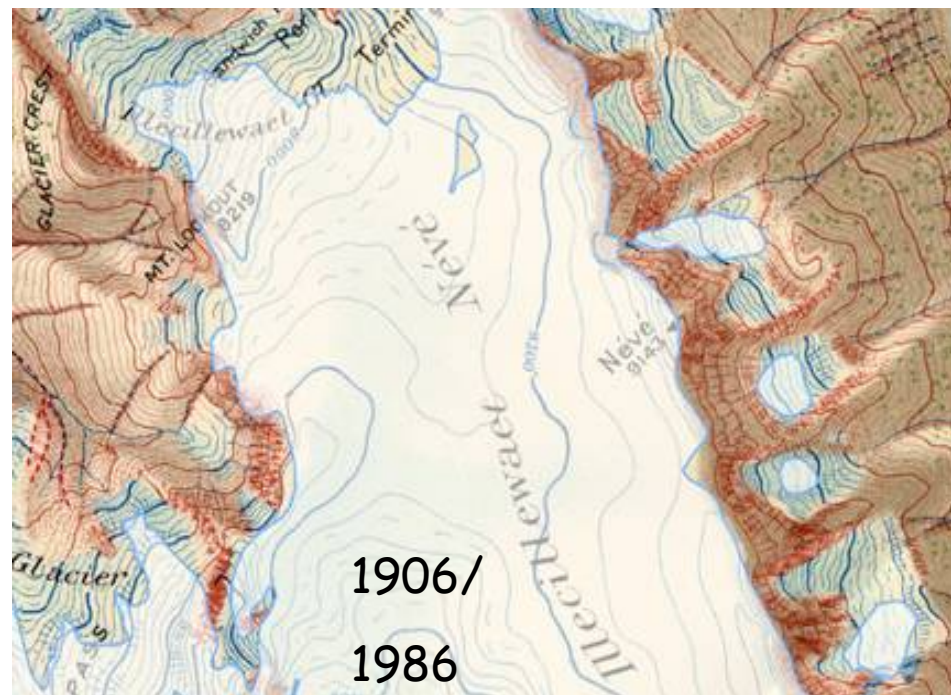



Glacier extents / elevations: past and present

Roger Wheate, UNBC

Brian Menounos, Matt Beedle, Tobias
Bolch

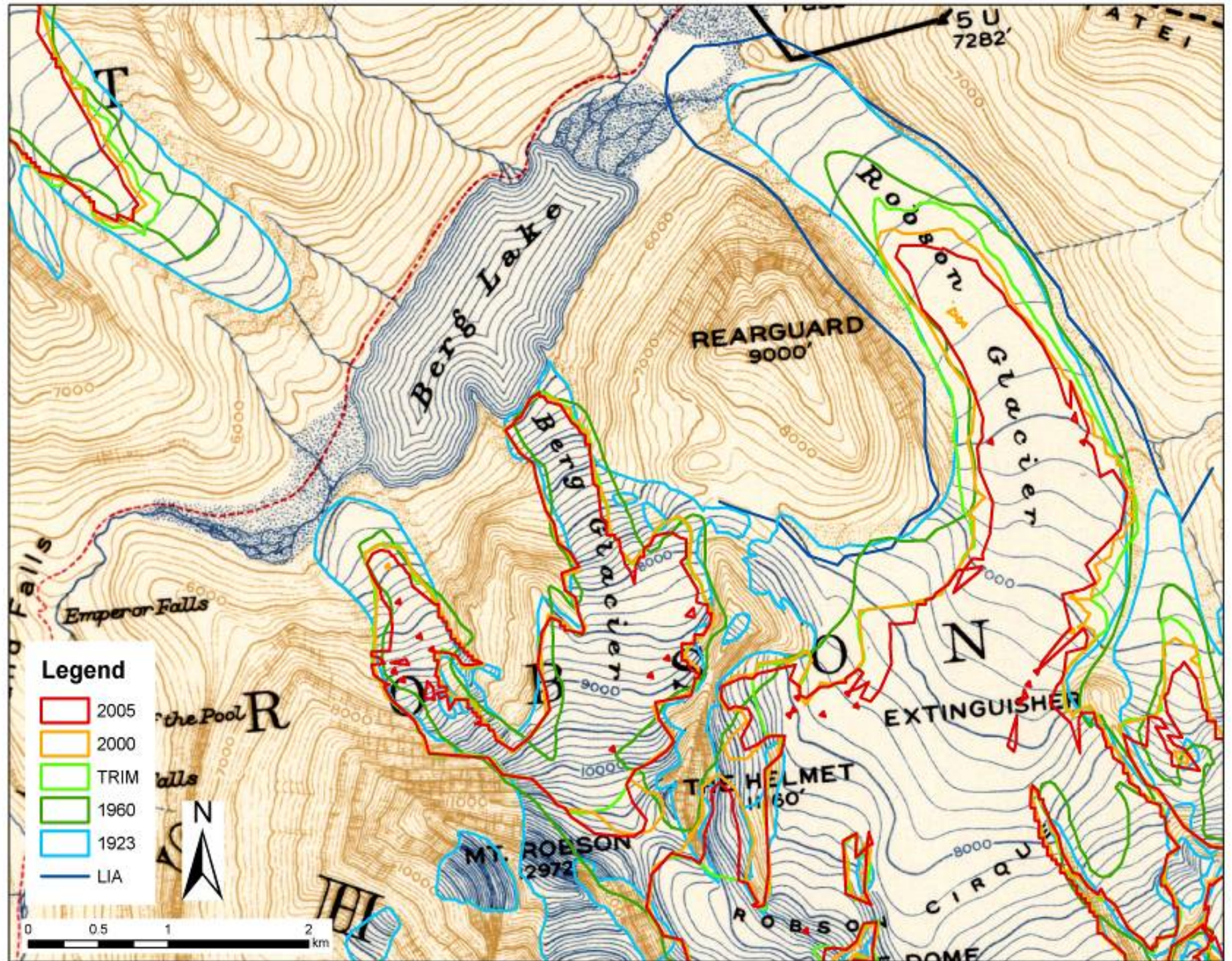


Summary: Data sources for glacier extent mapping and DEMs

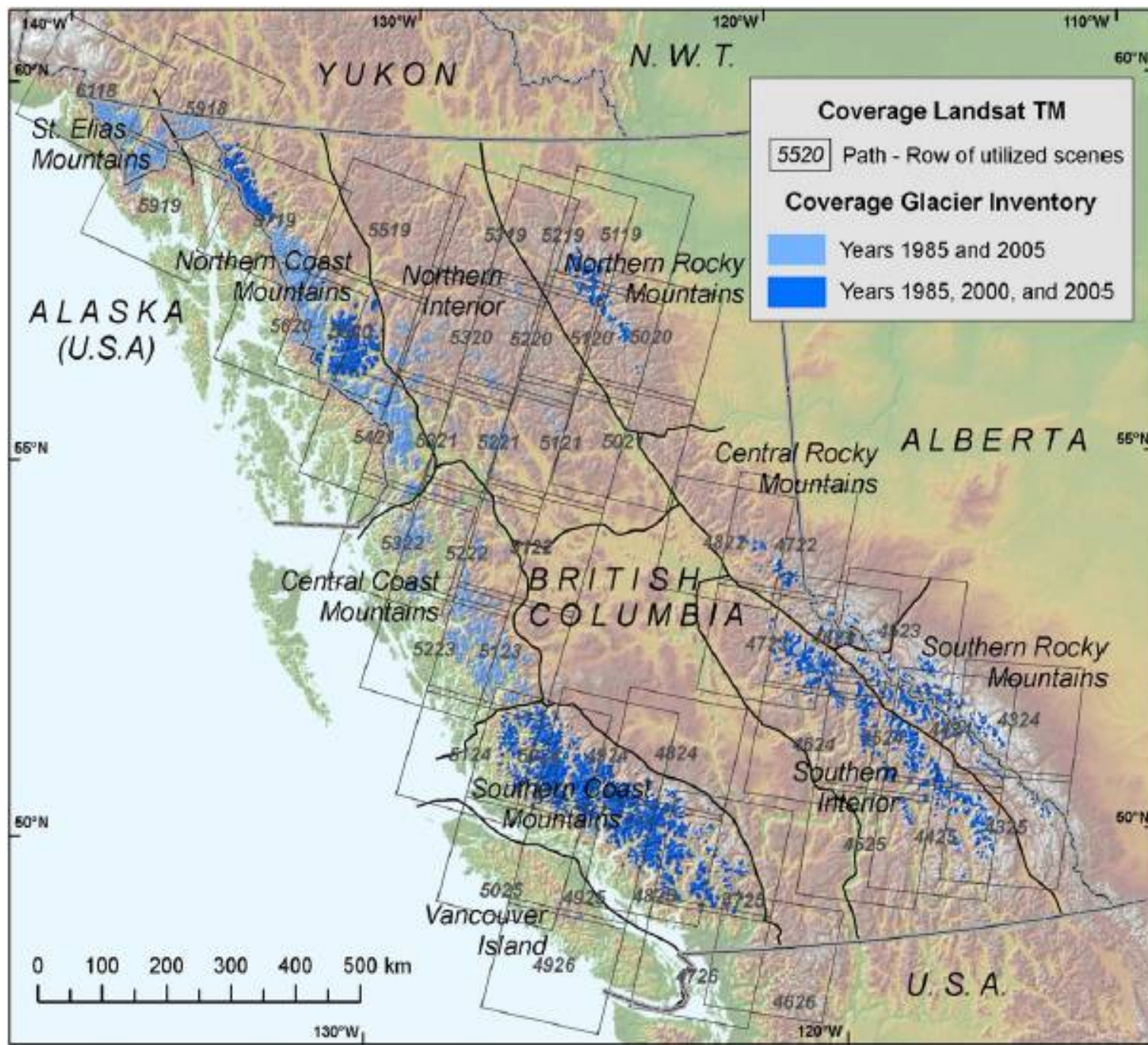


<u>Maps, vector or Image data</u>	<u>Dates</u>	<u>Extents</u>	<u>DEM</u>
Historic alpine maps	1890-1940	x	x
Glacier maps- Int. Hydro Decade	1965-75		x
National Topographic maps/data	1945-85		x
BC provincial TRIM data	1981-89		x
(Stereo) oblique photography	1890-1940	x	
Stereo aerial photography	1945->		x
Landsat MSS	1972-84		x
Landsat TM	1982->	x	
Landsat ETM+	1999-2003	x	
SPOT HRV	1986->	x	
SPOT high-res PAN	2002->	x	x
SRTM (Shuttle Radar)	2000		x
ASTER	2000-> 2008	x	x
LiDAR	2006, 2007		x

Successive glacier extents for Mt. Robson glaciers 1900-2005



Landsat-based inventory of glaciers in western Canada, 1985-2005



Glacier Retreat Rates ($\% \text{ a}^{-1}$) (~ 1985 – 2005)

-0.44 \pm 0.15

-0.35 \pm 0.13

-1.20 \pm 0.16

-0.79 \pm 0.15

Alberta: -1.27 \pm 0.17

BC: -0.54 \pm 0.15

-0.88 \pm 0.16

-1.21 \pm 0.23

-0.67 \pm 0.15

-0.61 \pm 0.18

-0.72 \pm 0.14

-1.11 \pm 0.24

Whole Inventory: -0.55 \pm 0.16



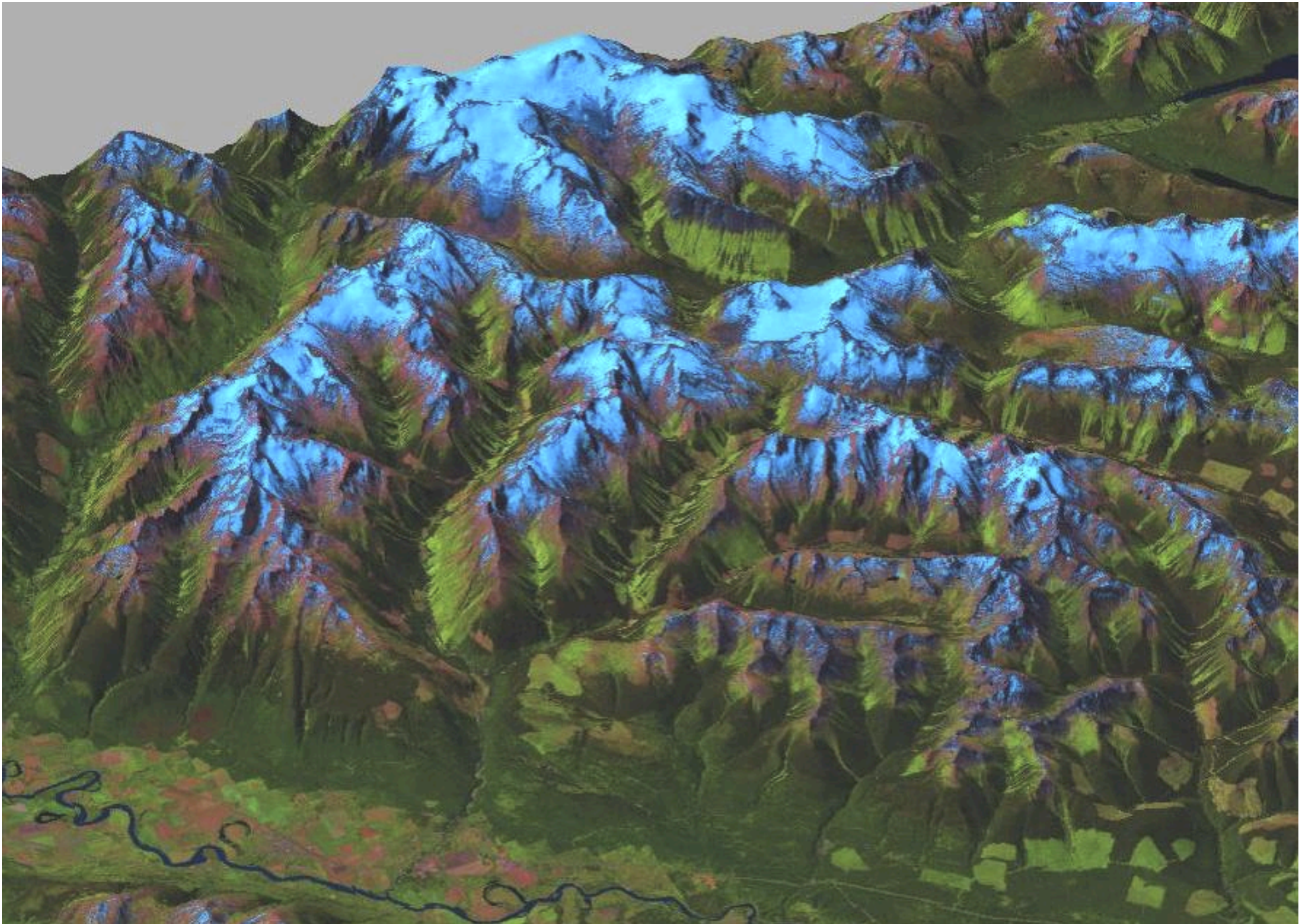
National Parks: glacier change 1985-2005

	#1985	area	#00	area	# 05	area	85-05%	av area
Jasper NP	554	915.09	472	895.39	419	795.57	-13.06	1.46
Banff NP	365	625.56	375	563.05	336	504.13	-19.41	1.70
Glacier NP	129	161.94	132	139.32	137	137.60	-15.03	1.26
Yoho NP	66	136.33	69	110.44	66	99.91	-26.72	1.43
Kootenay NP	33	21.26	39	20.53	37	15.65	-26.38	0.70
RevelstokeNP	8	10.41	12	8.77	11	7.70	-26.01	1.30

Alberta Rocky Mountain p-areas: glacier change 1985-2005

Park area	# 1985	area	# 2000	area	#2005	area	%85-05	av.area
Willmore	41	109.92	43	102.70	27	88.86	-19.16	2.74
Kananaskis	25	17.38	21	13.72	21	11.20	-35.57	0.65
White Goat	28	13.72	24	14.65	20	9.64	-29.75	0.49
Siffleur	24	12.47	27	15.26	23	12.02	-3.60	0.52
Spray Valley	1	0.36	1	0.30	1	0.22	-39.61	0.36

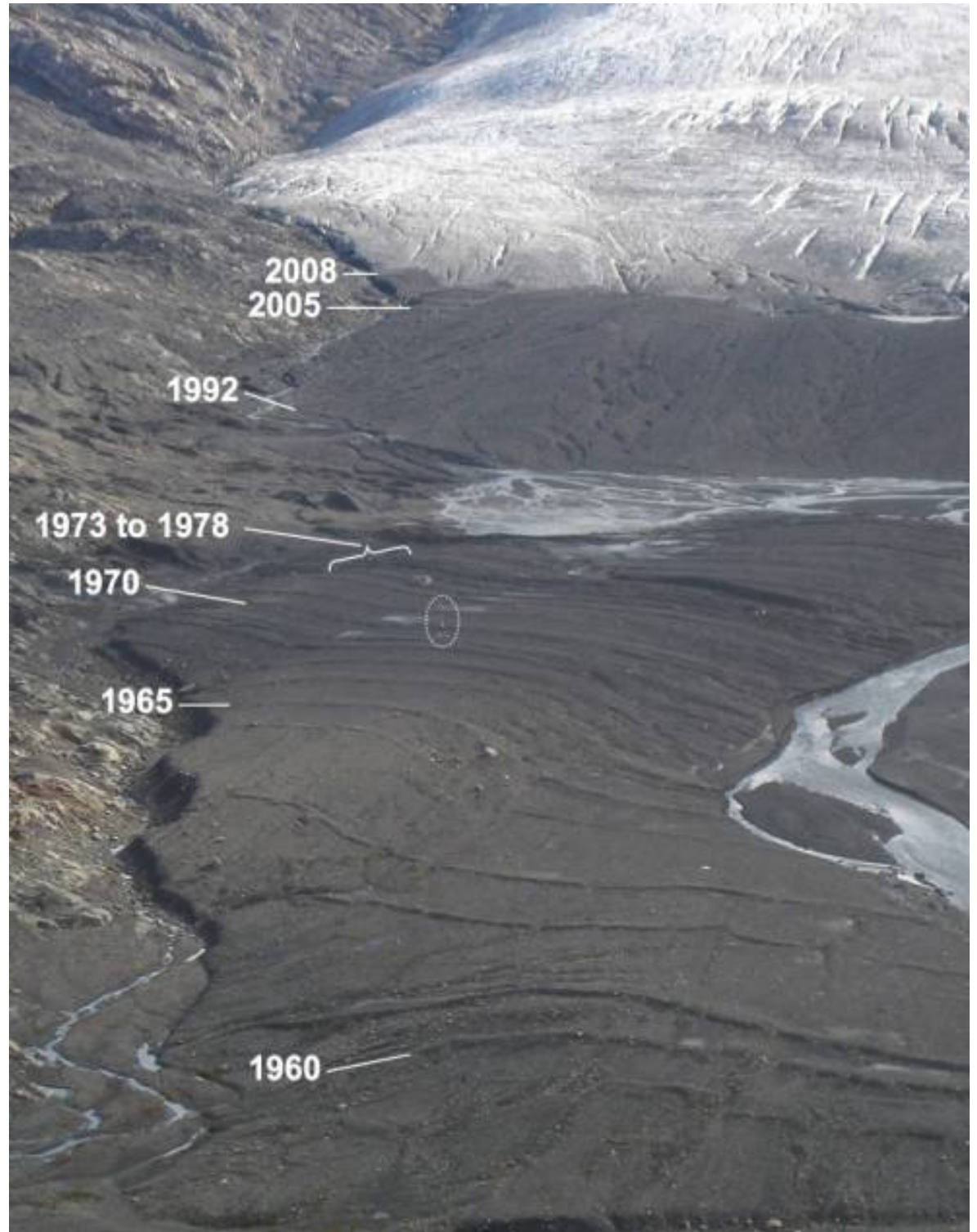
Rocky Mountain trench - Castle Creek Glacier



Castle Creek Glacier, Cariboo Mountains



Push moraines as climate proxy:
Castle Creek Glacier receded 701 m 1959- 2007, averaging 14.3 m/yr with a minimum of 3 to 4 m / yr in the mid- to late-1970s.
Recession rates accelerated to over 40 m/yr in the early 1990s



Early 20th century push moraines at Castle Creek / Caribou Lake

Photo by Brian Luckman, 2009

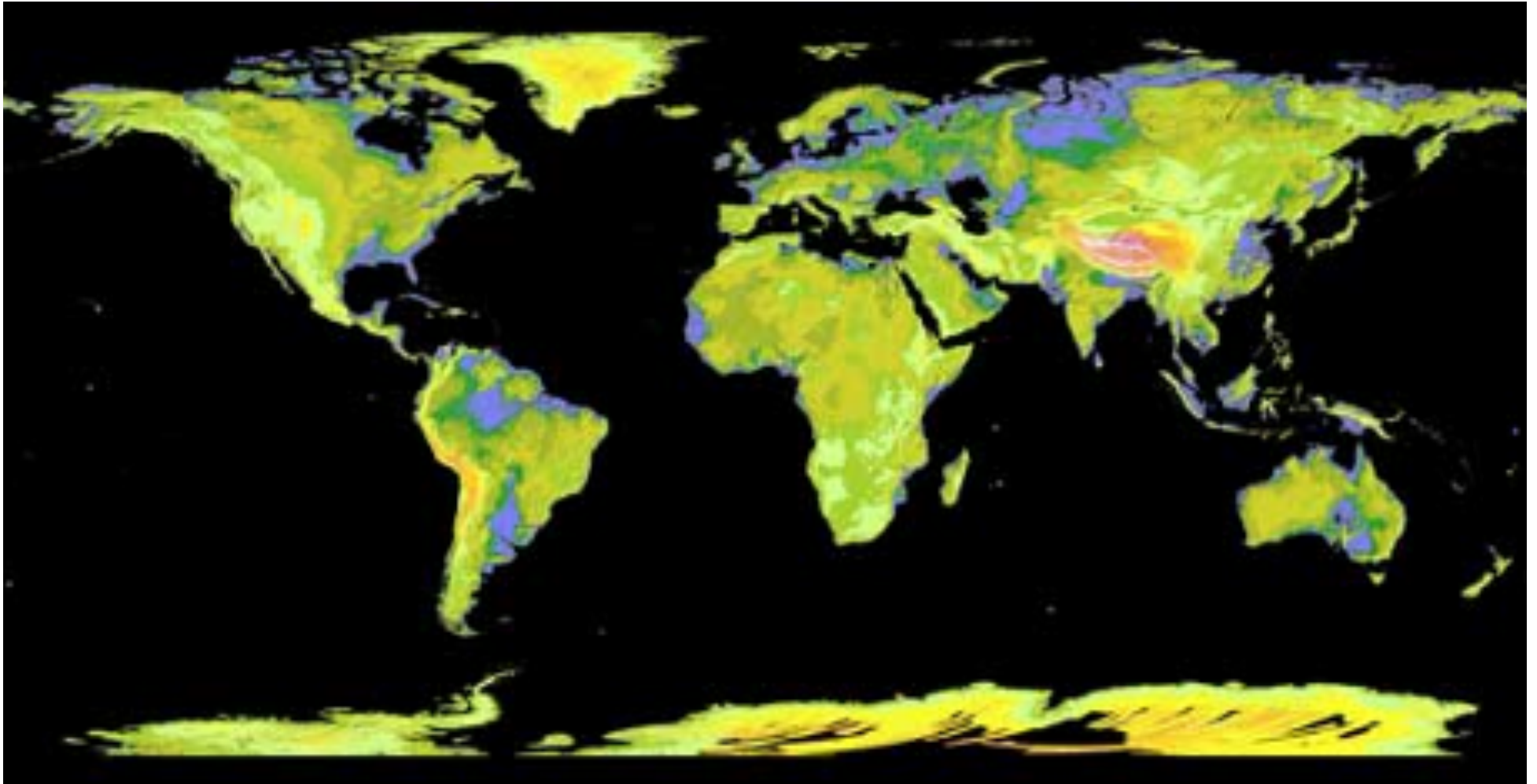


SRTM (Shuttle Radar Topographic Mission): 90 metre pixels, 60°S-60°N





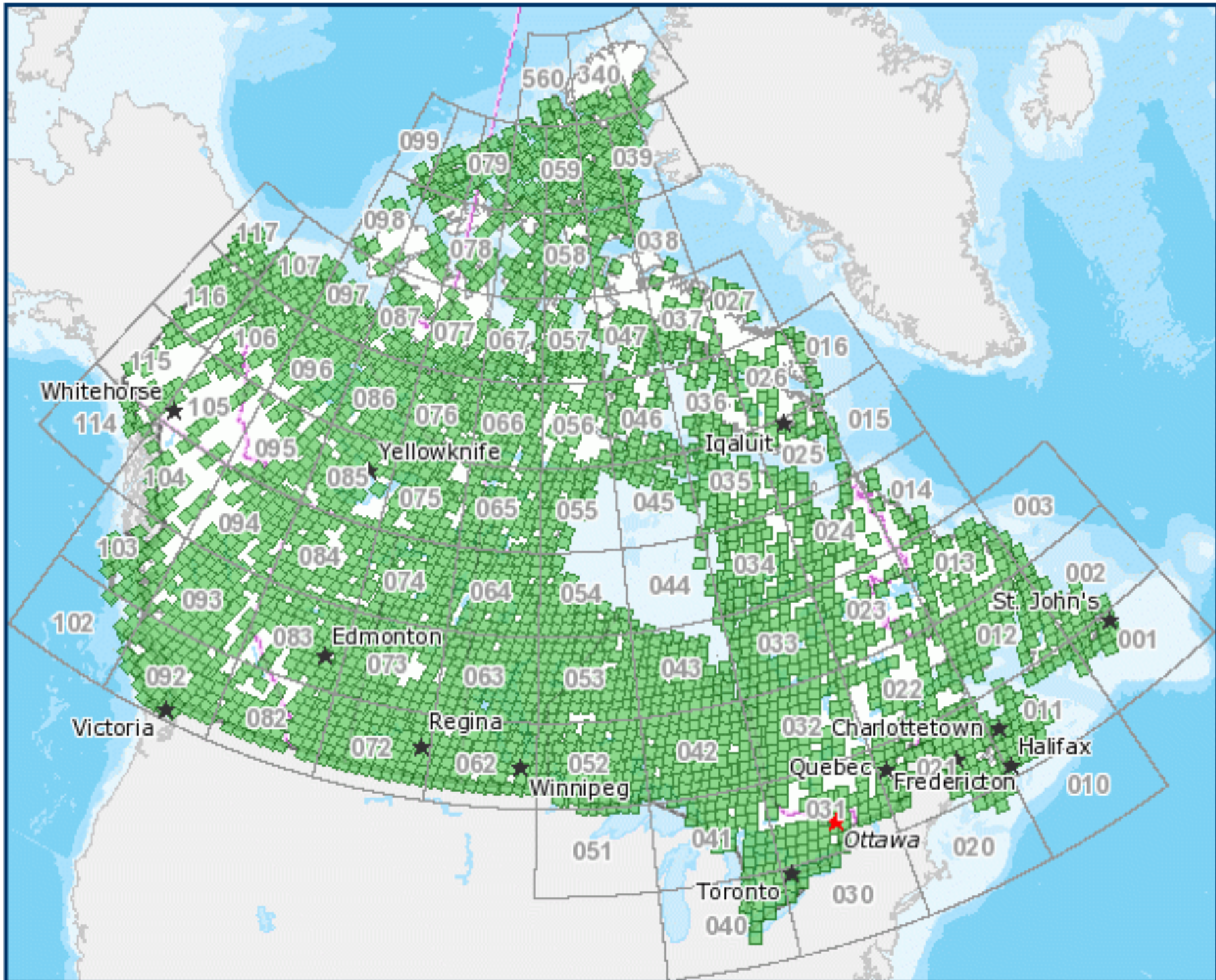
ASTER DEM
global DEM 30m
June 2009



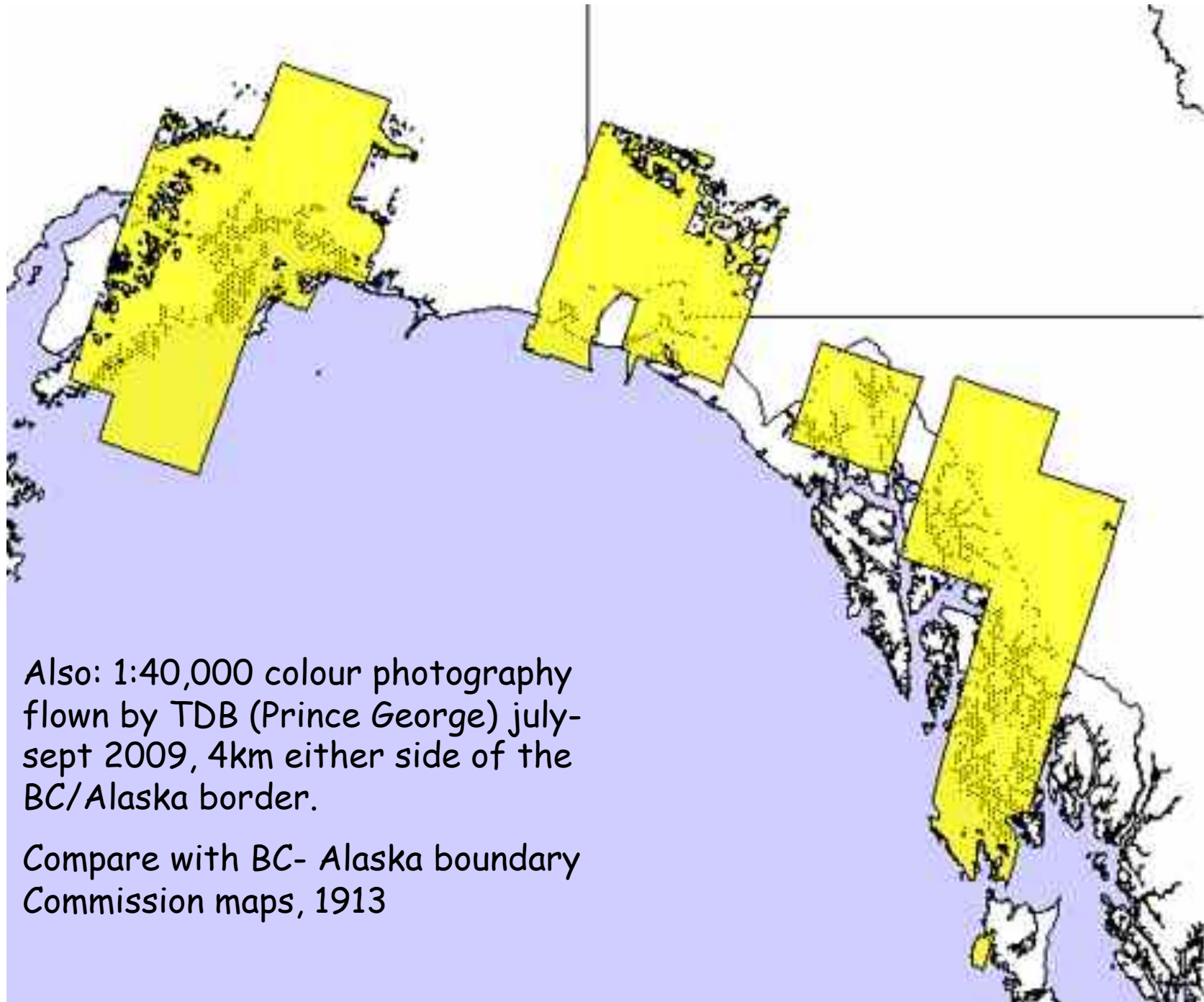
ASTER - SRTM comparison

	ASTER GDEM	SRTM3*	GTOPO30**
Data source	ASTER	Space shuttle radar	From organizations around the world that have DEM data
Generation and distribution	METI/NASA	NASA/USGS	USGS
Release year	2009 ~	2003 ~	1996 ~
Data acquisition period	2000 ~ ongoing	11 days (in 2000)	
Posting interval	30m	90m	1000m
DEM accuracy (stdev.)	7~14m	10m	30m
DEM coverage	83 degrees north ~ 83 degrees south	60 degrees north ~ 56 degrees south	Global
Area of missing data	Areas with no ASTER data due to constant cloud cover (supplied by other DEM)	Topographically steep area (due to radar characteristics)	None

GeoBase SPOT Orthoimages 2005-2010



SPOT DEMs - IPY SPIRIT program 2007-08



Also: 1:40,000 colour photography flown by TDB (Prince George) July-Sept 2009, 4km either side of the BC/Alaska border.

Compare with BC- Alaska boundary Commission maps, 1913