



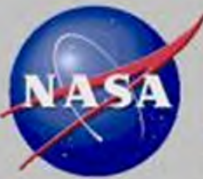
Balancing the water budget of the Whillans Ice Plain: Implications for the nature of the subglacial hydrologic system



Sasha Peter Carter, Helen Amanda Fricker
Matthew Sigfried,
Scripps Institution of Oceanography
Donald D. Blankenship *UTIG*
William H Lipscomb *LANL*

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 a 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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WISSARD Team (19 PIs, 9 institutions)

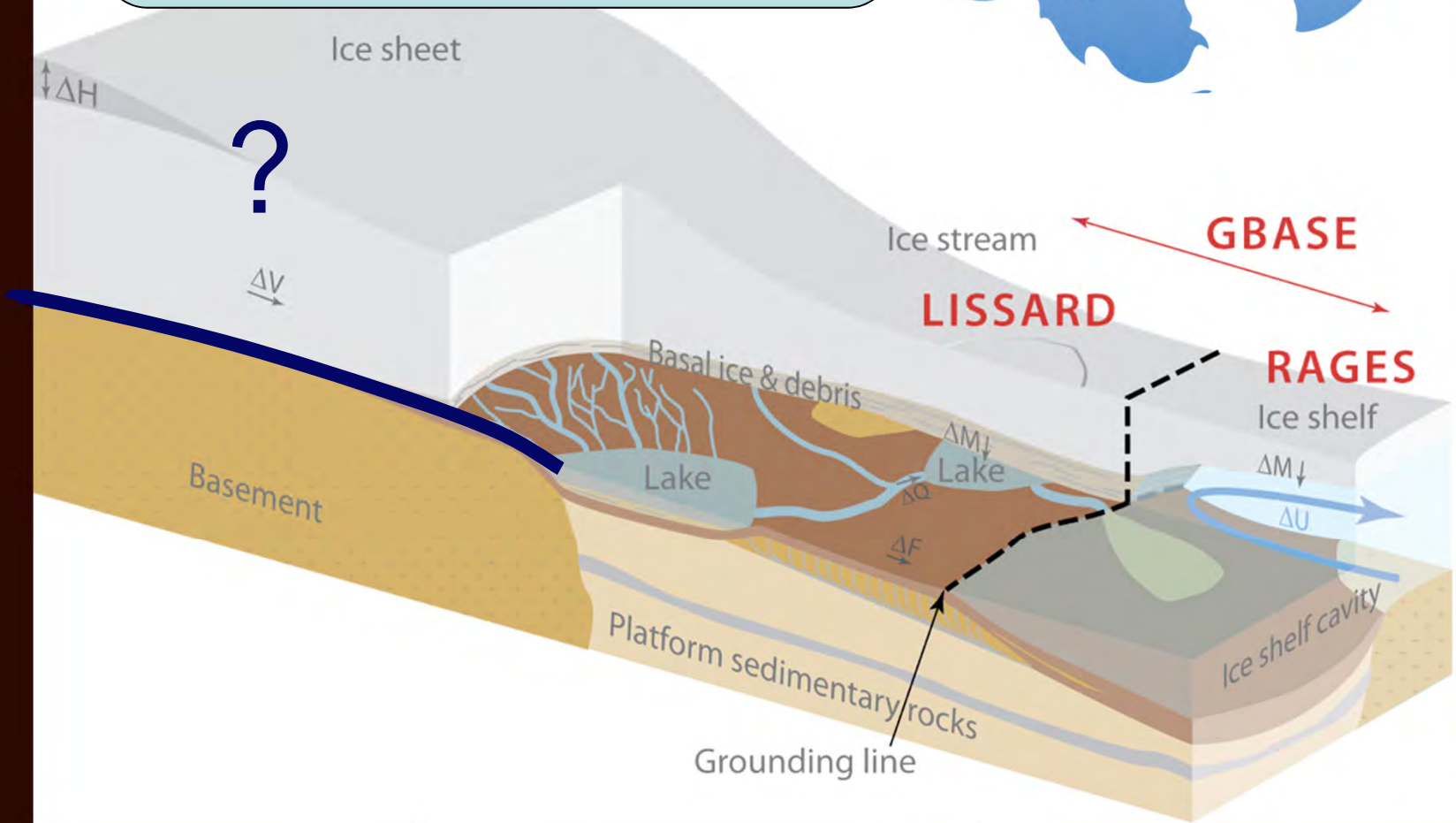


| PROJECT | PI | INSTITUTION |
|----------------|---------------------------|---|
| GBASE | John Priscu (lead PI) | Montana State University (MSU) |
| | Brent Christner | Louisiana State University (LSU) |
| | Jill Mikucki | Dartmouth College (DC) |
| | Andrew Mitchell | Montana State University (MSU)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



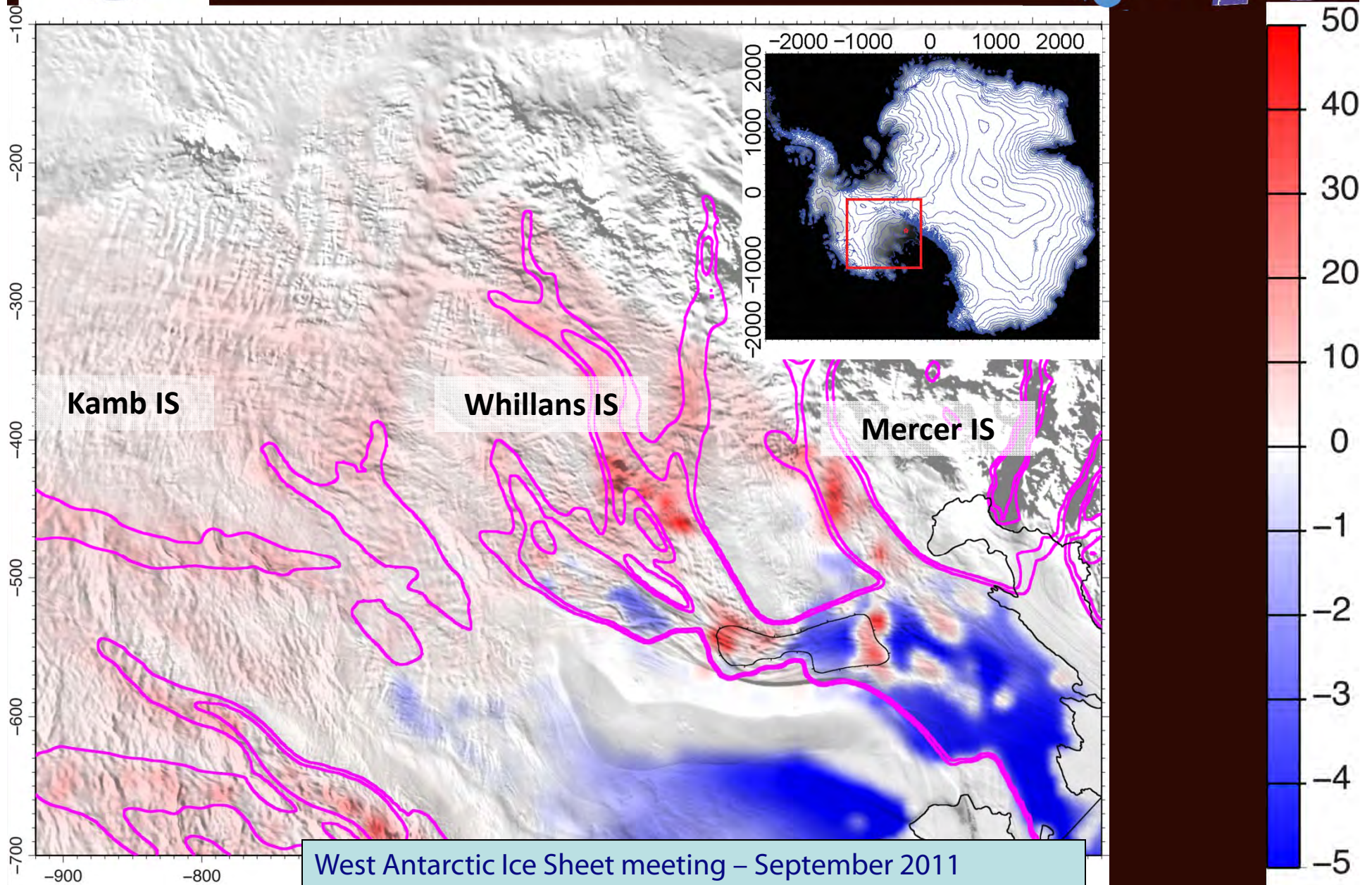


Where does my water come from?



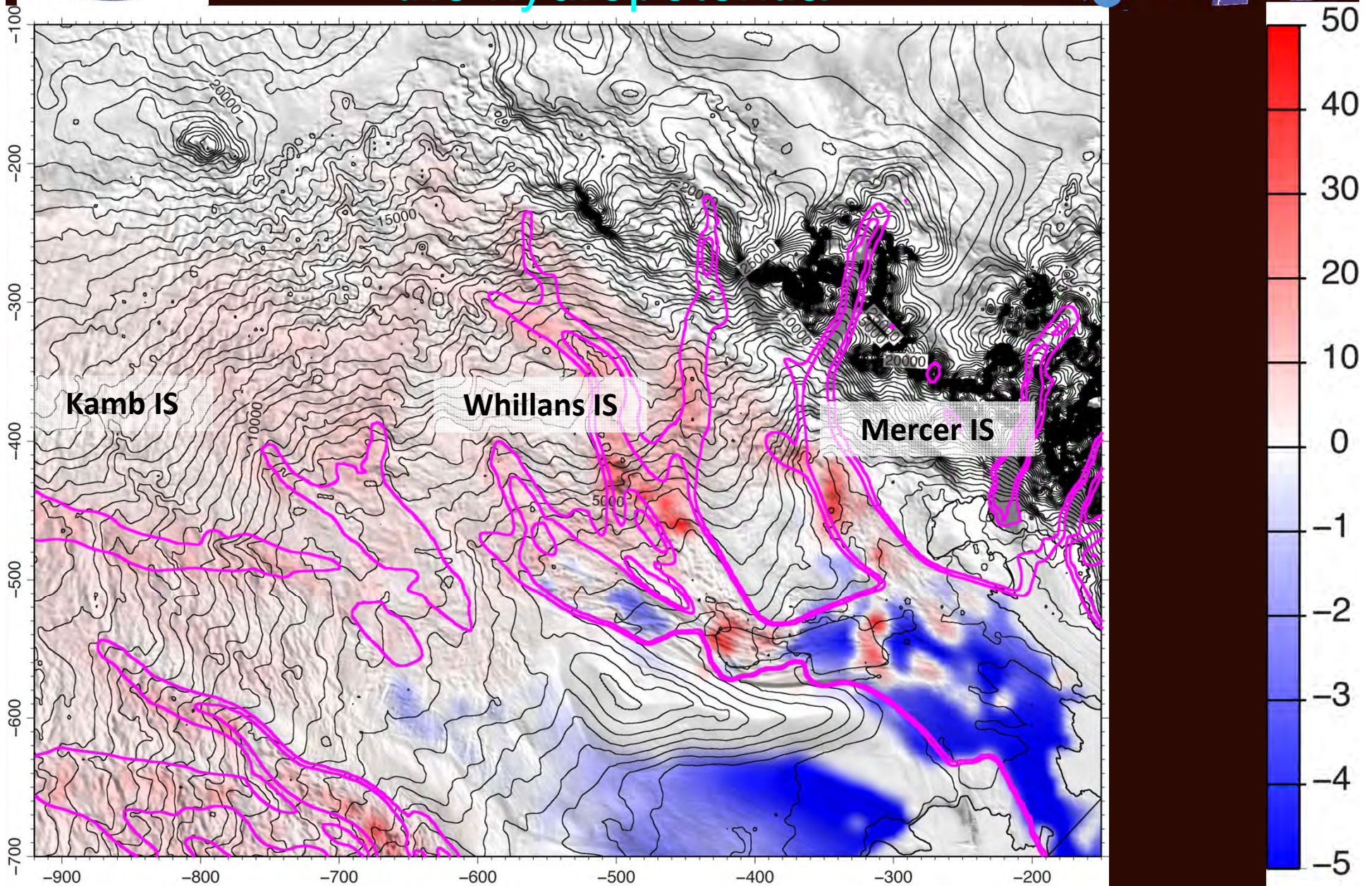


Basal Melt Rate (mm/a) (Joughin et al., 2004)



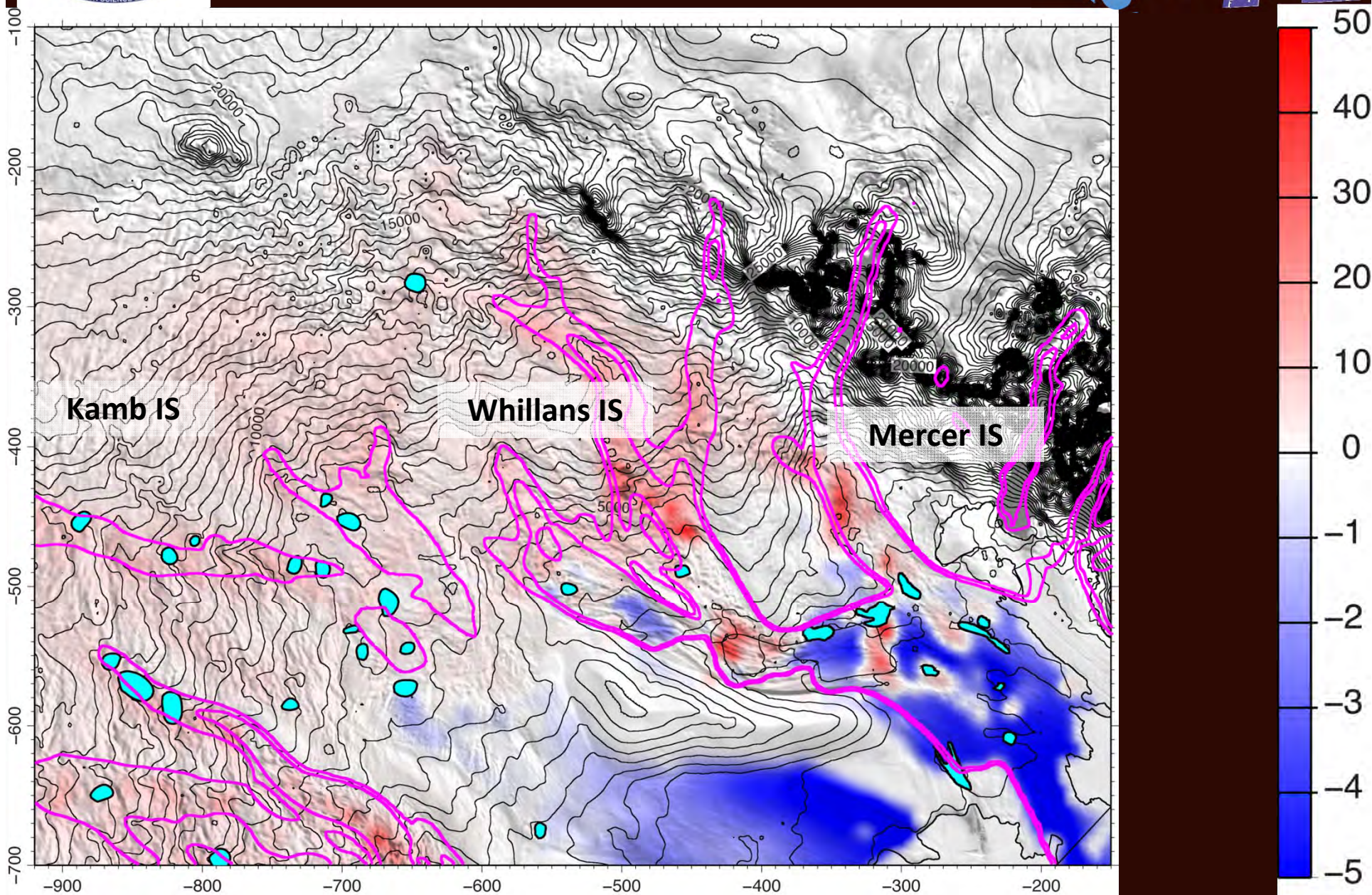


Water is routed down the hydropotential



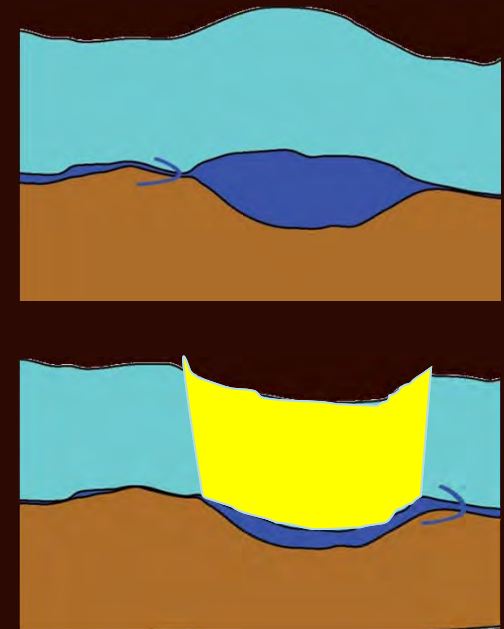
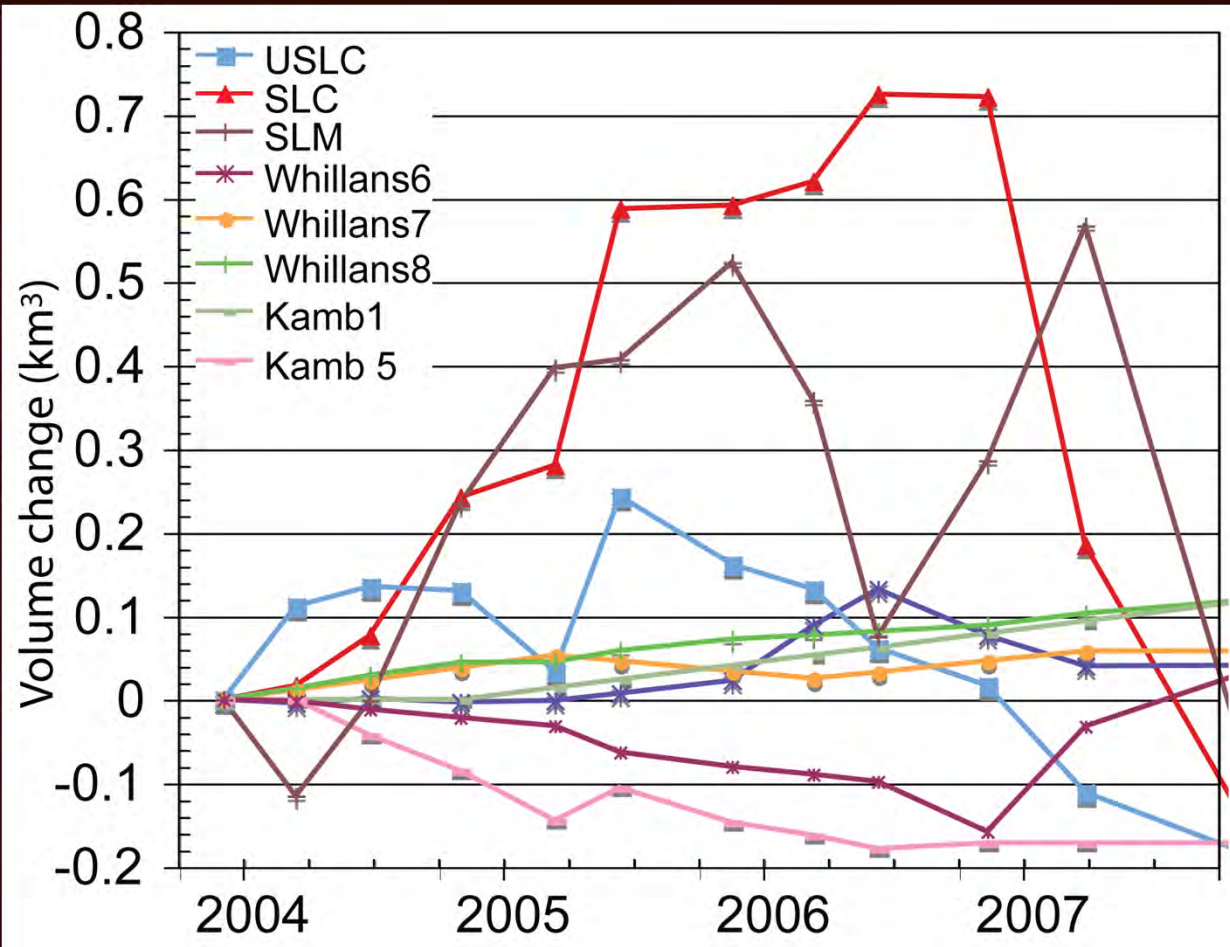
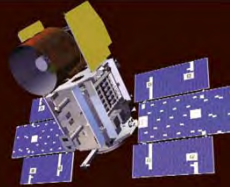


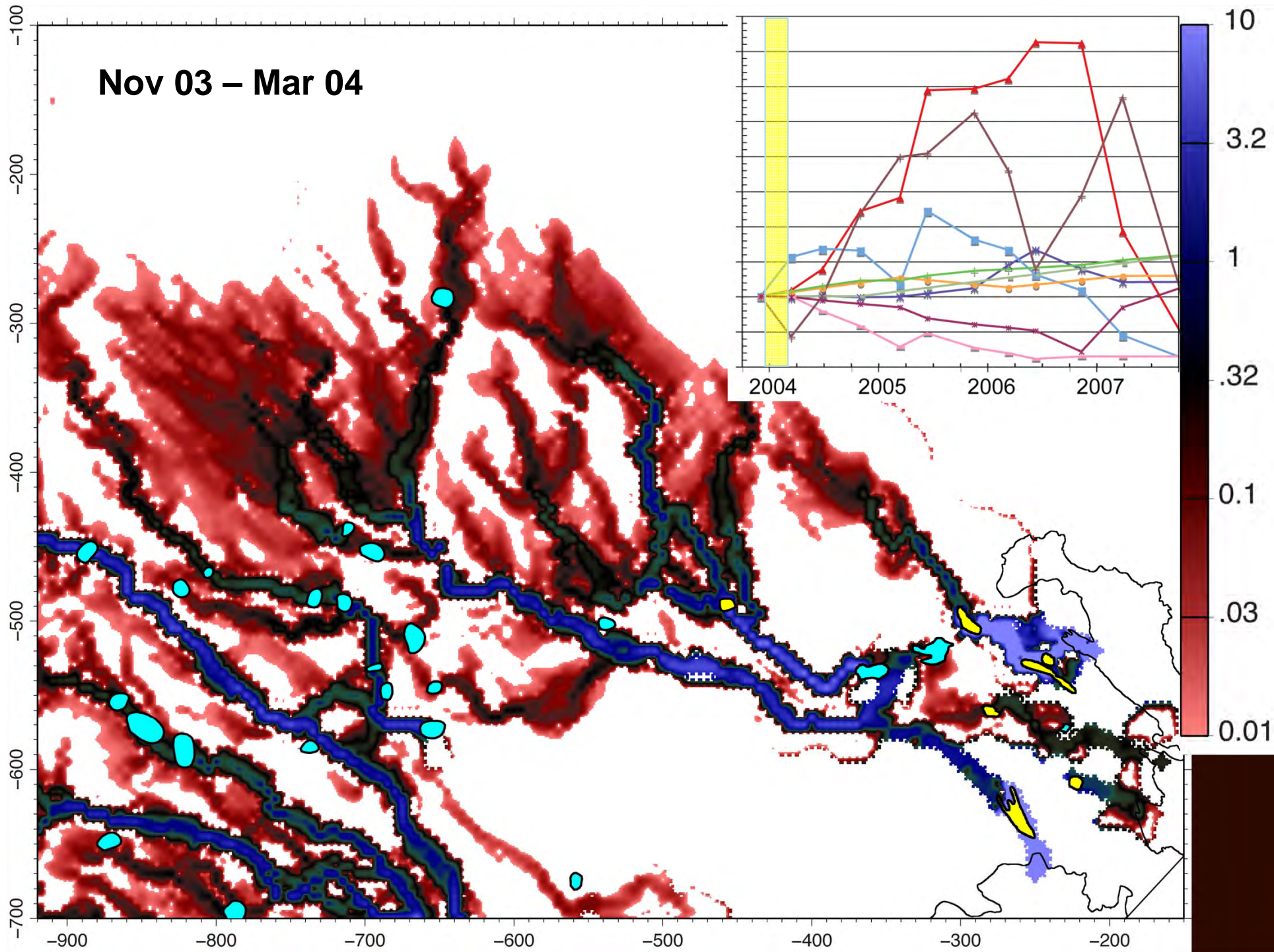
Lakes complicate the picture

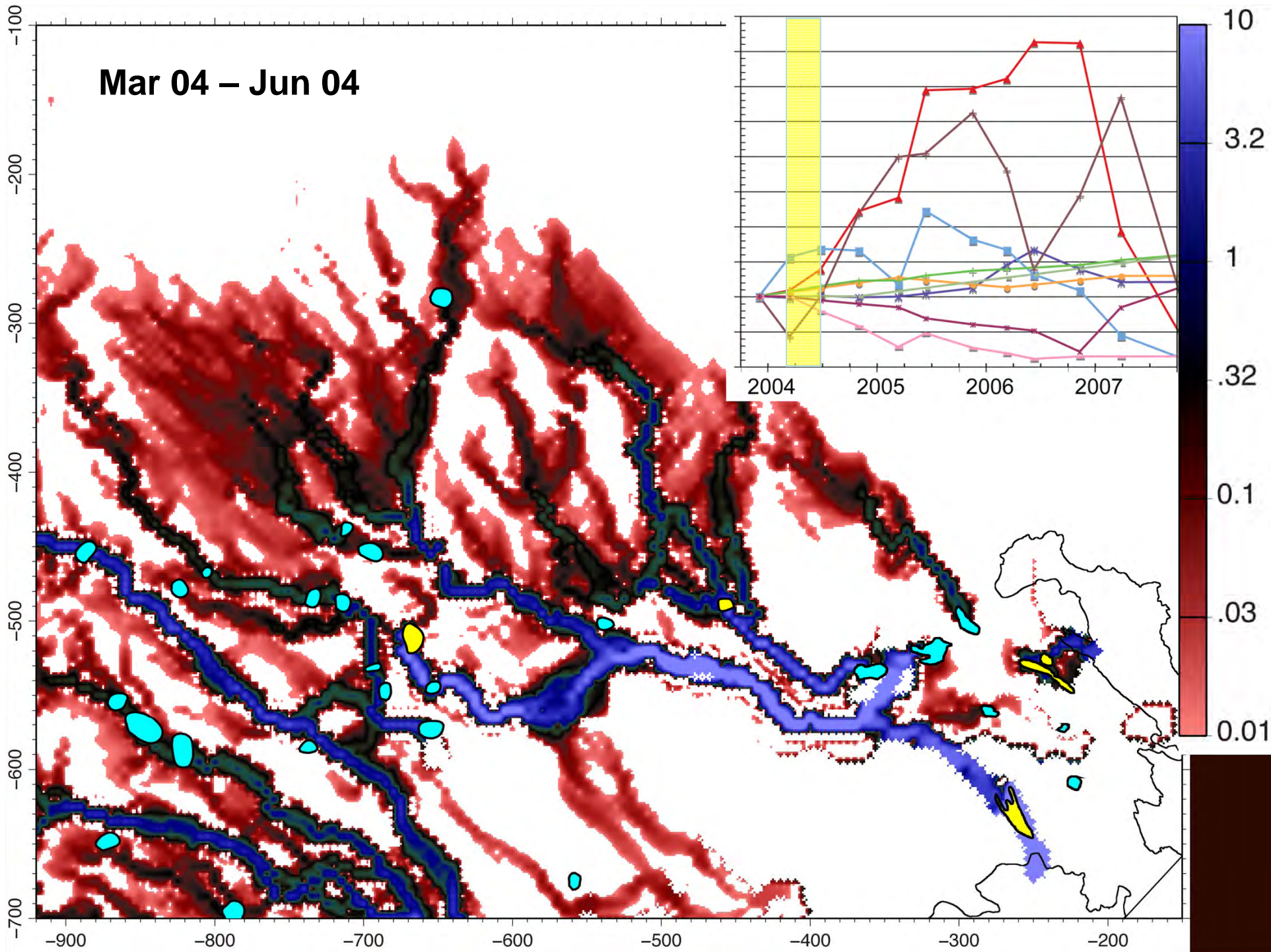


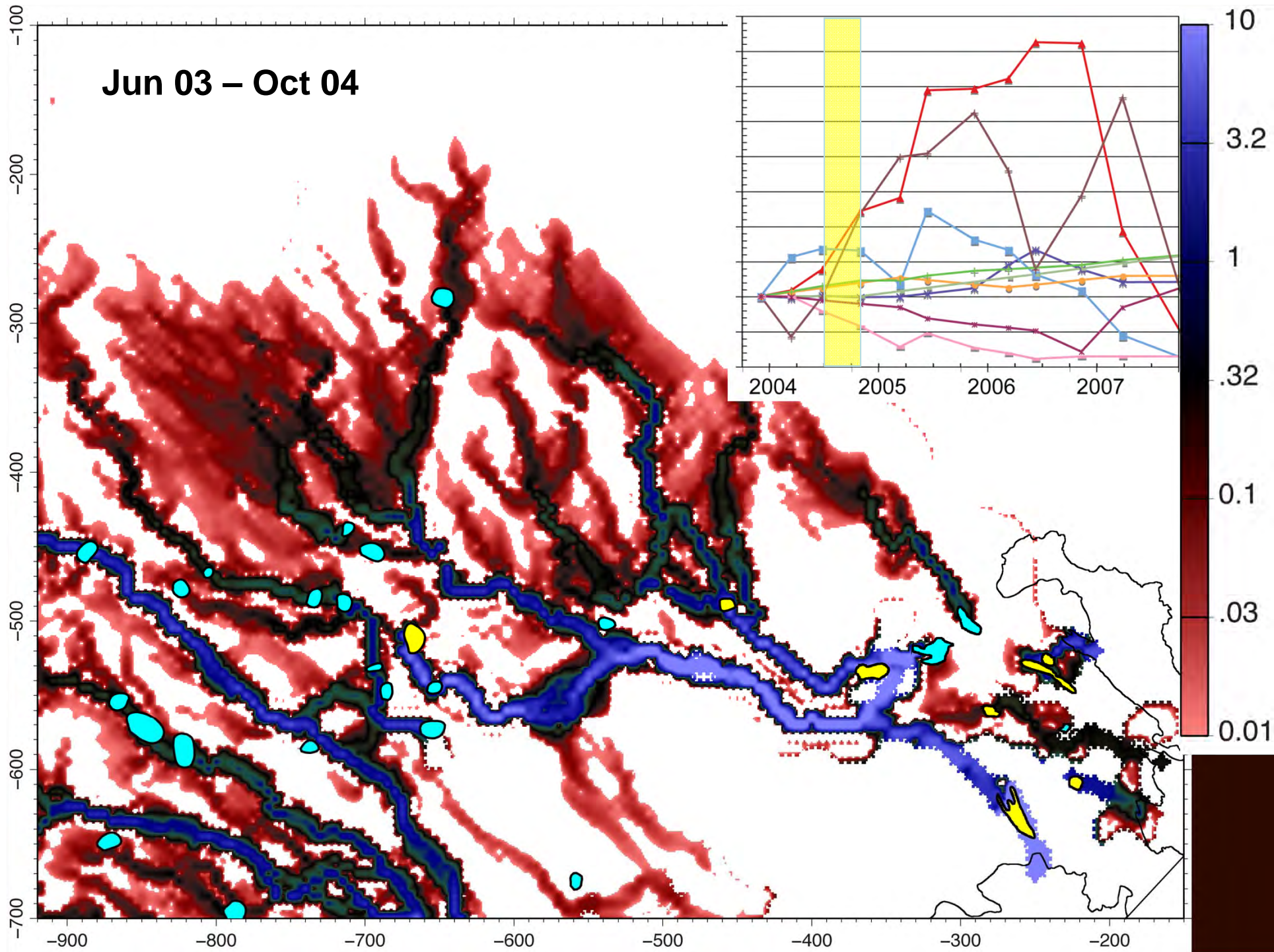


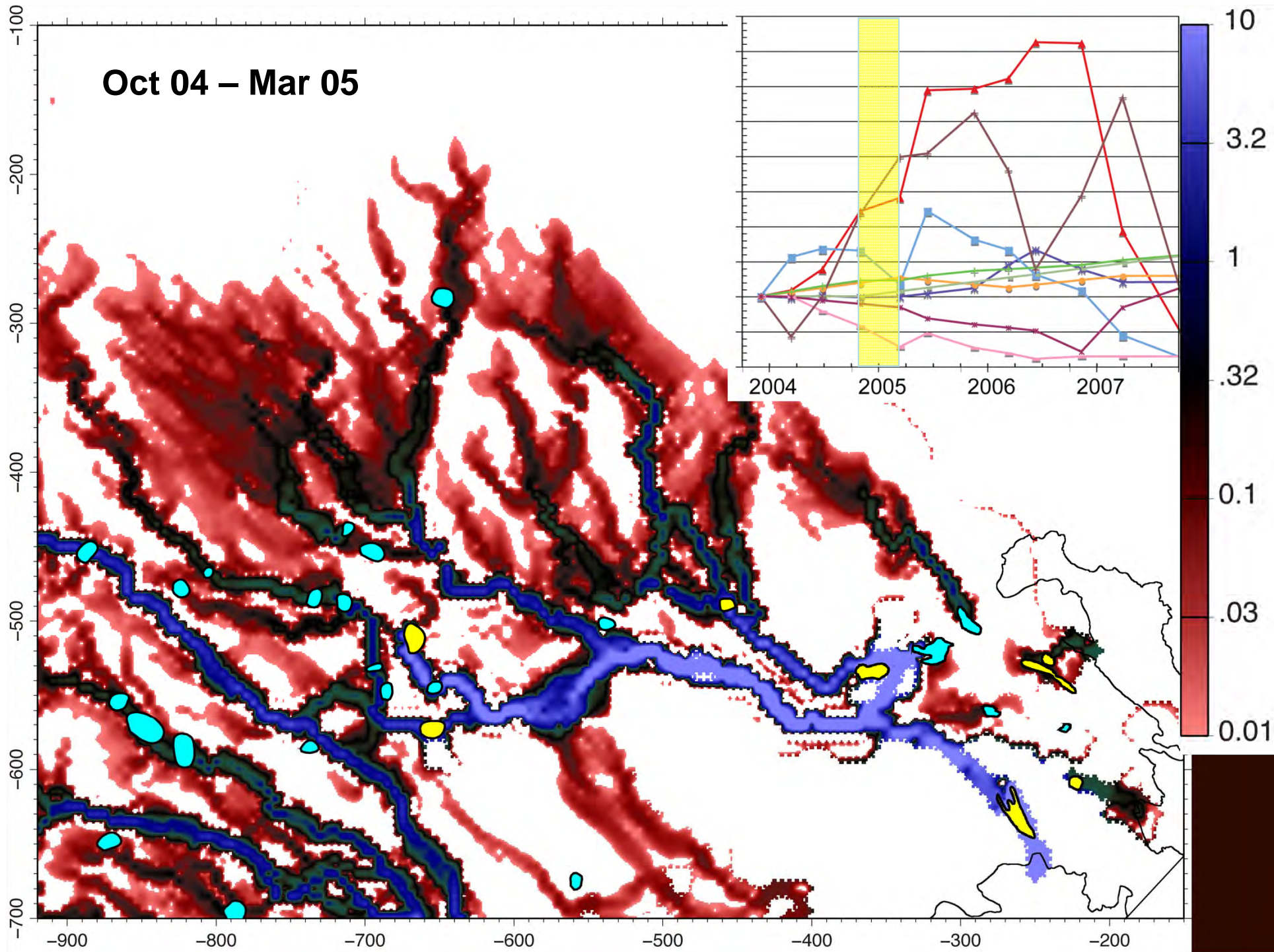
A simple parameterization for lake volume change

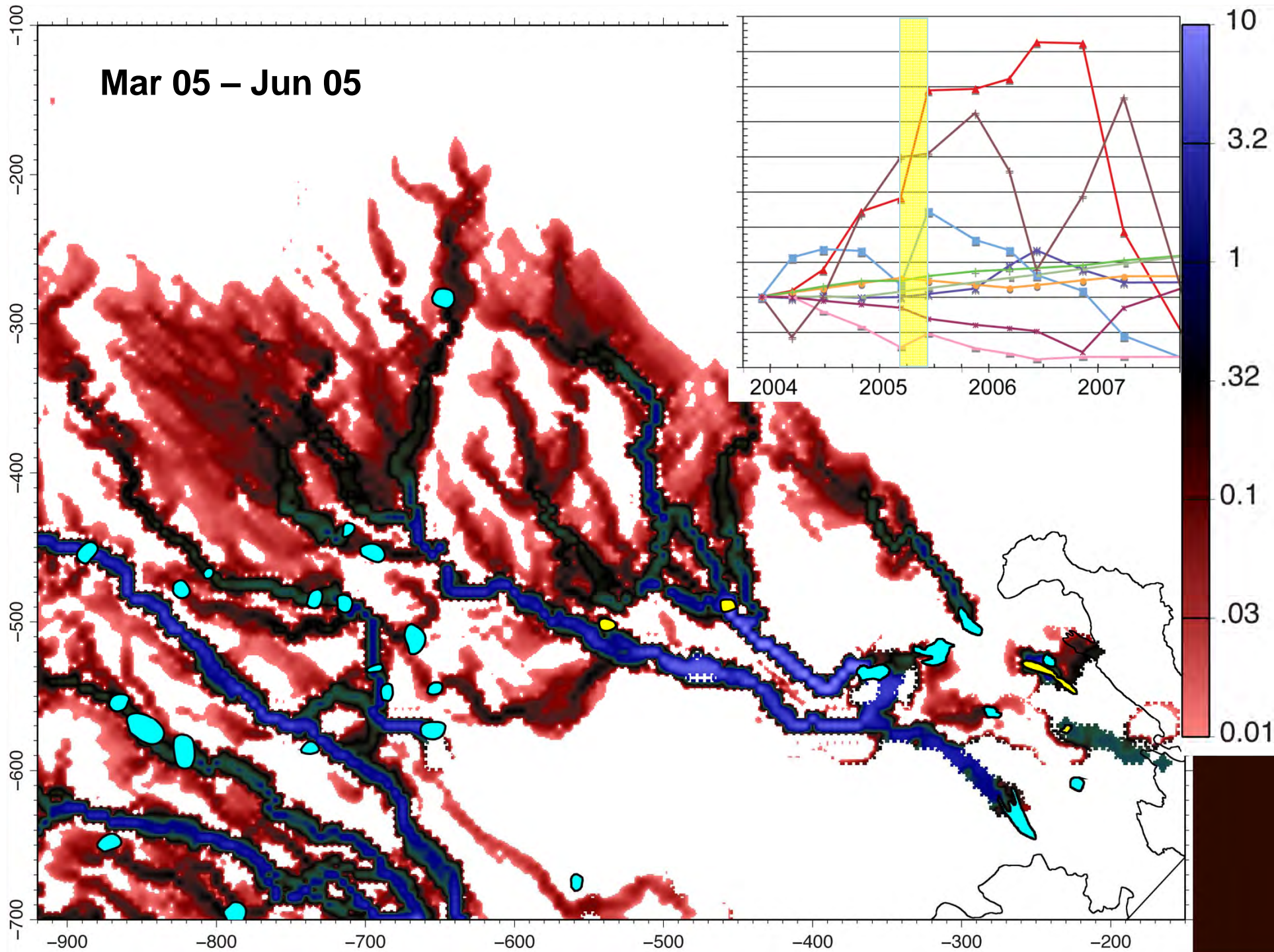


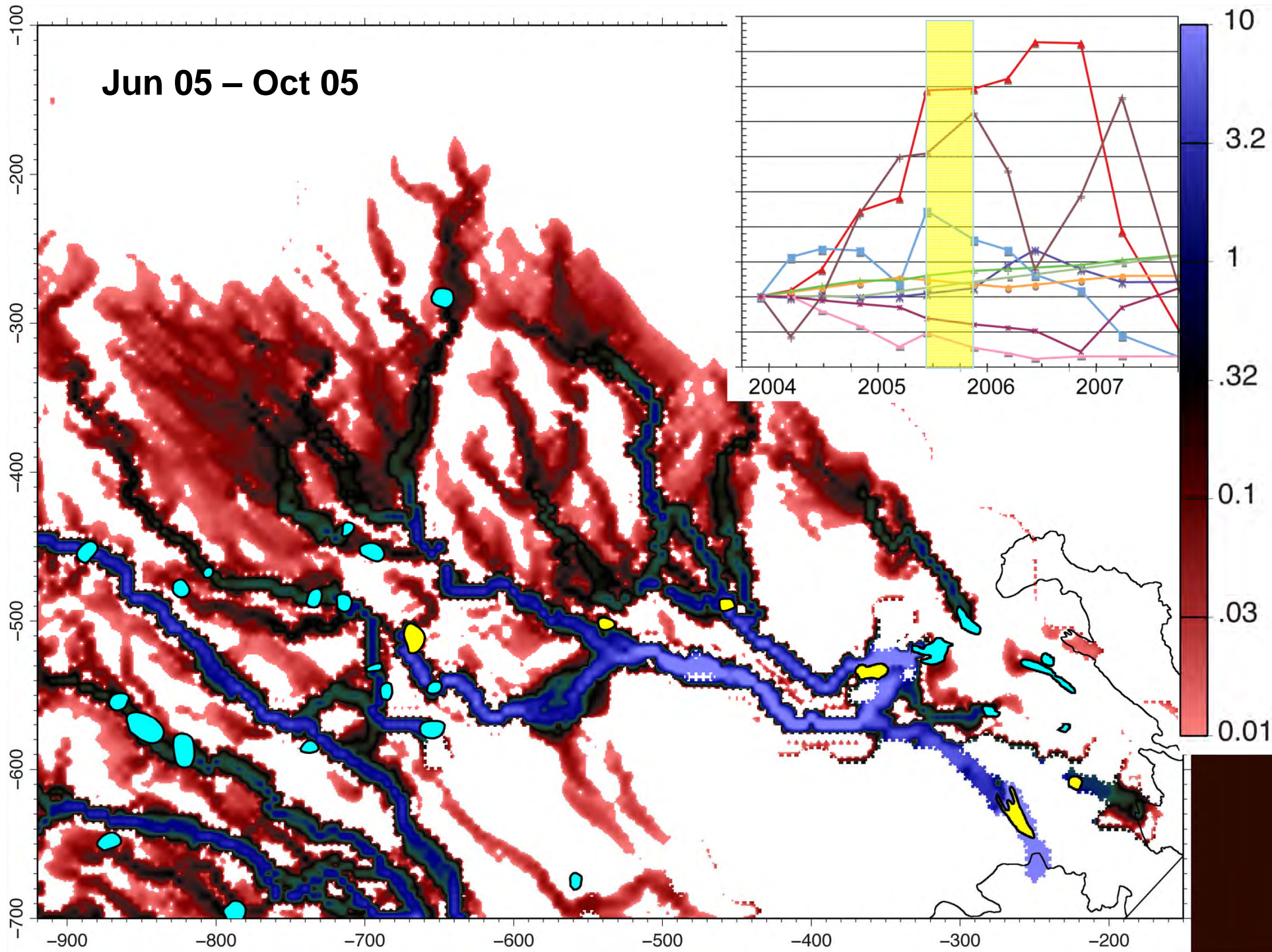


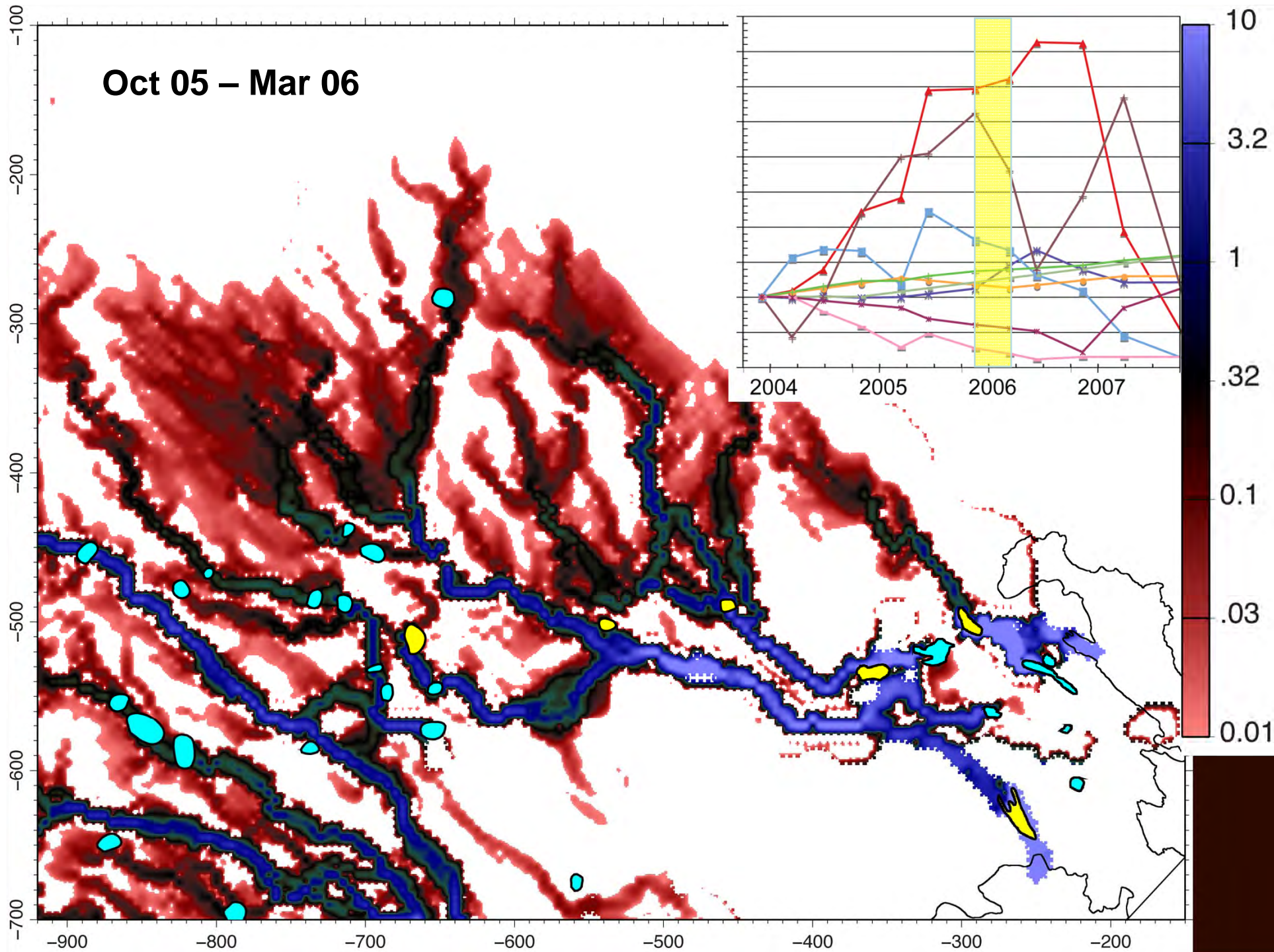


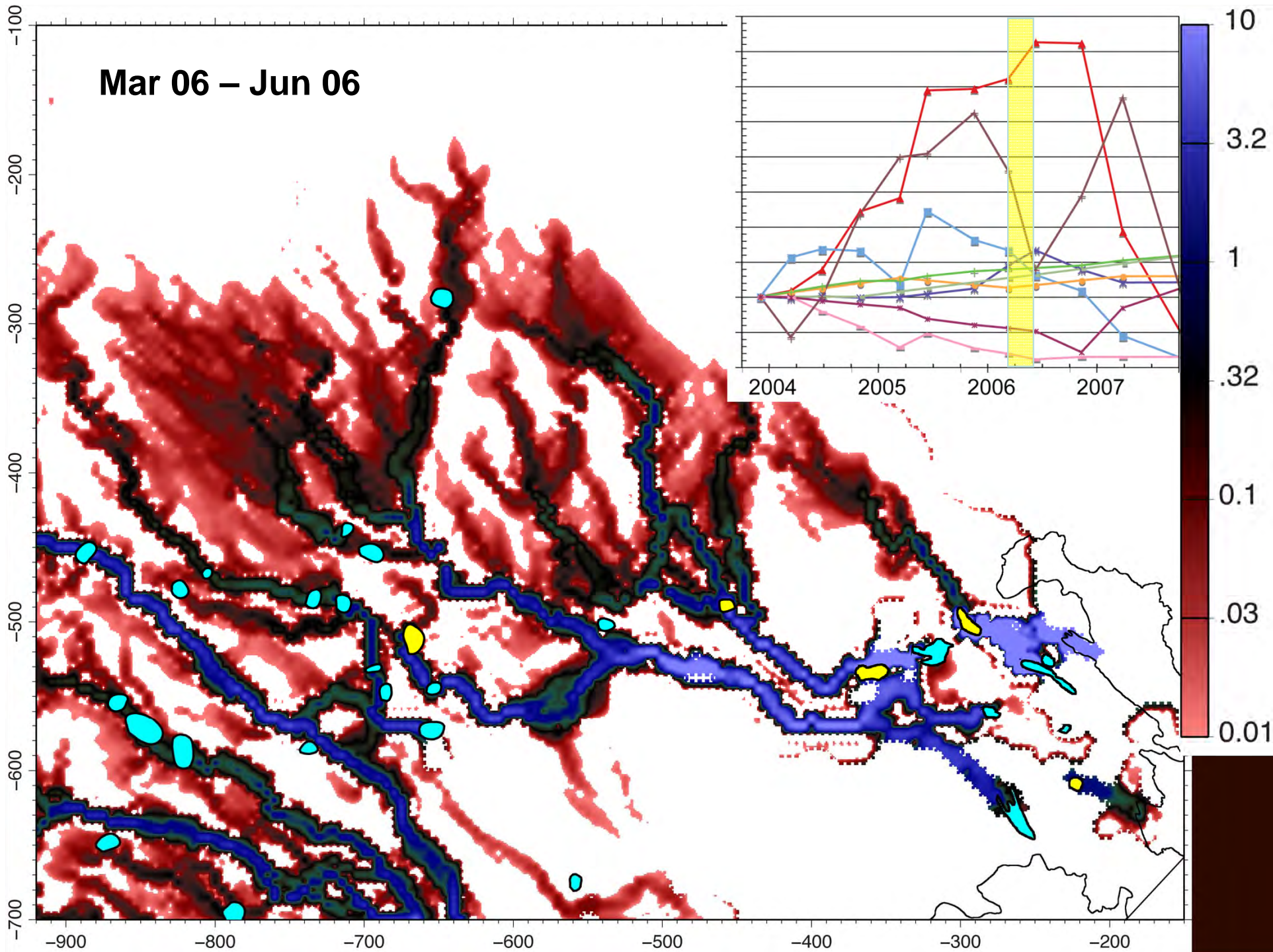


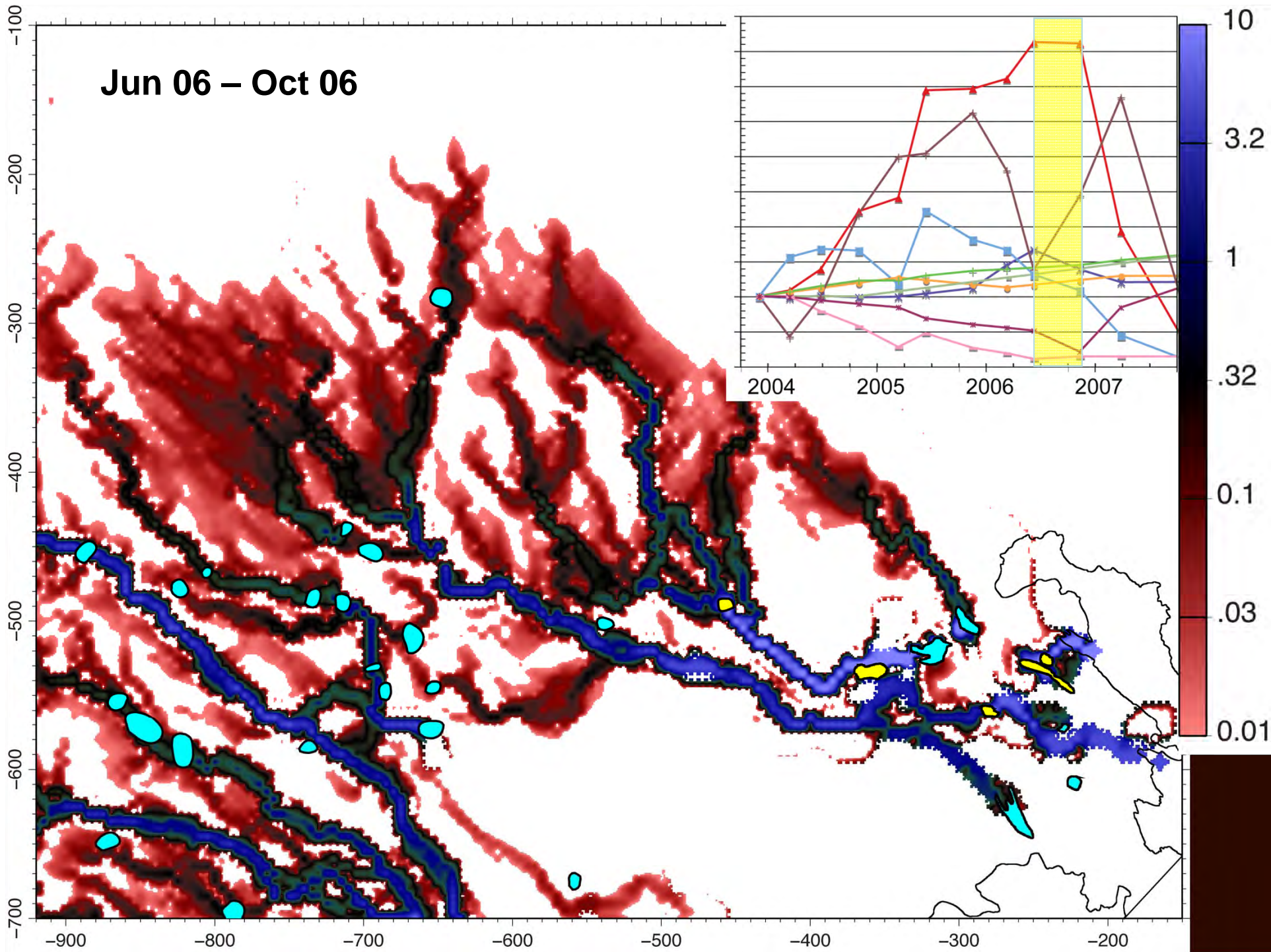


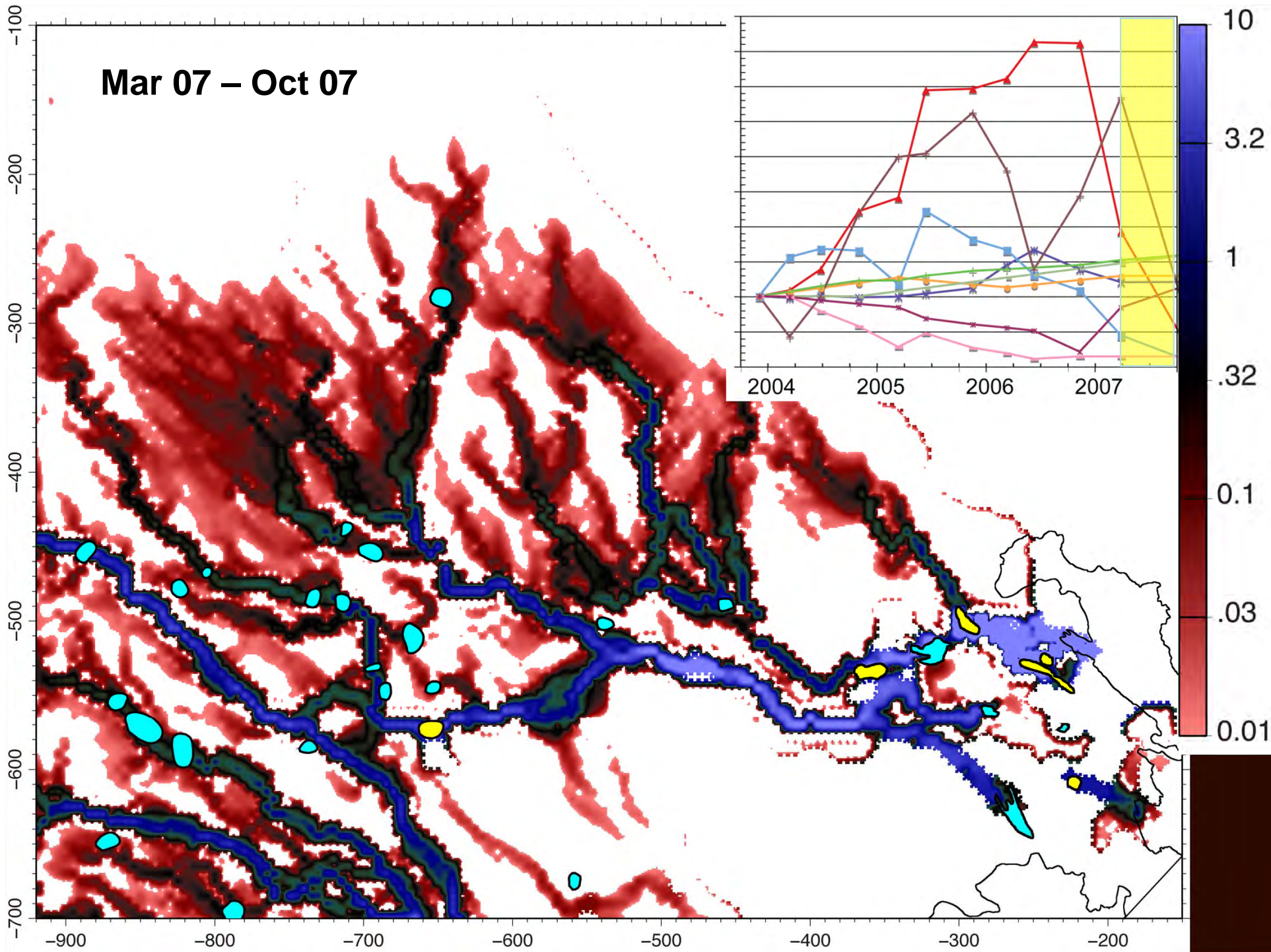






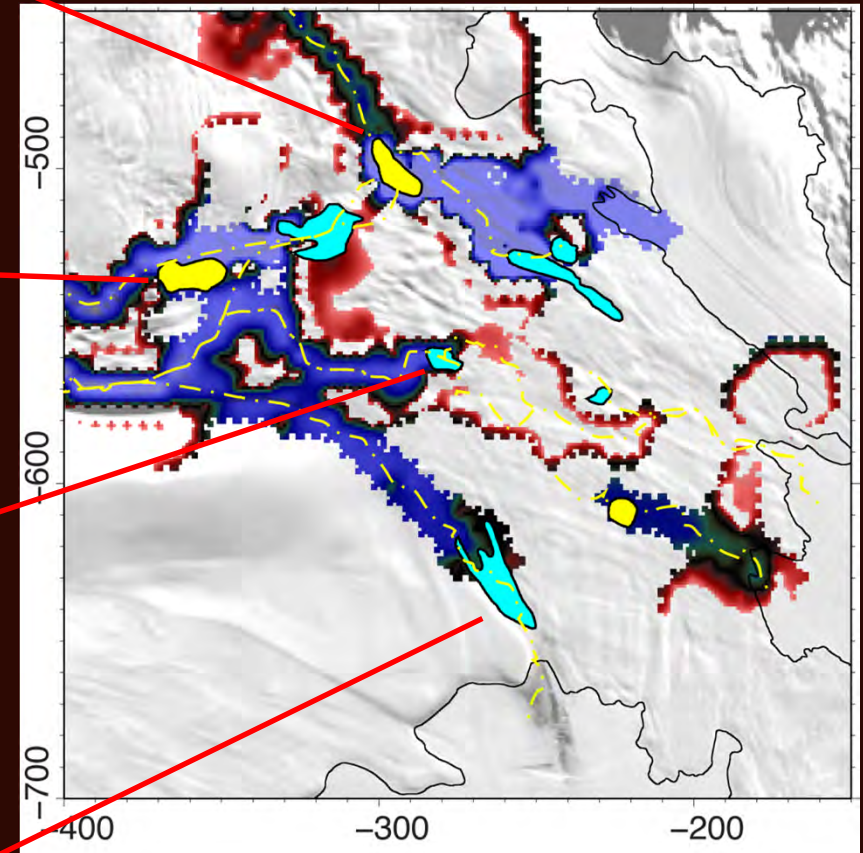
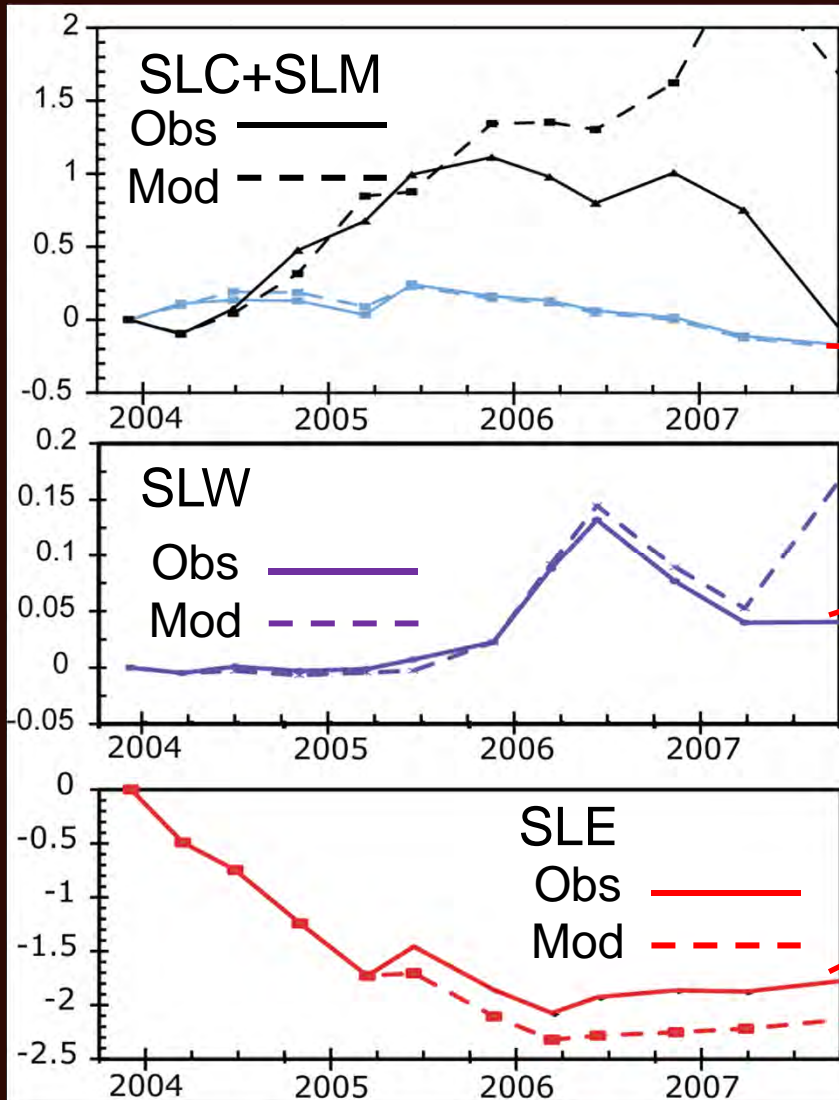
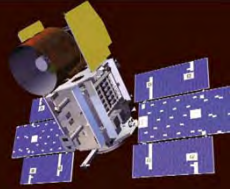








Balanced water budget Validates Kamb Piracy hypothesis

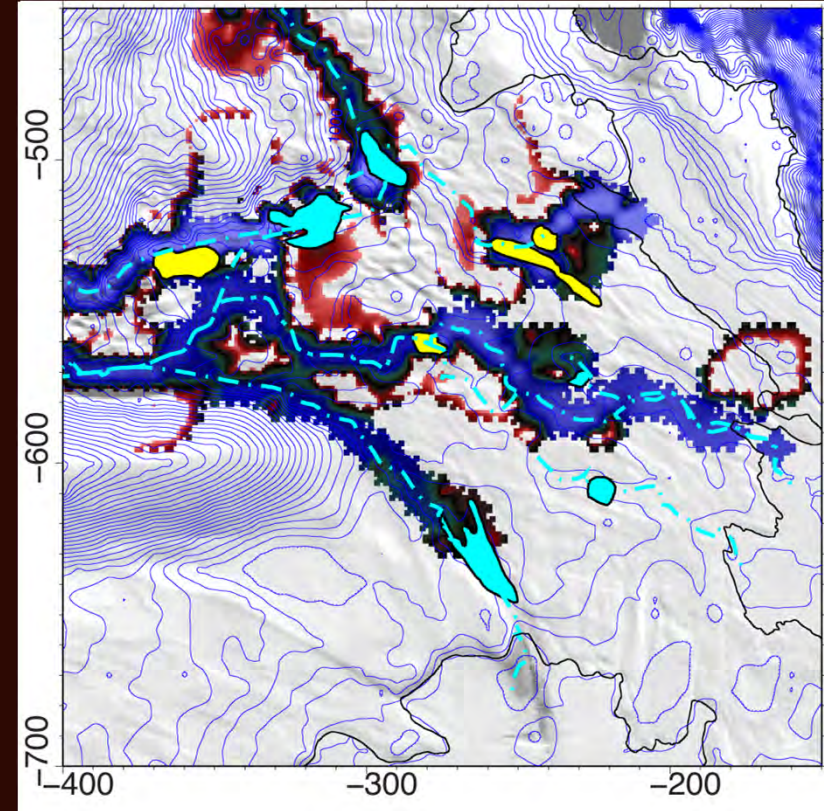
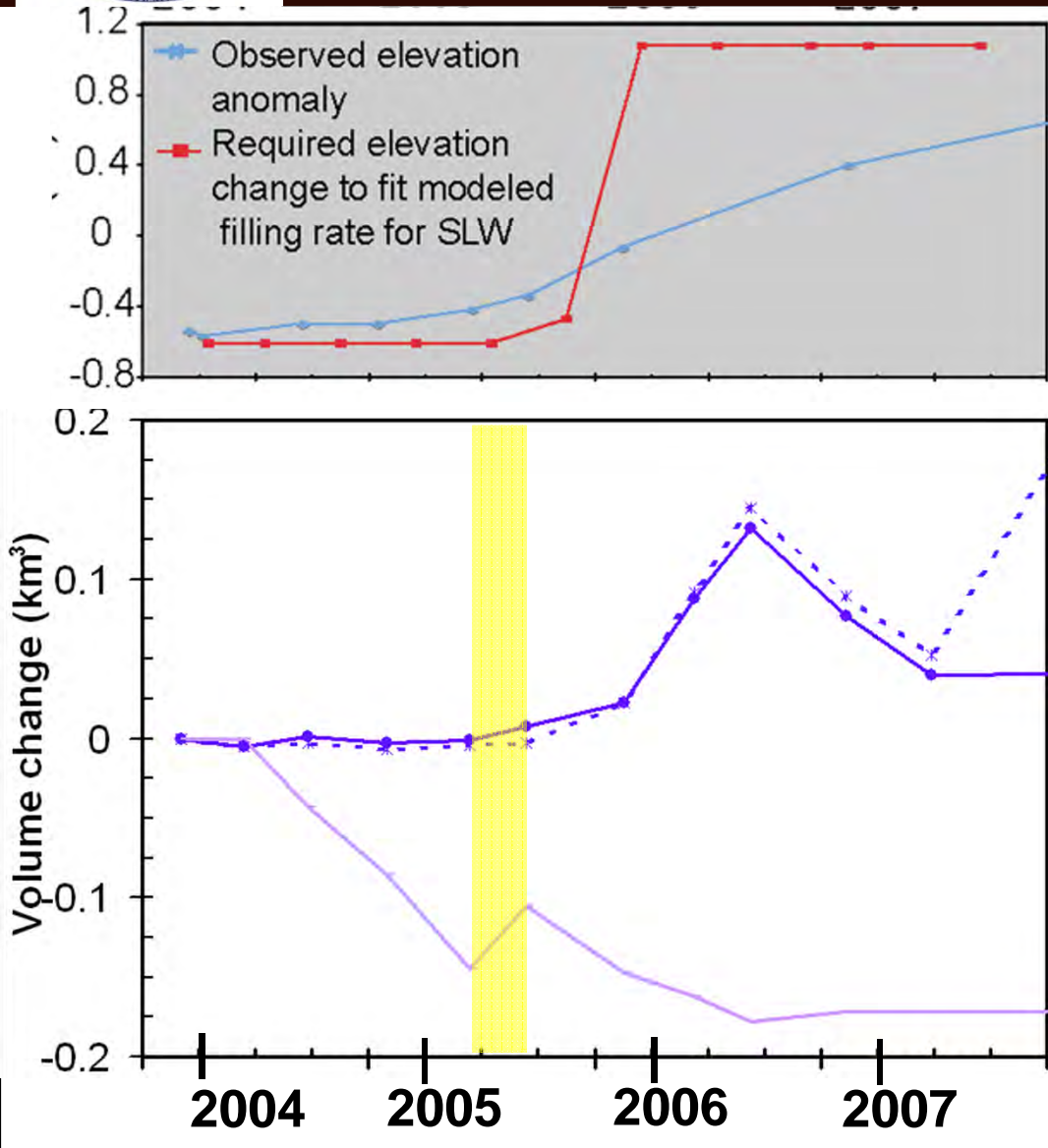
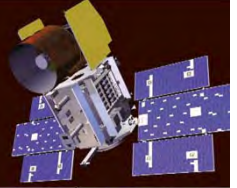


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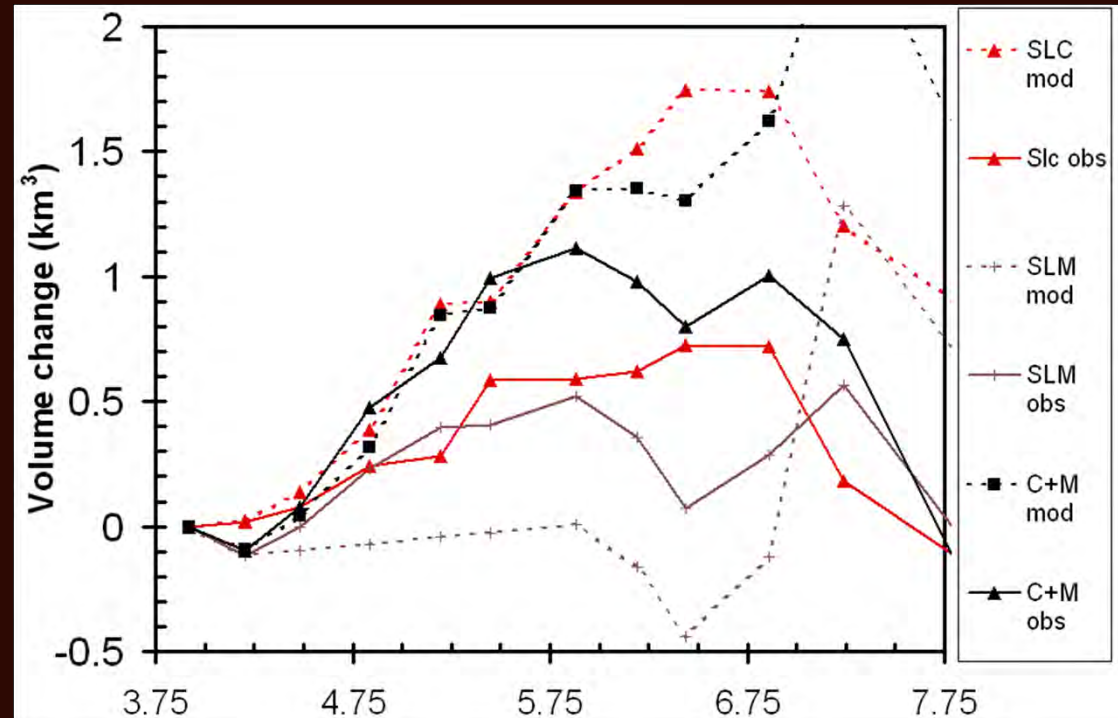
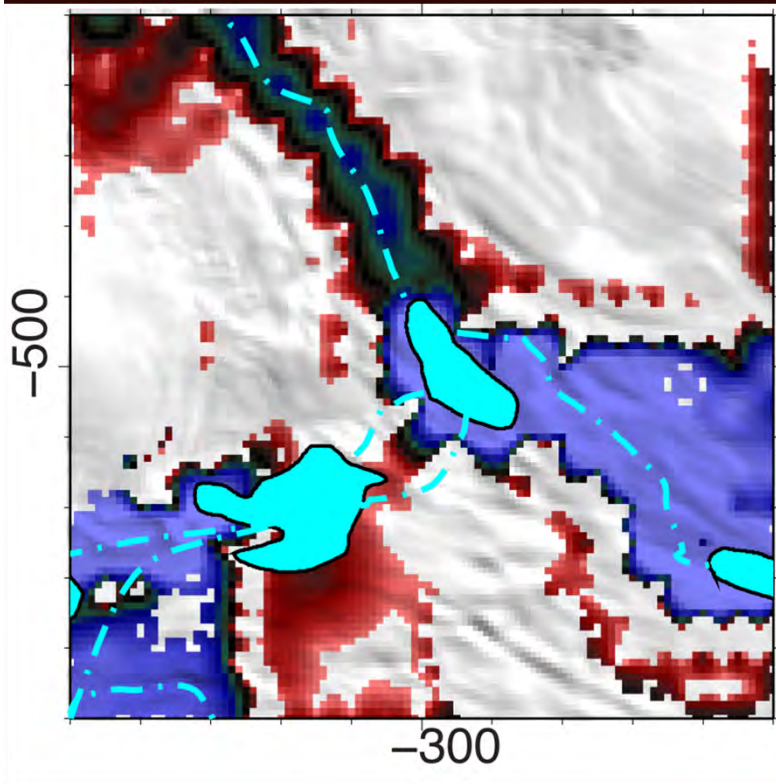
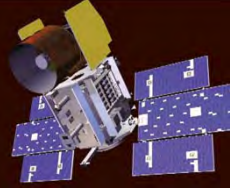


Water Piracy 2005-2006





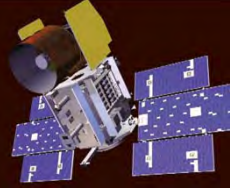
So what's the deal with SLC and SLM?



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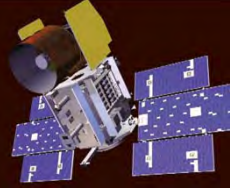
Conclusions



- 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