CBN Version 3.0

Processing, Adjustment & Integration Status Report

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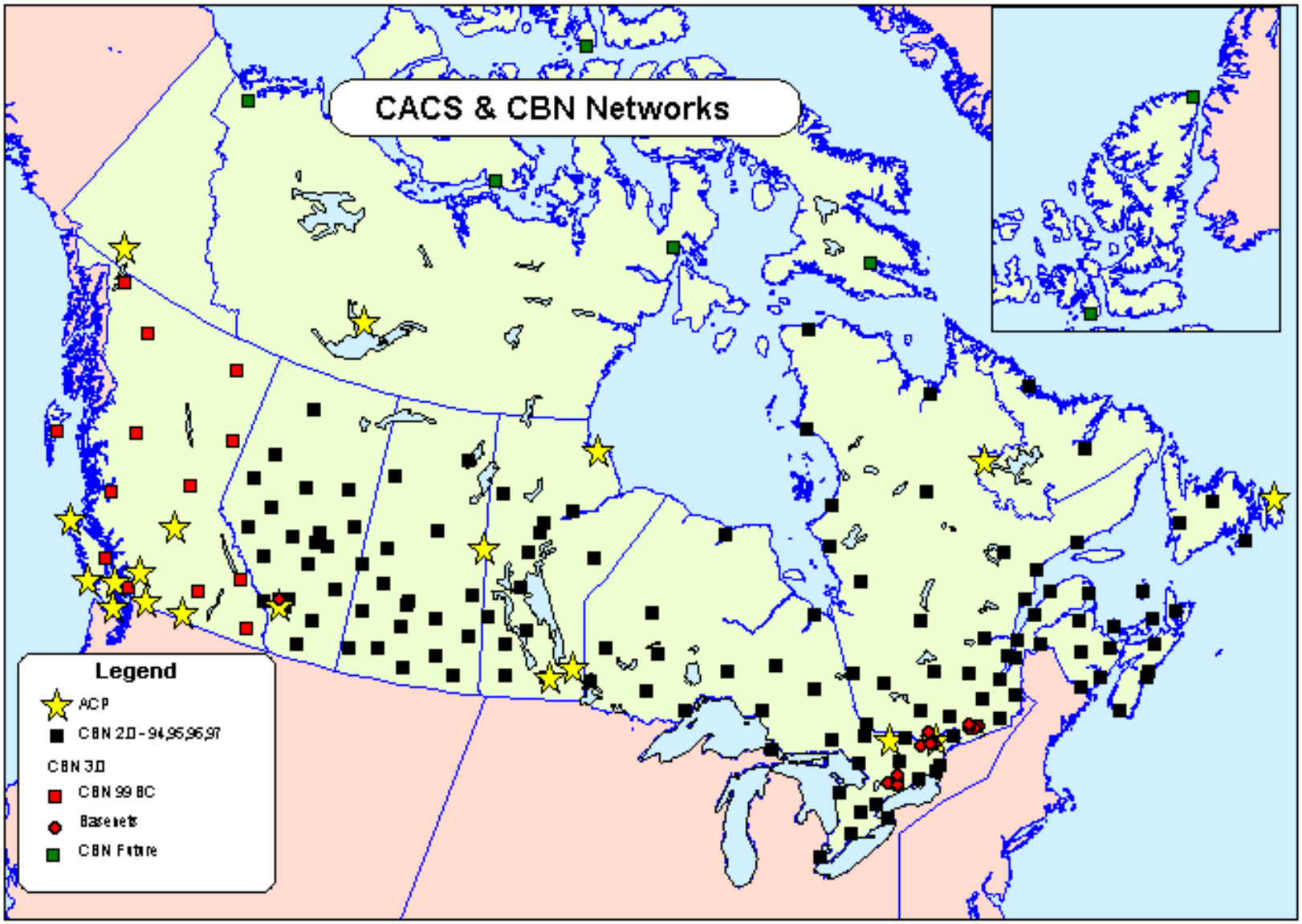
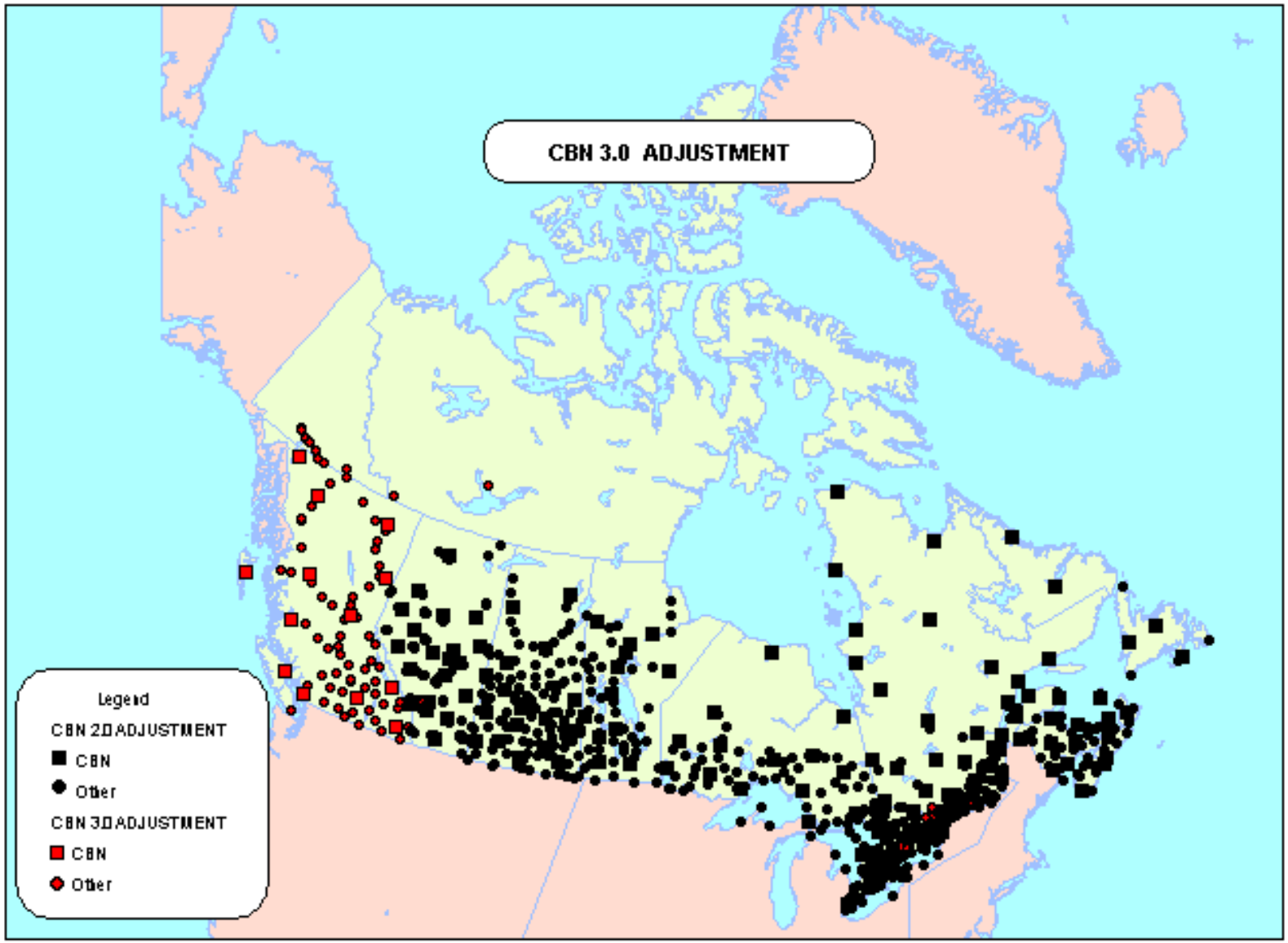

CACS & CBN Networks
Legend
ACP
CBN 2D - 94,95,96,97
CBN 3D
CBN 99 BC
Baselevels
CBN Future

Data Used in CBN 2.0

- CBN Survey Campaigns
  - 1994 (S. Quebec, Maritimes)
  - 1995 (Alberta, Saskatchewan)
  - 1996 (E. Saskatchewan, Manitoba, N.W. Ontario)
  - 1997 (Ontario, N. Quebec, Newfoundland/Labrador)
  - 1999 (British Columbia)
- CBN Reobservations
  - 1996 (N. Alberta) — To fix a couple of CBN stations
  - 1996 (S. Quebec, Maritimes) — Absolute-G stations

New Data in CBN 3.0

- CBN in British Columbia (1999)
- GPS Validation Networks
  - Montreal (1996)
  - Ottawa (1996)
  - Peterborough (1998)
  - Calgary (1996)
- Other
  - N. British Columbia GPS on BM (1996)


CBN 3.0 ADJUSTMENT
Legend
CBN 2.0 ADJUSTMENT
CBN
Other
CBN 3.0 ADJUSTMENT
CBN
Other

Network “Layers”

- “Layers” identified by network hierarchy and observation session length
  - Federal CBN (>three 24 hr sessions)
  - IGLD BMs (two 24 hr sessions)
  - GPS on BM (one 12 or 24 hr session)
  - NAD83 horizontal control (one 12 or 24 hr session)
  - Provincial (varied, usually multiple 3-8 hr sessions)
  - US HARN (multiple 6 hr sessions)
  - US CORS (> three 24 hr sessions)

GPS Processing

- Software & Procedures
  - Bernese GPS Software v4.0
  - GSD GPS Processing Guidelines (1997)
  - Simultaneous observations processed simultaneously
  - NRCan precise orbits
  - IGS antenna phase centre offsets
  - Tropospheric zenith delay parameters every 2 hrs
  - L3 (ionospheric corrected) for final solutions
  - Ambiguities fixed using QIF method on lines <500 km

Reference Frames

- GPS Processing
  - ITRF of date of observations
    - ITRF92 – CBN94
    - ITRF93 – CBN95, MarReobs96, Basenets96
    - ITRF94 – CBN96/96, AlbReobs96, NorBC96
    - ITRF96 – CBN99, PetBasenet98
- Adjustment & Integration
  - Transformed GPS sessions to NAD83(CSRS98) using adopted transformation (TRNOBS software)

Adjustment & Integration

- Software: GHOST on HP/UX
- Observations: 2131 baselines
- Parameters: 2672 541 Deg. of freedom
  - 3 rotations + scale per campaign: Total 44
  - Stations 876
    - 21 CACS/WCDA/IGS stations
    - 146 CBN stations
    - 22 GPS validation network stations
    - 225 GPS on BM stations
    - 41 IGLD BM stations
    - 12 CCG DGPS stations
    - 127 Horizontal control stations
    - 260 Provincial stations
    - 19 US CORS/HARN/FBN stations
    - 25 Miscellaneous stations

Minimum Constraint Adjustments

1. Each campaign adjusted separately
   - Checked for outliers (none found)
   - Scaled cov. matrices by estimated variance factors (170 to 297 for CBNs, 88 to 420 for others)
2. All CBN campaigns combined together
   - Checked for outliers again (none)
   - Scaled cov. matrices again by estimated VF (1.197)

NAD83(CSRS) Integration

- Integrated into CACS network
  - Constrained to ITRF97 solution from IERS
    - improved solution for CACS stations
    - coordinates transformed to NAD83(CSRS98)
  - CACS weighted using full cov. matrix from ITRF97
- Procedure
  1. CBN 94-99 integrated first – Scaled cov. Matrices* (VF=1.035)
  2. Reobs/basenets integrated/scaled* (VFs = 1.12 to 2.44)
  3. Final simultaneous adjustment & scaling of cov. Matrices* (VF = 0.999)

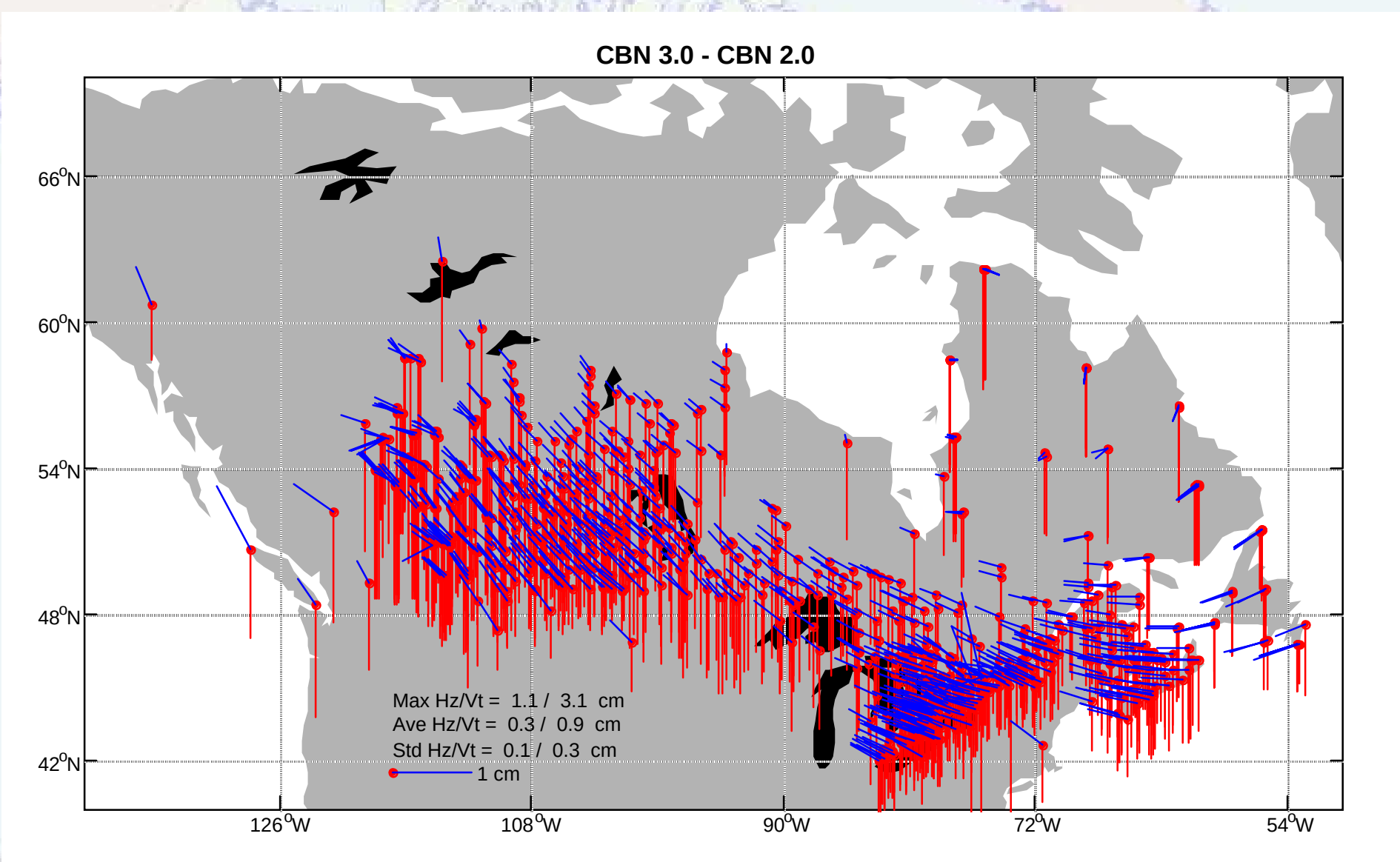
* Constraints not scaled

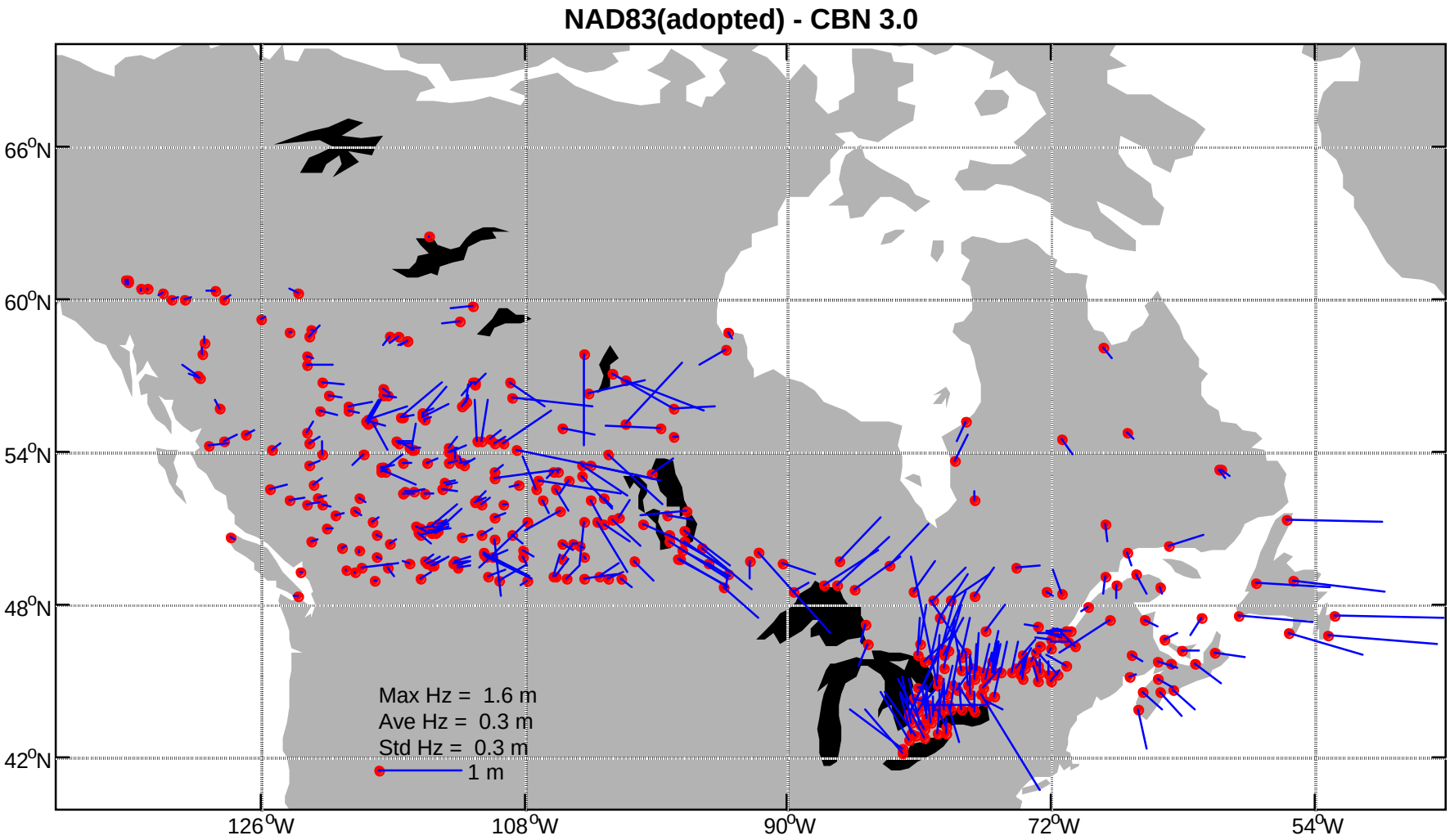
CBN 3.0–2.0 Discrepancies (cm)

	Mean	Std	Max
Horizontal	0.3	0.1	1.1
Vertical	–0.9	0.3	–3.1

Adopted–CBN 3.0 Horz. Discrepancies (m)

	Mean	Std	Max	Pts
All	**0.31**	**0.27**	**1.65**	**390**
Y/NT	0.05	0.04	0.11	11
BC	0.12	0.08	0.44	53
AB	0.21	0.15	0.79	98
SK	0.40	0.34	1.65	48
MB	0.57	0.26	1.01	22
ON	0.46	0.26	1.56	83
QC	0.21	0.11	0.57	49
Mar	0.29	0.17	0.72	15
NF	0.86	0.46	1.32	8


CBN 3.0 - CBN 2.0
66°N
60°N
54°N
48°N
42°N
126°W
108°W
90°W
72°W
54°W
Max Hz/Vt = 1.1 / 3.1 cm
Ave Hz/Vt = 0.3 / 0.9 cm
Std Hz/Vt = 0.1 / 0.3 cm
1 cm


NAD83(adopted) - CBN 3.0
66°N
60°N
54°N
48°N
42°N
126°W
108°W
90°W
72°W
54°W
Max Hz = 1.6 m
Ave Hz = 0.3 m
Std Hz = 0.3 m
1 m