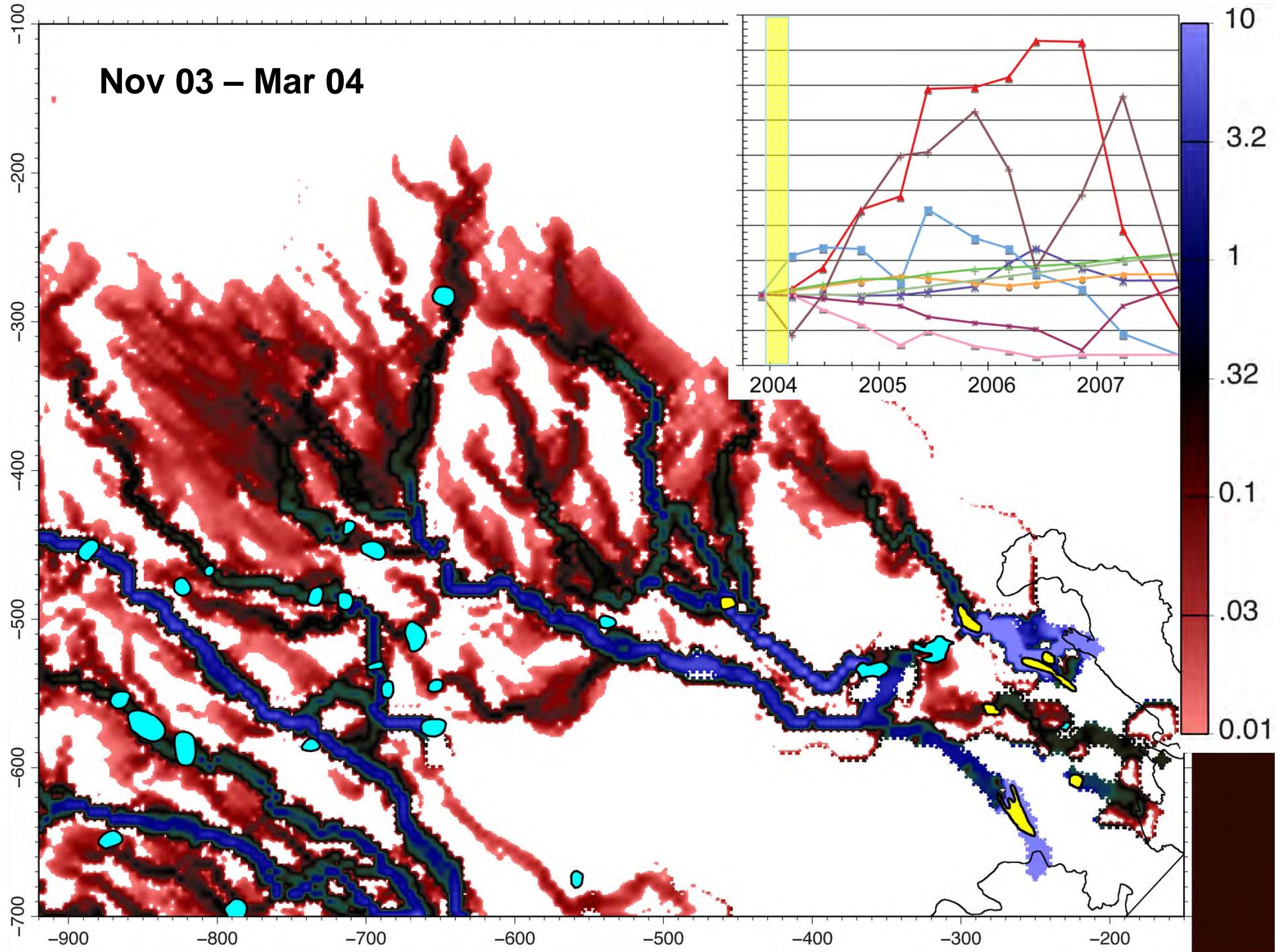


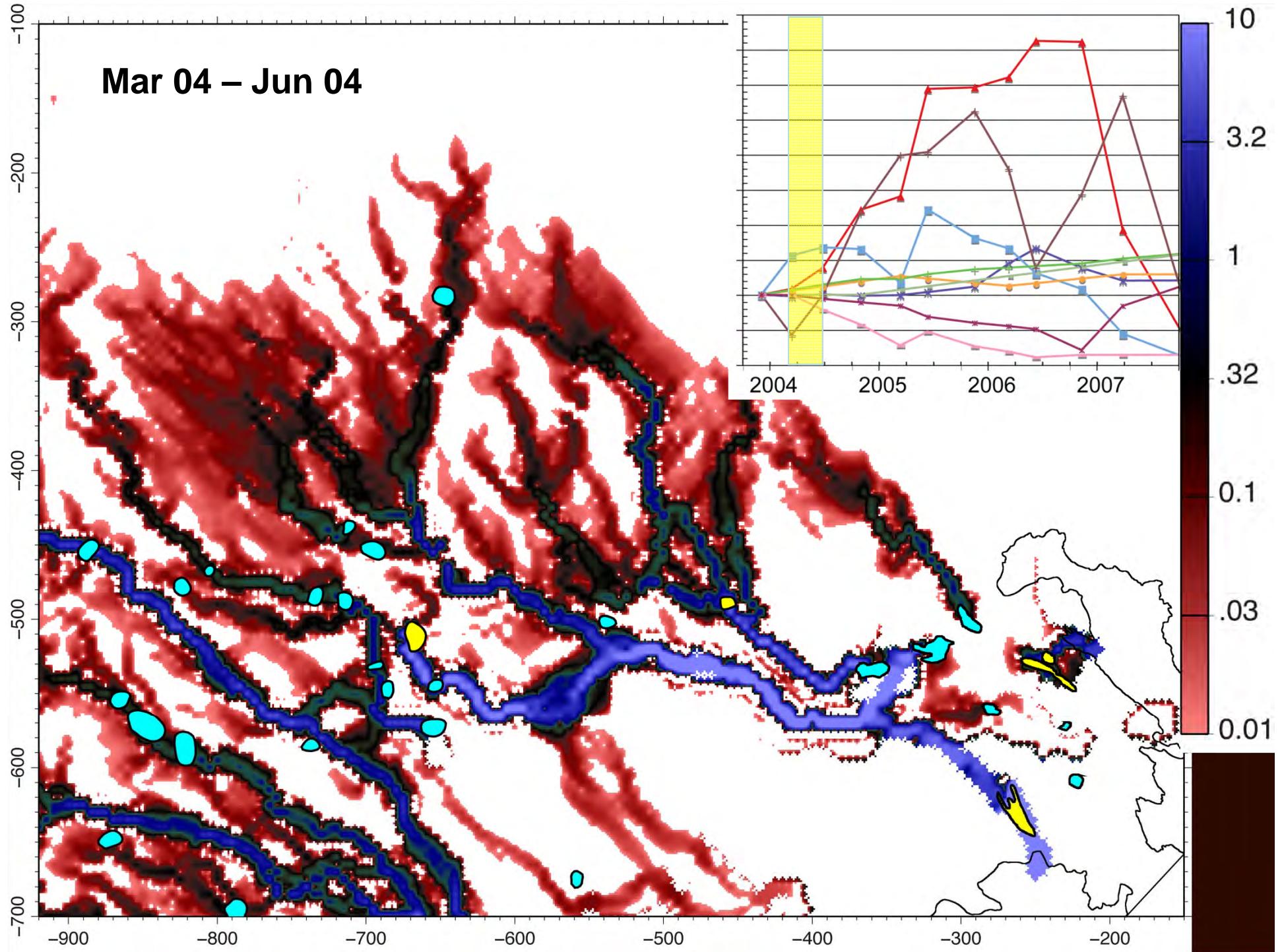


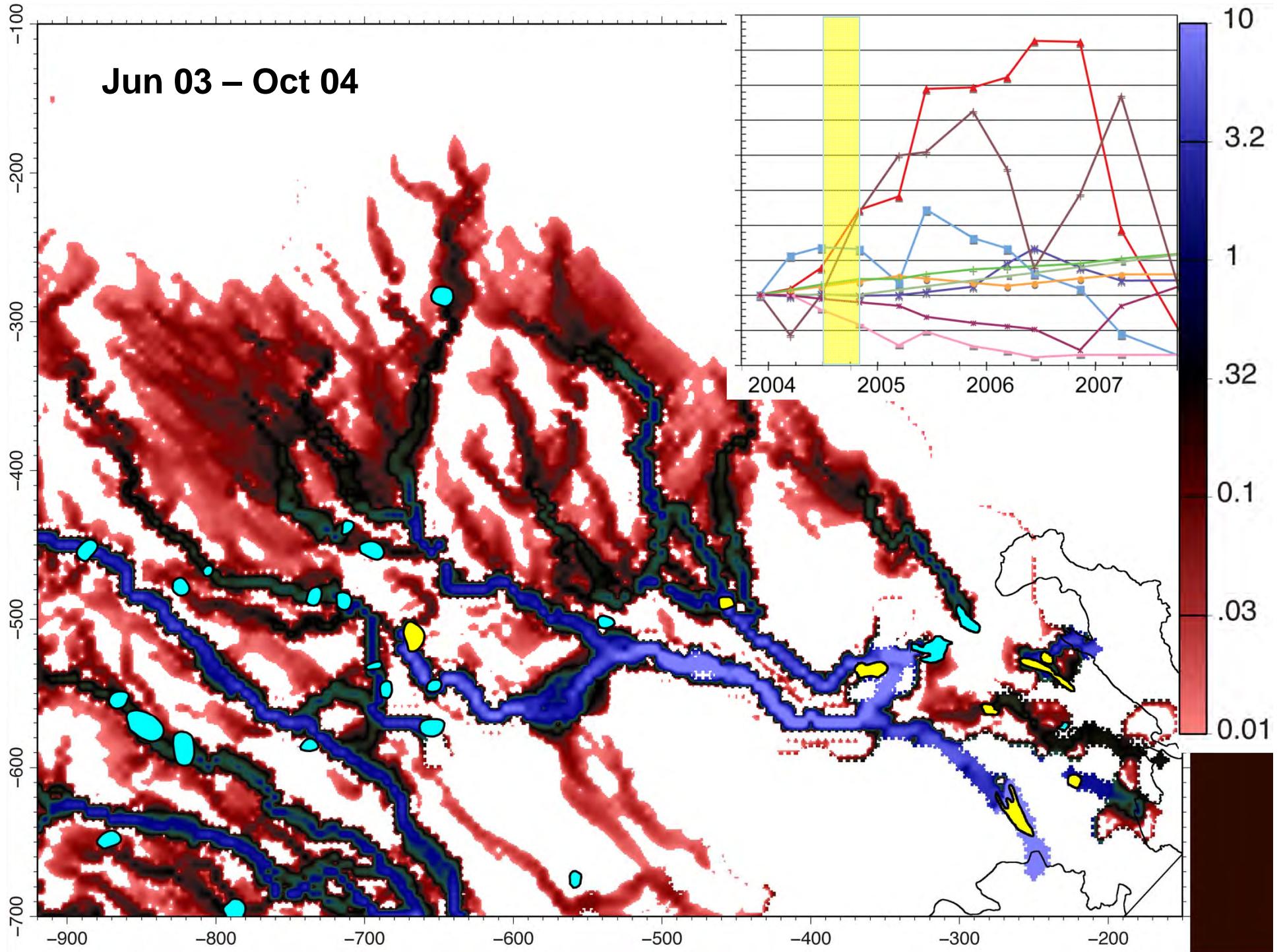
# A simple parameterization for lake volume change

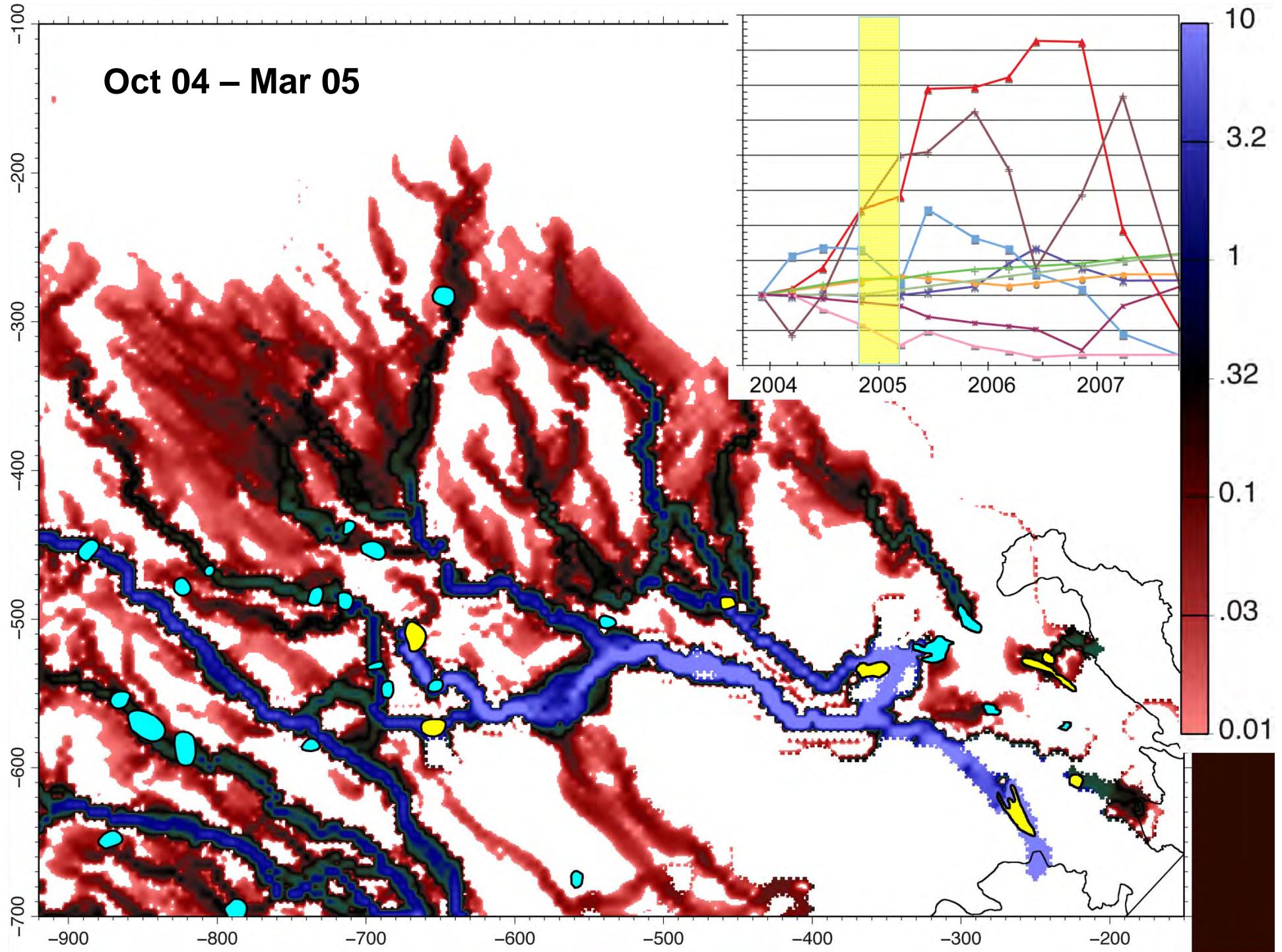


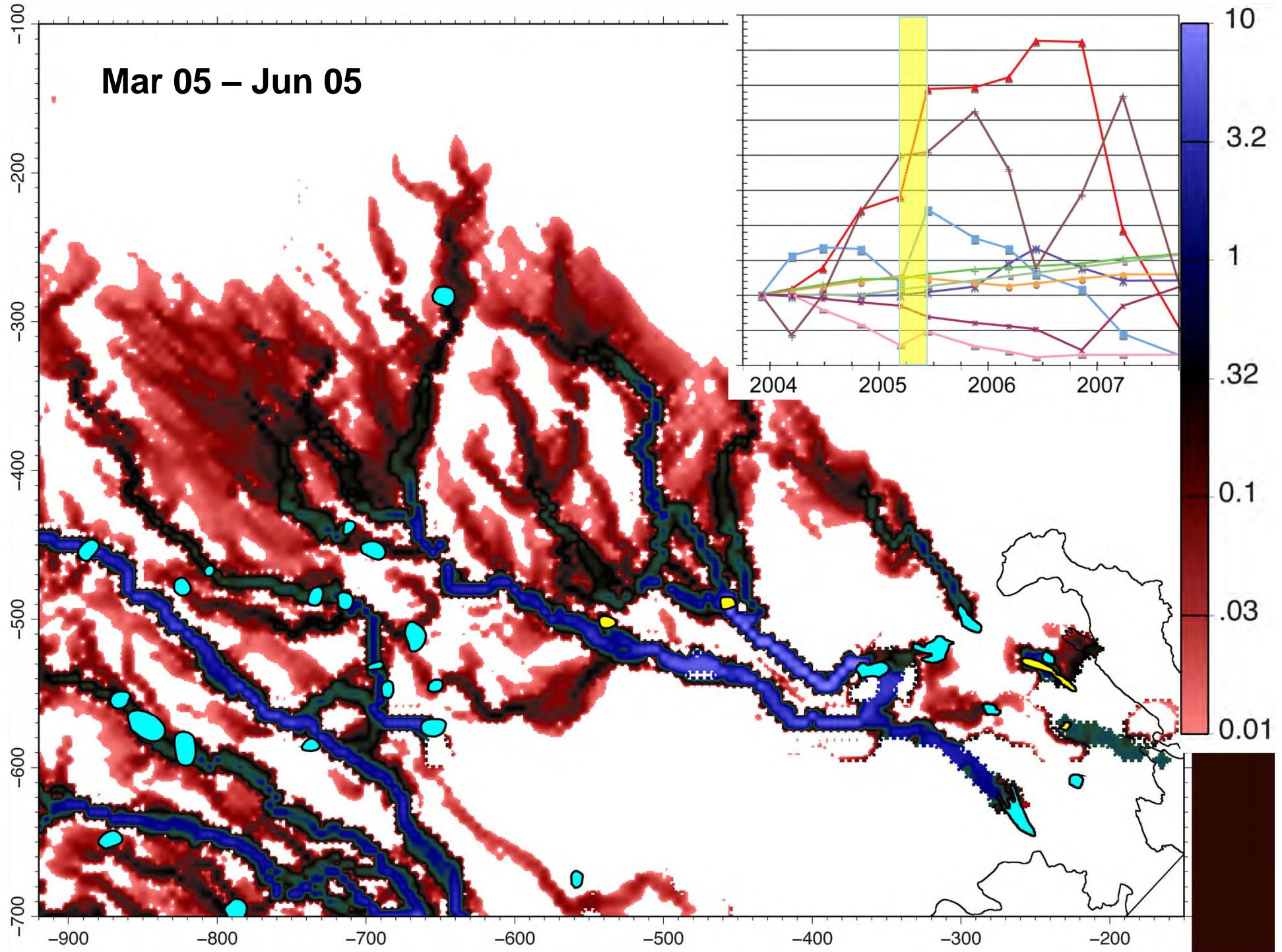
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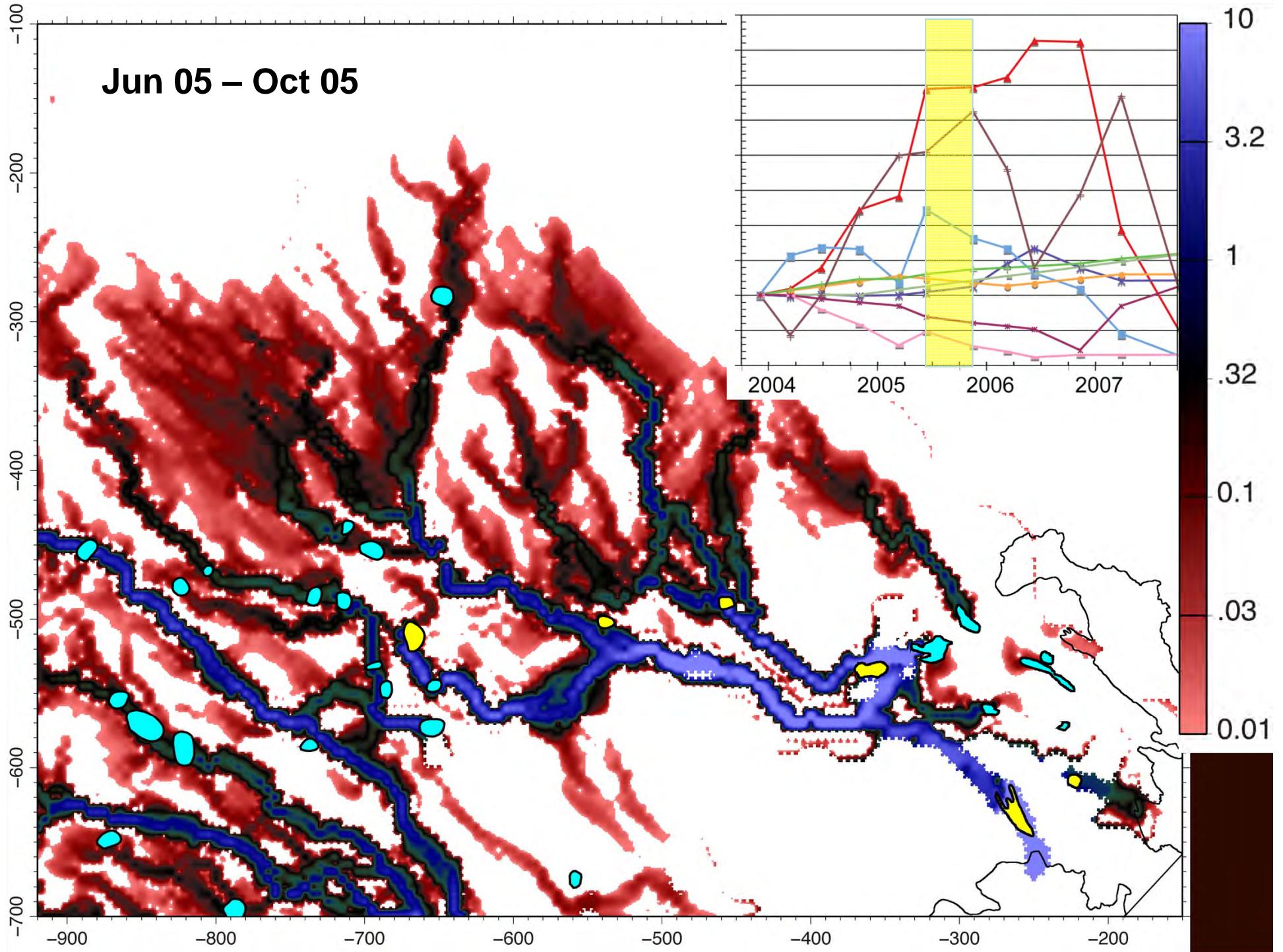


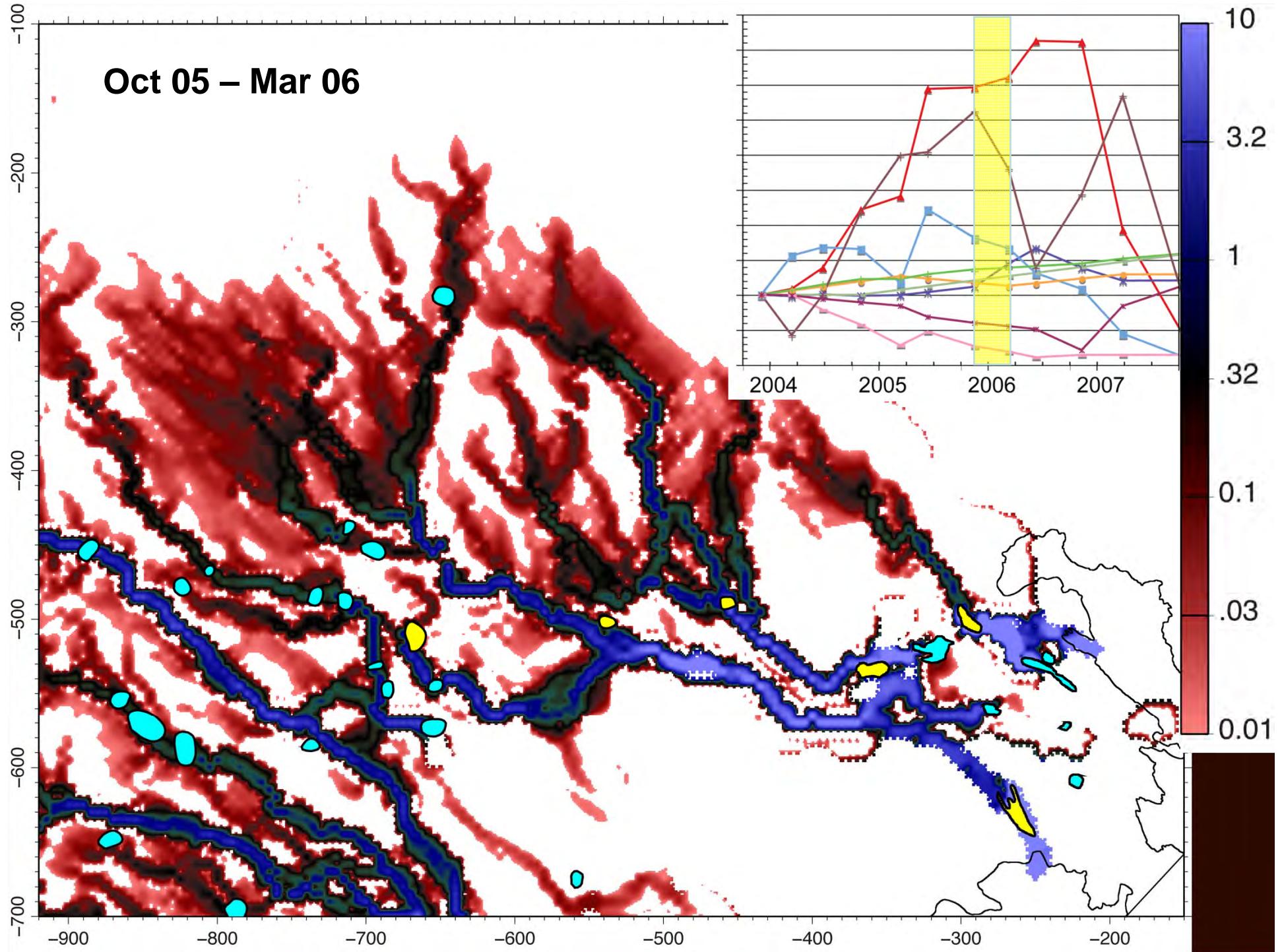


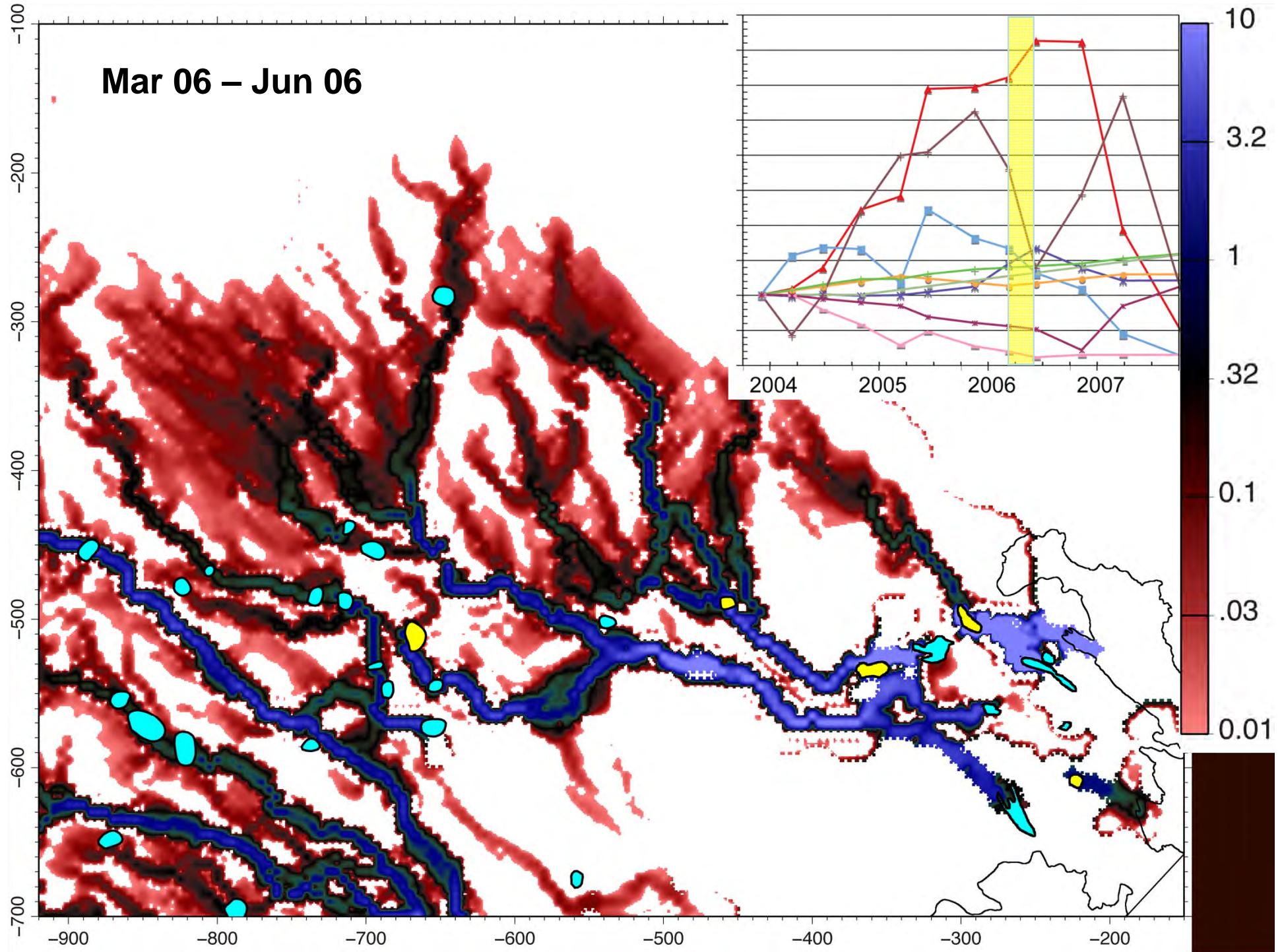


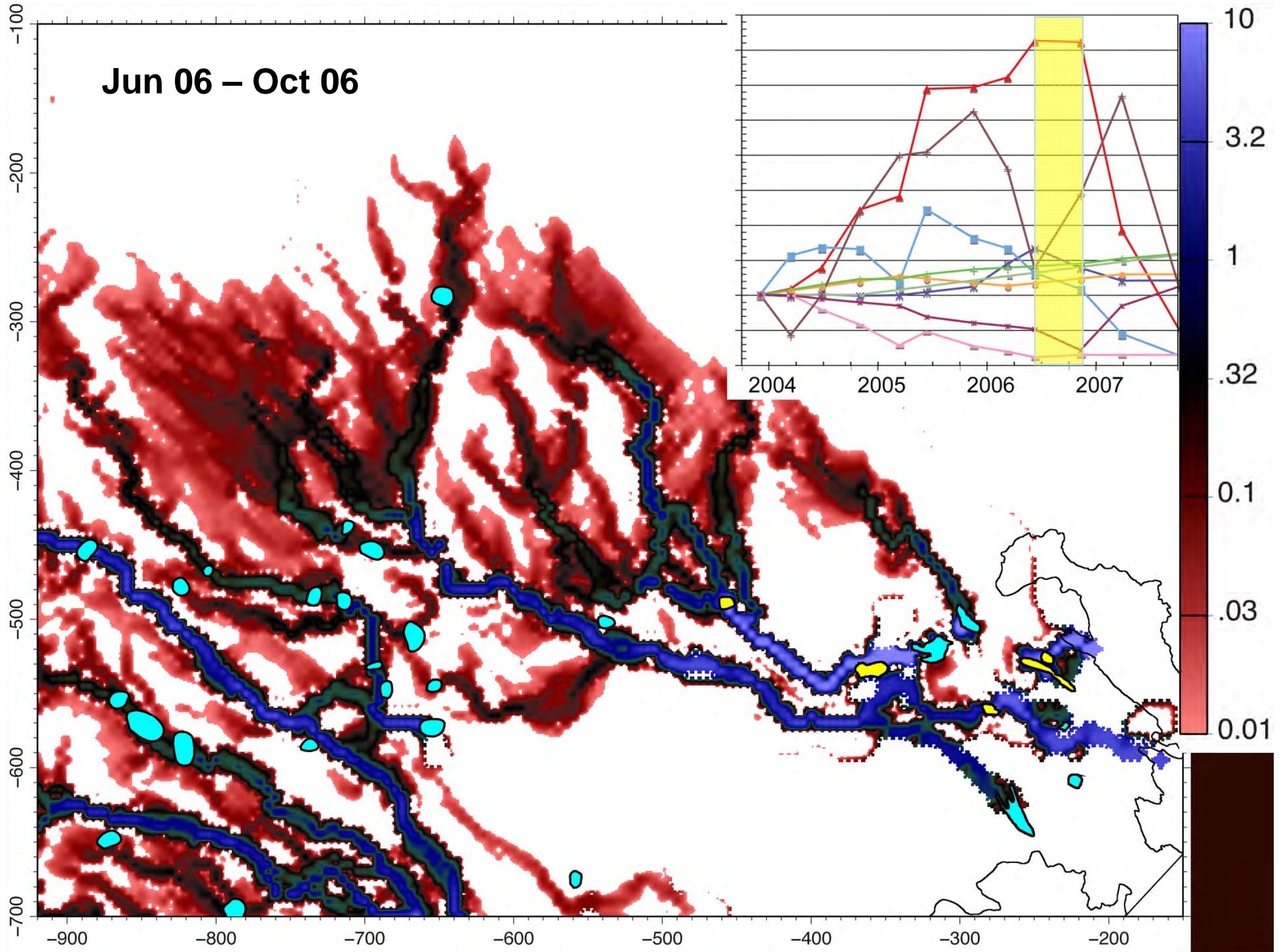


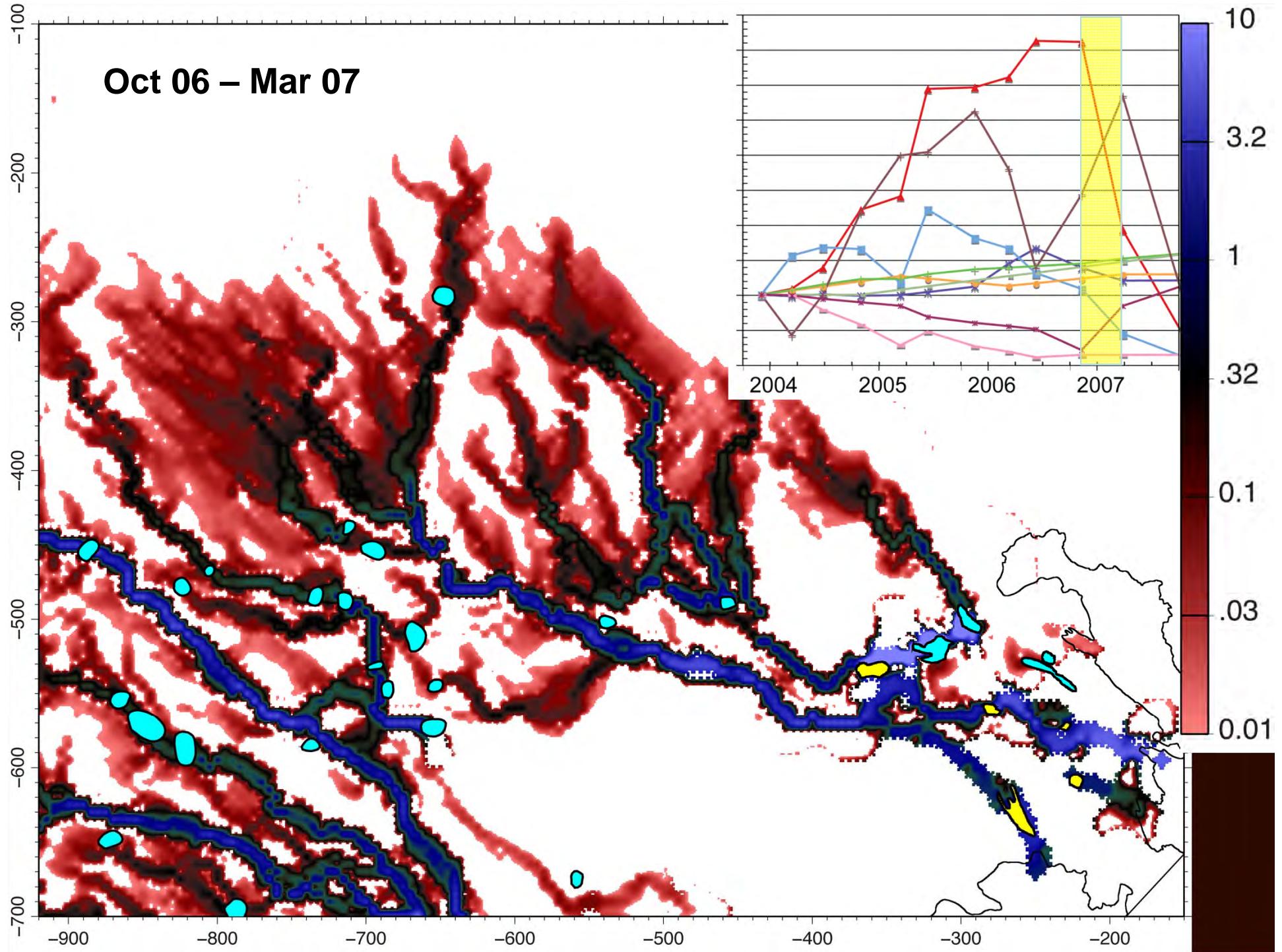


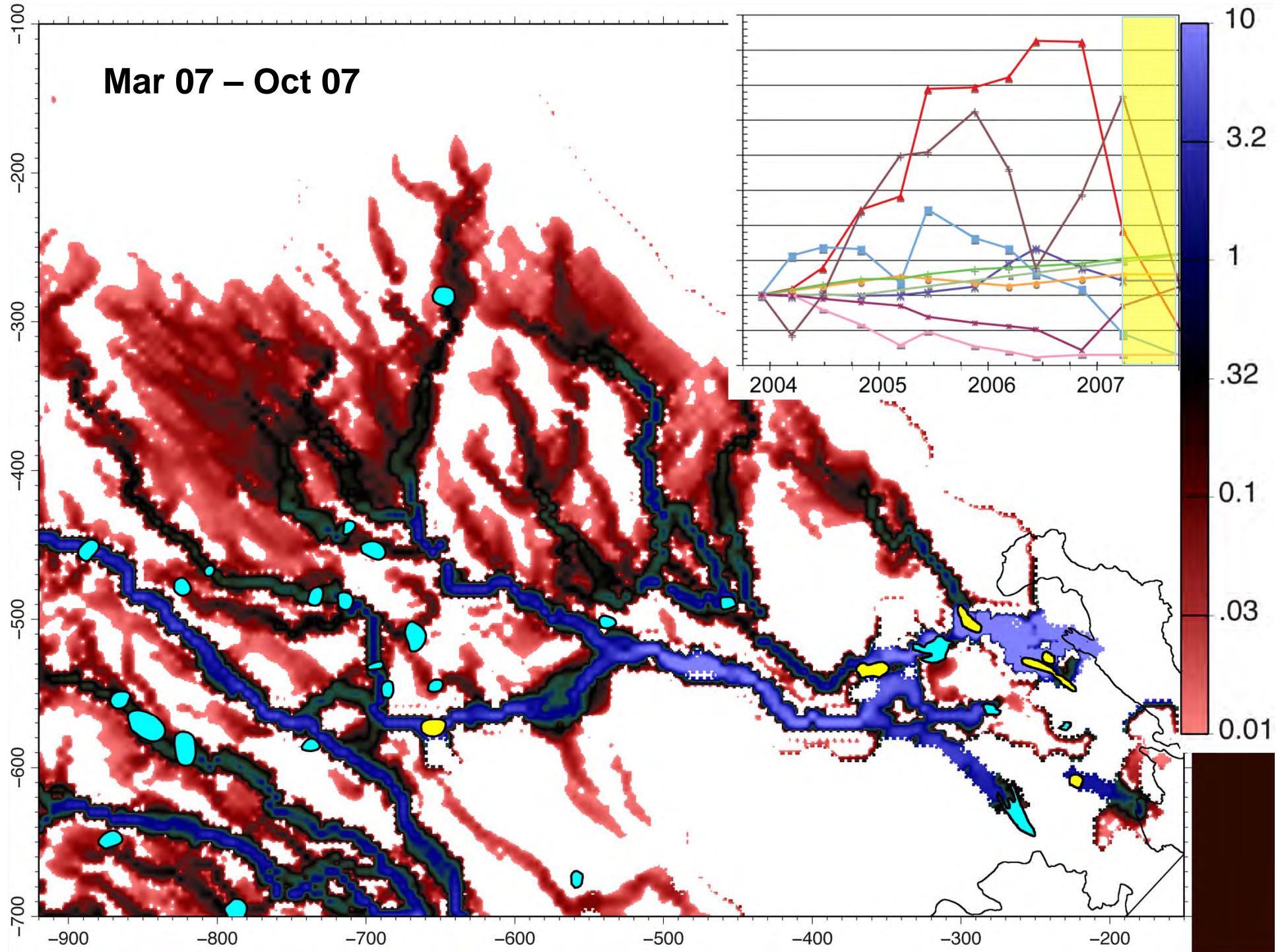


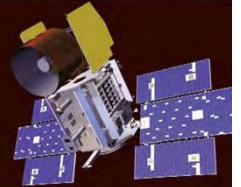




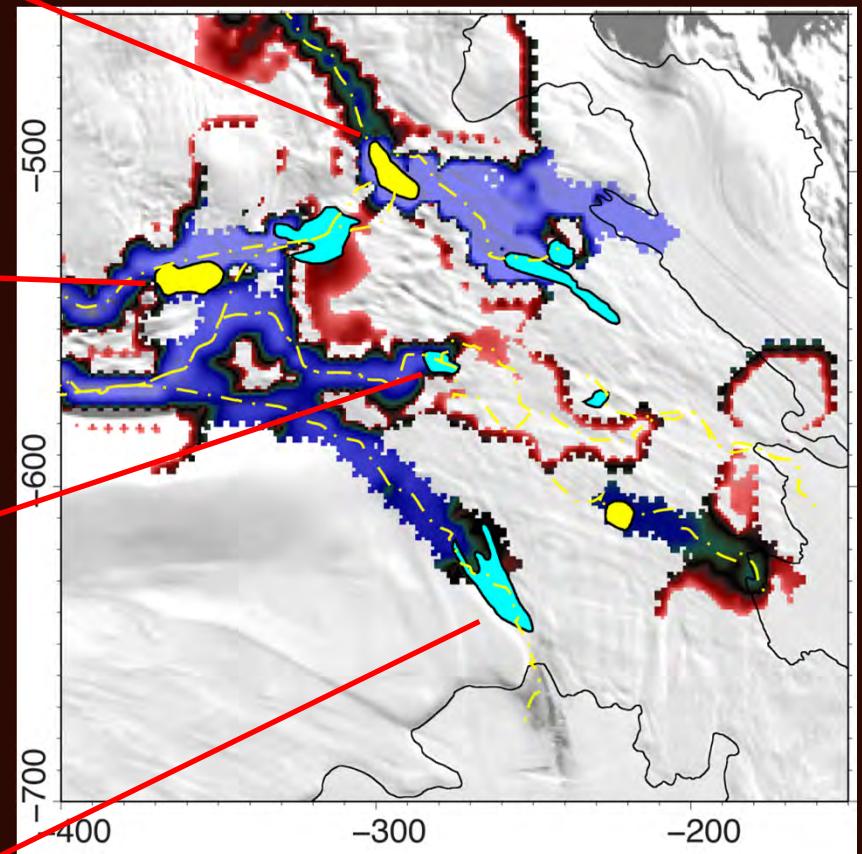
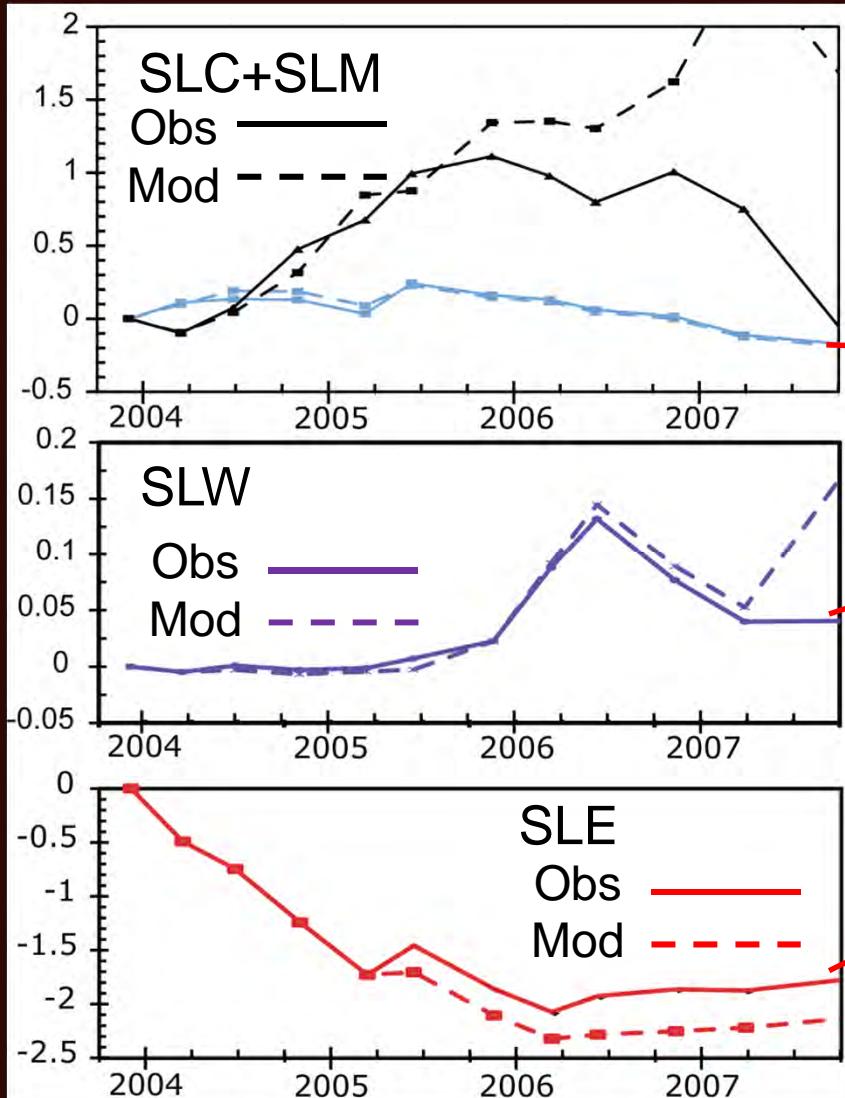






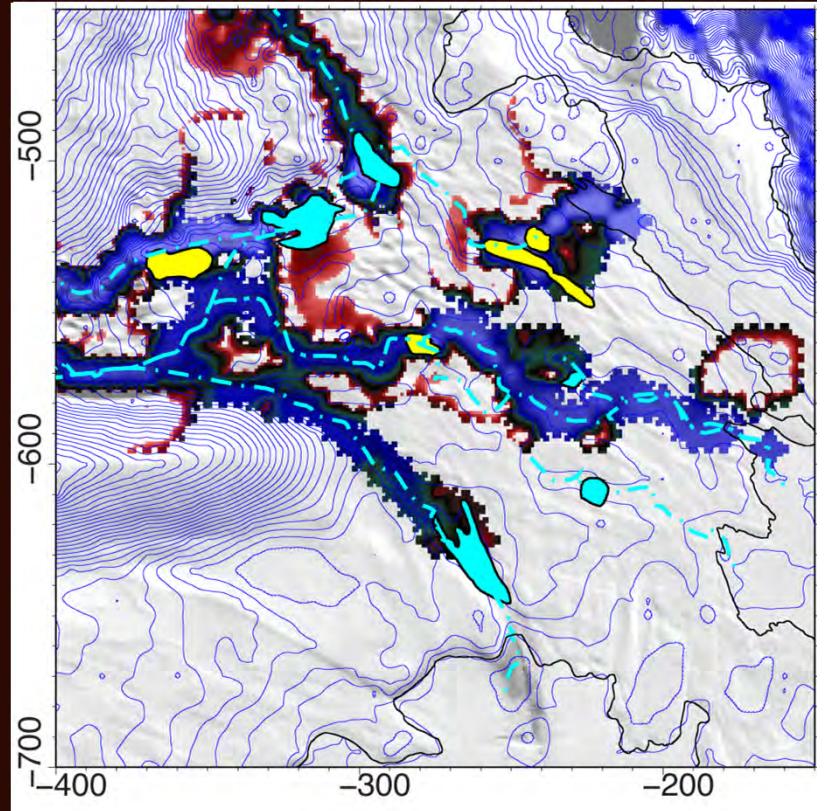
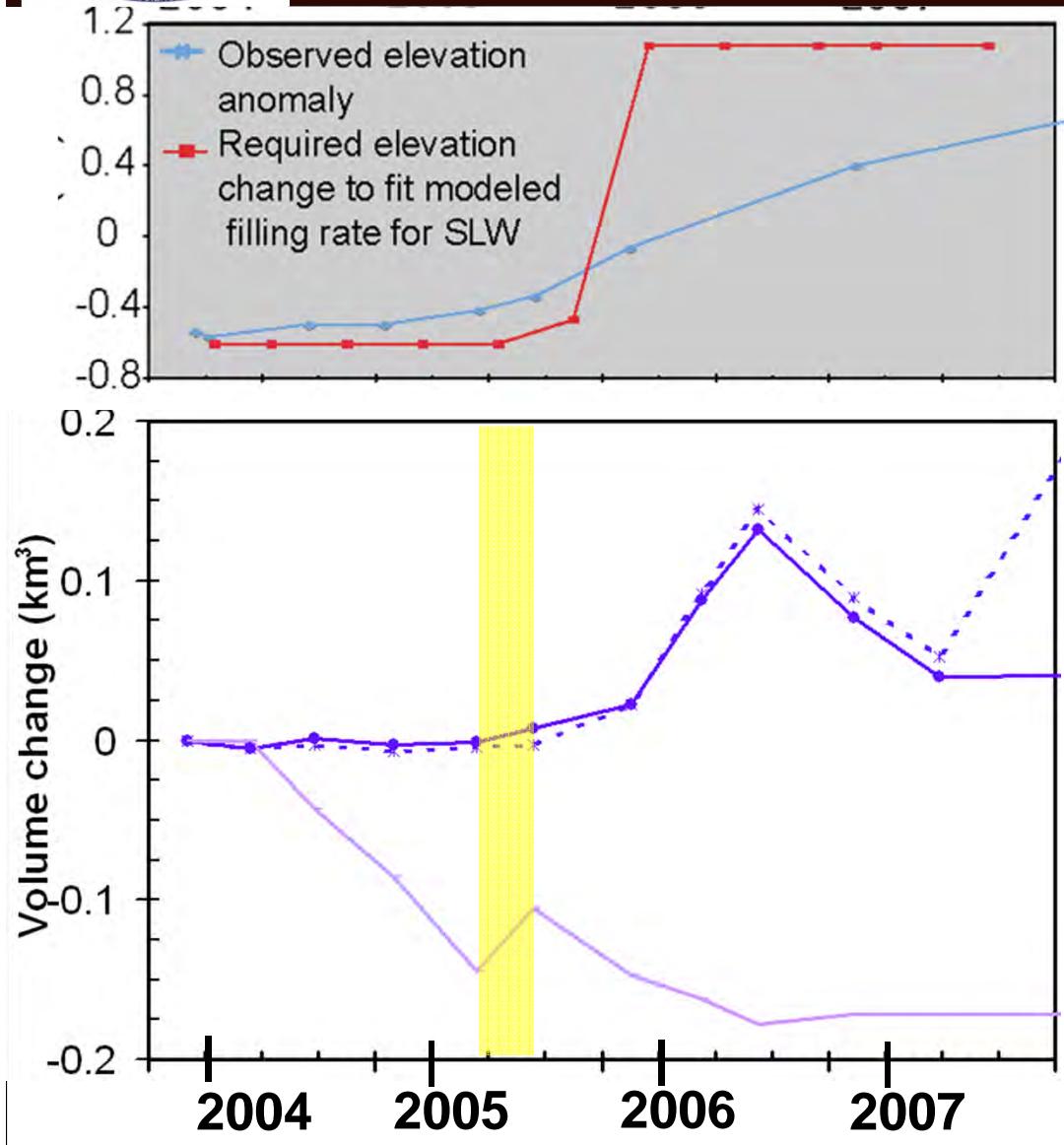
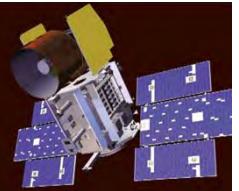


# Balanced water budget Validates Kamb Piracy hypothesis



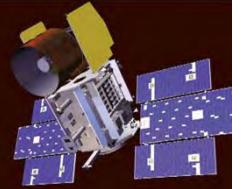


# Water Piracy 2005-2006

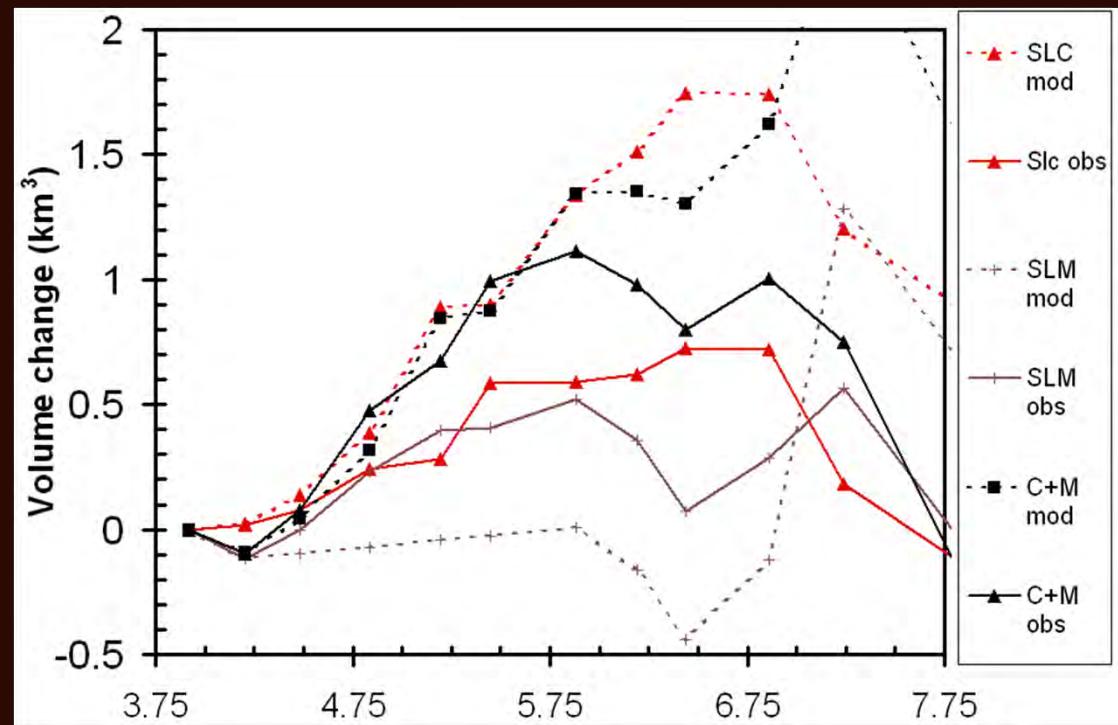
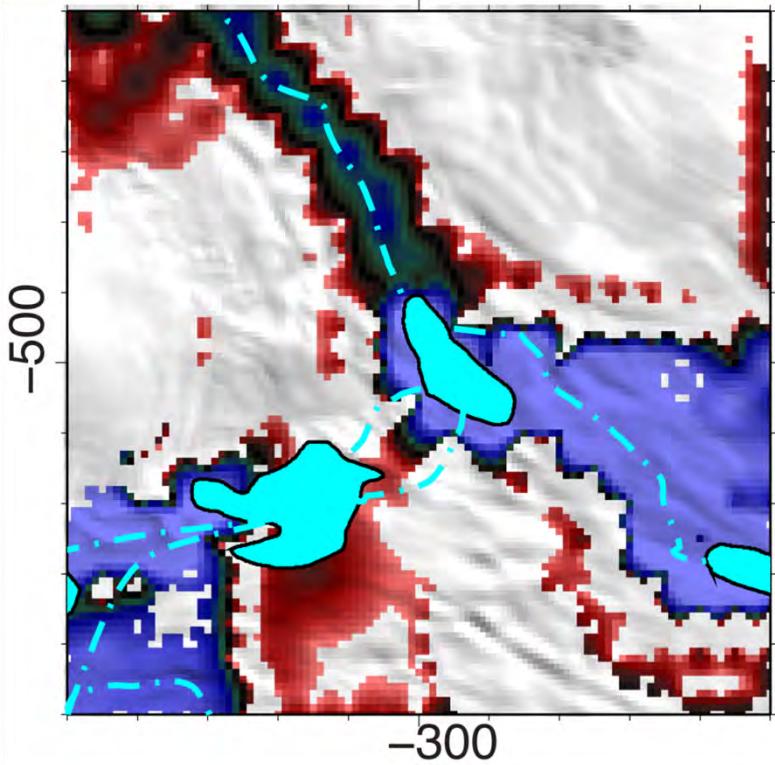




# So what's the deal with SLC and SLM?

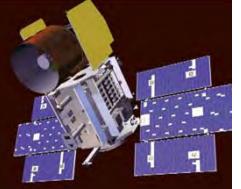


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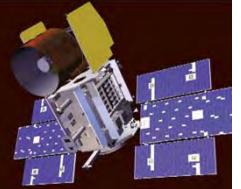
# Conclusions



- Water from upper WIS and KIS contribute to filling of SLW
- Observed volume change of SLC requires piracy of water from upper KIS
- Water systems are changing course
- Some lakes undergoing rapid filling such as SLC may leak at a limited rate.



# More WISSARD at WAIS



- Thursday 2:30

Christiansen et al. Radar Results from the Geophysics Site Characterization of Subglacial Lake Whillans, West Antarctica

- Thursday 2:45

Jacobel et al., Dynamics of Subglacial Lake Whillans from WISSARD Radar, Seismic and GPS Surveys and Satellite Laser Altimetry

- Friday 9:30

Horgan et al., Englacial Seismic Reflectivity – Imaging Crystal Orientation Fabric in West Antarctica

- Instrumentation testing currently underway at Lake Tahoe as we meet