Seasonal changes of surface velocity and elevation of Columbia Glacier, Alaska using time-series TerraSAR-X/TanDEM-X data

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1 RESEARCH QUESTIONS

★ Do surface velocity and elevation of Columbia vary on seasonal scale?
★ Can time-series of TanDEM-X data be used for this?
★ How mass flux varies with seasonal change in velocity and elevation?
★ Is the behaviour of two branches of split Columbia Glacier similar?

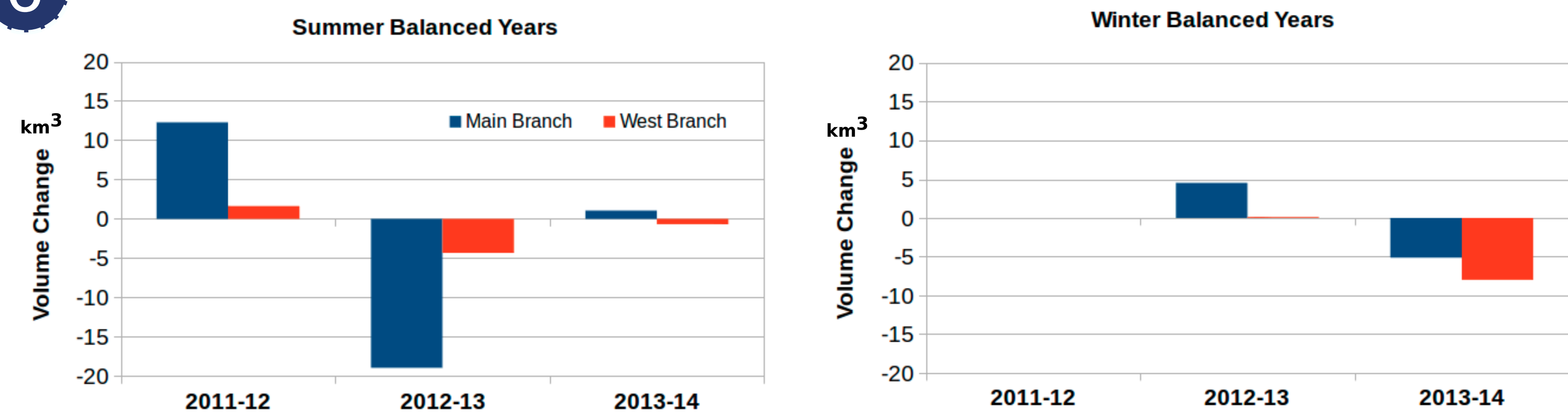## 2 DATASET

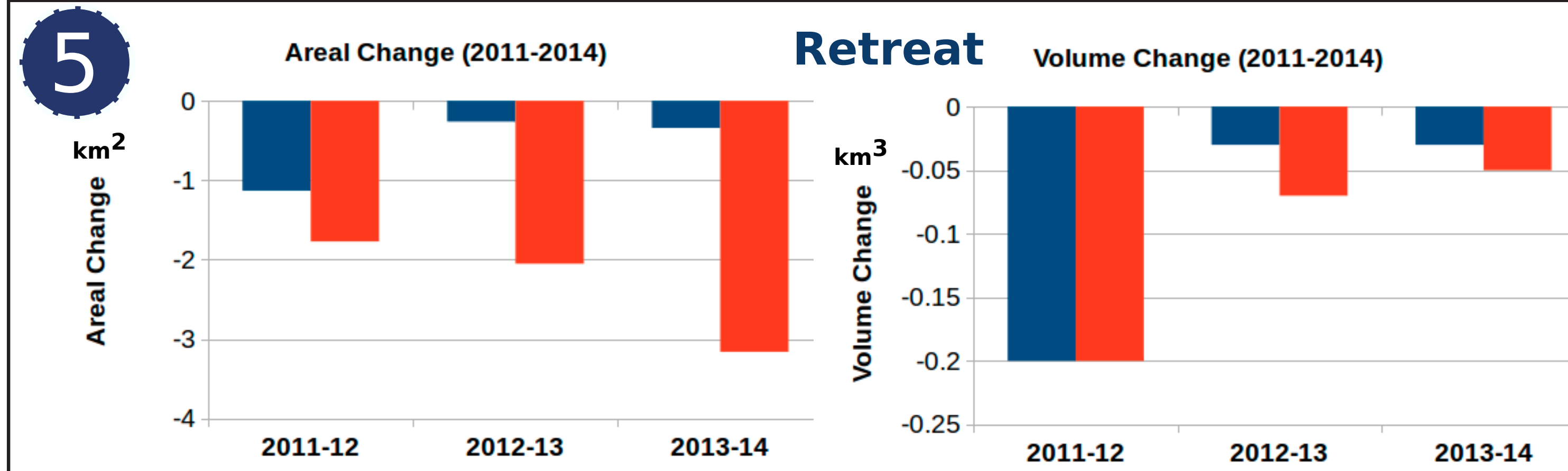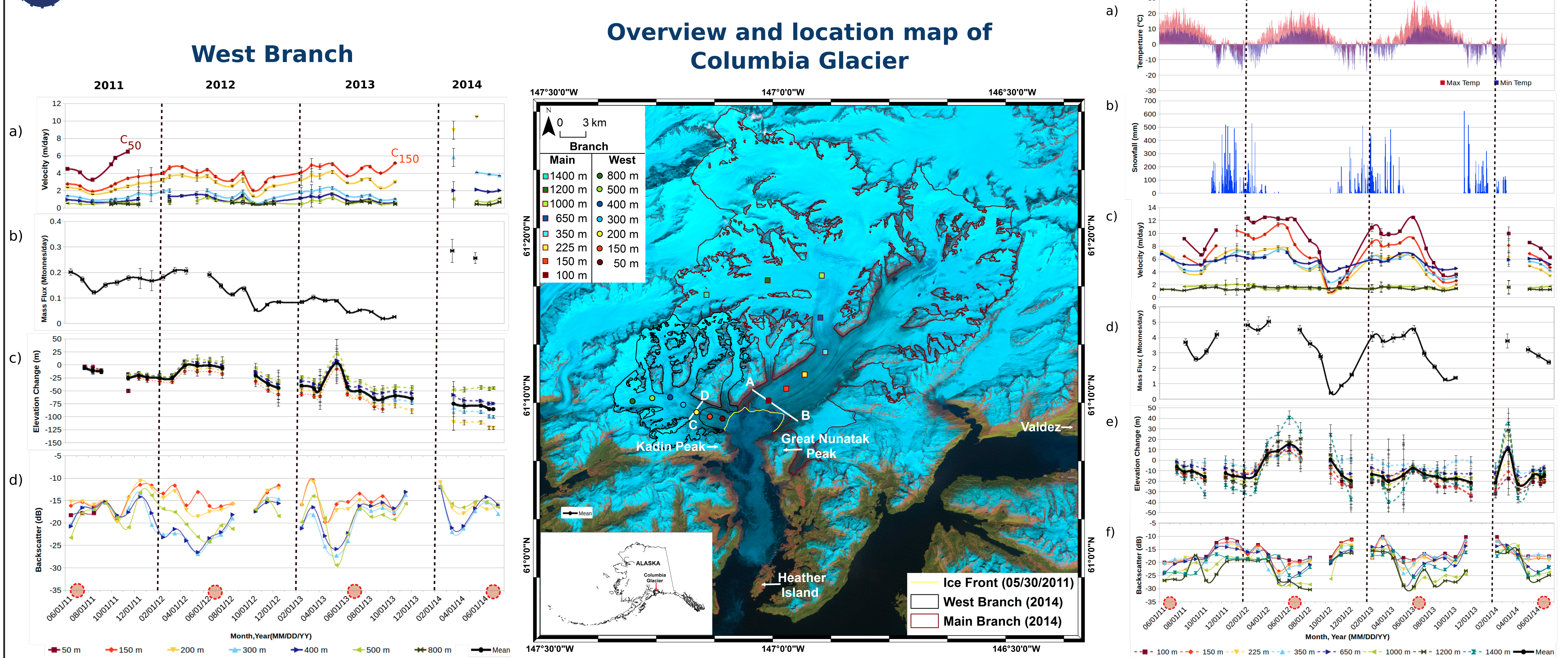| Data	Data Type	Data Provider
★ TSX / TDX	Radar Data	DLR, Germany
★ IceBridge	Altimetry Data	UAF, NSIDC
★ Temp. / Snowfall	Climate Data	Valdez W.S., US
★ Bedrock Topography	Bed Elevation	McNabb et al., 2012
★ DEM 1957	Height Data	USGS, US
★ RGI 3.2	Glacier Outlines	Arendt et al., 2012
★ Landsat	Optical Data	NASA, US

3 METHODS

★ InSAR processing of bistatic TanDEM-X data: DEM generation
★ SAR offset tracking: Surface velocity
★ Integrating velocity and ice thickness: Mass flux
★ DEM differencing: Geodetic volume change
★ Updating glacier outlines: Retreat rate

4 SEASONAL VARIABILITY

West Branch

Overview and location map of Columbia Glacier

Main Branch

5 Retreat

Areal Change (2011-2014)

Volume Change (2011-2014)

6 Surface Thick/Thinning

Summer Balanced Years

Winter Balanced Years

Radar Penetration: Icebridge and TDX

Icebridge - 03/17/2012
TanDEM-X - 03/08/2012

Linear Fit Equation
Y2 = 0.0045*X + 11.24
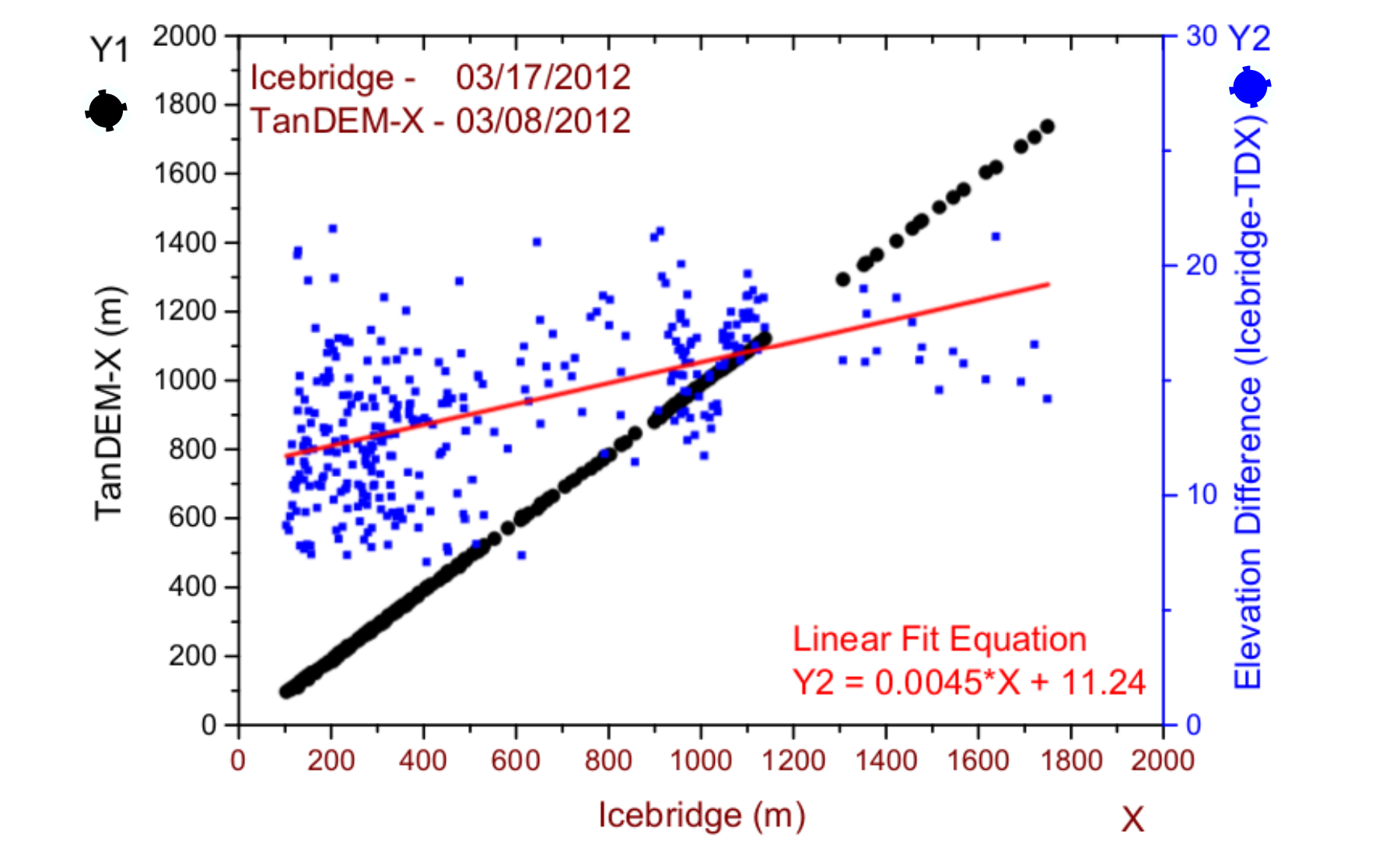
7 OUTCOMES & CONCLUSIONS

★ The seasonal variability of surface velocity is driven by basal hydrology and bed lubrication

★ The seasonal fluctuations of velocity is not present at higher elevations (eg. Main Branch >1000m)

★ The mass flux rate goes synchronizingly with seasonal velocity change

★ The flux from the west branch is ~6% of main branch (2011-14)

★ After the split, west branch lost its area by 4 times faster than main branch

★ Radar signal penetrates with different depths as per changing surface conditions (snow, ice or firn) seasonally

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