Methodology and Data Sources for Agriculture and Irrigation's Interpolated Data (1901-Current)

Disclaimer:

This data is provided as-is with no warranties neither expressed nor implied. As a user of the data, you assume full responsibility for any and all uses that are connected to and/or based on this data set.

The data for each township center was estimated using an inverse distance weighted interpolation procedure employing a pre-defined search radius (see below). If no stations within the search radius were found, the nearest neighboring station was used regardless of distance from the township center. As a result for many locations, the user is strongly discouraged from using this prior to 1961, due to low Station density in many areas of the province (Figure 1). ACIS currently uses a data flagging scheme that provides data only if there was a single station operating on a given day within 30 km of the township center, or if there are two or more stations within a 60 km radius. This is intended to prevent unreliable estimates for weather variables that were derived from station(s) that were simply too far away to provide a reasonable estimate. When selecting elements of interest for the *daily* option, there is an additional checkbox titled "***Include Interpolation Flags (Table/CSV)***". Checking this will provide the interpolation flags that are available for each estimated observation, describing the station neighborhood used on that day.

An example of a single data flag is as follows:

N=8, C = 14.81, F=83.49

Where:

N = number of stations (8)
C = closest station distance (14.81 km)
F = farthest station distance (83.49 km)

Note: the interpolation process tends to degrade in those areas, and/or during times where sharp spatial gradients exist for the element in question. Typically, errors are greatest in and around the mountains and foothills, or through other areas where there are large elevation changes. In addition, many areas in the province have poor station coverage, particularly during the winter. In these areas the interpolation is also degraded. Users are encouraged to take the time analyze the data flags and cross reference the interpolation estimates with nearby stations for each target area they are using the data for, in order to "get a feel" for its suitability for the intended application.

Input Data Sources

Raw data was provided by Alberta Agriculture and Irrigation, Environment and Protected Areas (EPA), Forestry and Parks (FP) and the Meteorological Service of Canada (MSC). Preliminary, but not exhaustive data quality control procedures have been applied to the data from EPS, FP and MSC, prior to 2005. From April 2005 all ACIS data is used along with a relatively small number of stations provided by EPA, FP and MSC. Since early 2005 ACIS data has undergone extensive quality control and fewer errors are likely. Note that for the entire period of record (1901-current) any raw input observations deemed as suspect were removed from the analysis.

Precipitation

- Utilized the Hybrid Inverse Distance cubed weighing (IDW) process using a daily search radius out to 60 km, or a maximum of eight closest stations, whichever was satisfied first.
- If there were no stations within 60 km of the township center, the nearest neighbor was used regardless of its distance from the township center.

Temperature, Humidity and Solar Radiation

- Utilized a linear IDW procedure with a radius of 200 km or 8 closest stations whichever is satisfied first.
- If there were no stations within 200 km the nearest neighbor is used regardless of its distance to the township center.
- ***Note***: Due to lack of stations that measure solar radiation, often **Solar Radiation** reverts to nearest neighbor.
- ***Input data sources:***
  - ***Temperature:*** daily maximum and minimum temperatures
  - ***Humidity:*** computed using the daily average of hourly humidity observations. Note that no conditions were imposed for completeness of the hourly record. For example, if only five observations (hours) were present for a given station on a particular day then, the daily average was computed using the average of five hourly values.
  - ***Solar Radiation Source:*** Daily total of all hourly values. Conditions were imposed for completeness, such that all 24-hours needed to be present to yield a daily total.

Caution

Figures are included here that depict historical data density and station completeness for precipitation measurements only. Other elements (humidity, solar radiation often have far less density). Data density beyond 1961 is typically deemed insufficient for a regional analysis of the province as a whole.

Figures

Each figure provides a summary of yearly station density along with the percentage of observations collected in that year. Station completeness was expressed as a percentage of actual observations relative to possible total number of observations. For example, if the station had 100 days of observations in a given year and a possible 365 days of observation, that station would have collected 27% of that years possible observations.

A historical overview of station counts and data completeness is given in Figure 1. Throughout the 1950's Station density began to improve dramatically. By about 1970 a quasi-steady-state was achieved that lasted through most of the 1980's. Over the next decade, many stations were dropped from the Environment Canada network, due to chronic lack of funding for the automated stations along with the loss of volunteer observers that were not replaced. By the Mid 1990 station density was on the rise again and in the early 2000's Alberta Agriculture and Irrigation started building stations in earnest to fill holes and improve drought, flood and fire reporting, along with provincial crop insurance programs, adding 190 stations from 2003 to 2023. Late in the 2010, the fire weather network, representing the forested areas, began a modernization period. Manned lookouts were replaced with automatic stations. Most of these automatic stations, employed tipping bucket style rain gauges that are only reliable when the ambient air temperature is above zero. Thus spring and fall measurements are at times subjected to errors as snow and freezing water makes quality controlling difficult. At times accumulated snow in the gauges may later melt out and provide false positives for precipitation. This is particularly problematic during the early spring as winter snows which accumulated in the gauges, suddenly melts out as the weather turns warm for several days. Much of this has been removed from the record, but undoubtedly some errors of this type are likely still present in the interpolated data. By about 2017, some of the tipping bucket gauges across the forested areas were replaced by all season gauges. This process is relatively slow and ongoing and by 2024. At the time of the last update to this document (April 2024) 14 tipping bucket rain gauge stations were upgraded with all season precipitation gauges. The drop in station density in 2017 was due to further losses in Environment Canada's volunteer network and the manned Forestry lookouts.   In 2005 Alberta Agriculture and irritation began systematically quality controlling data received from all of the hourly stations reporting data across the province and as such data quality has improved dramatically, with robust quality control process still in place to this day.

For a complete historical overview

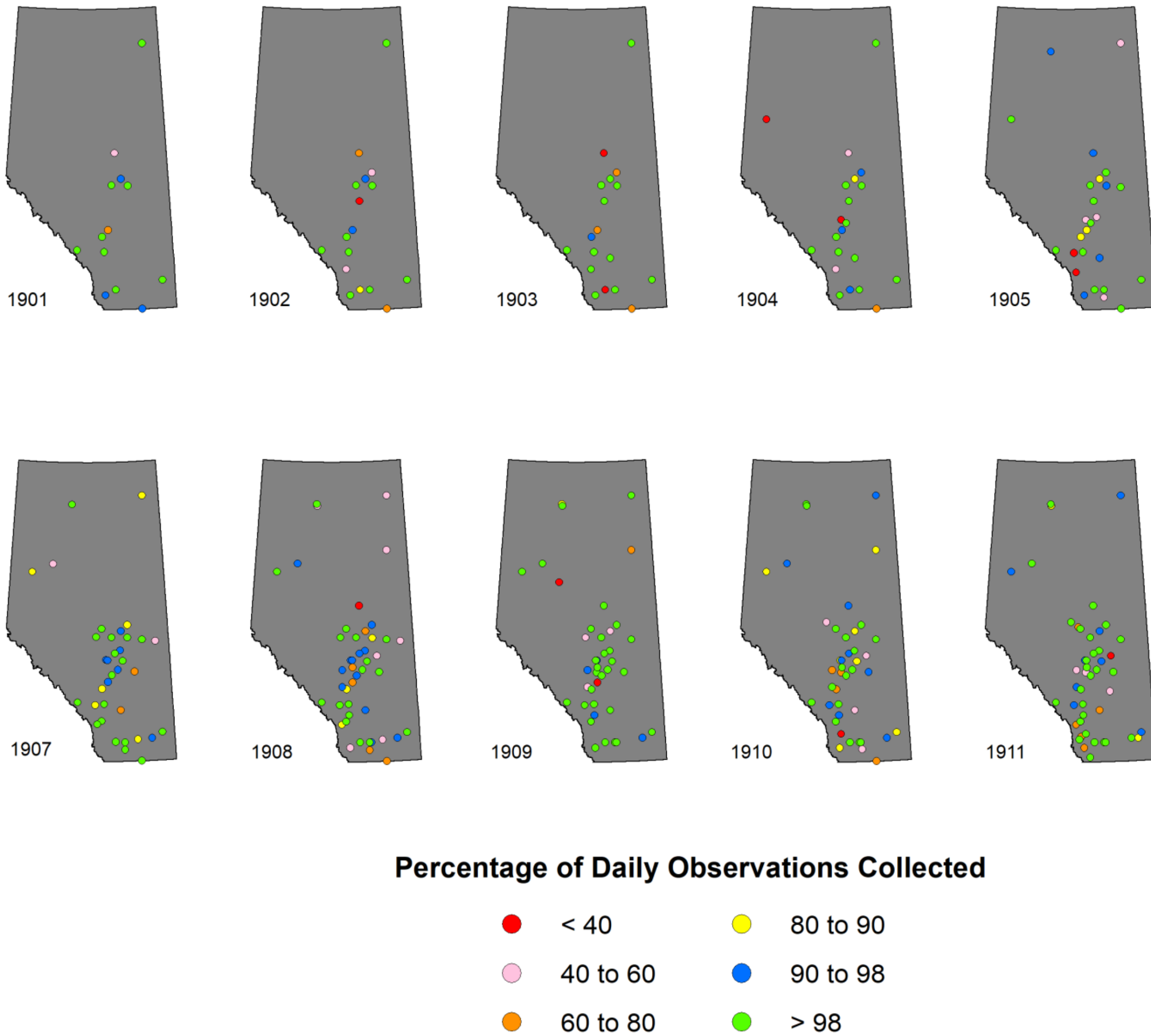


Figure 3, shows a glimpse into each decade showing the locations of stations used in the interpolation. (Figure 3 to Figure 13) depict each year, (1901 to 2022) in a similar fashion (Figure 3 to Figure 13) allowing users further insight into yearly data availability. Its note is the relatively low completeness of stations in the forested areas. Many of these stations were seasonal and as such, generally only operated May through to September, thus yielding about 40% of observations in that year. The dot maps are very useful for identifying those areas that had relatively low station density and provide insight into data quality in various locations around the province. However a systematic analysis of the data flags will yield better results and allow users to customize their own methodology for evaluating the integrity of the data as it applies to their particular use.

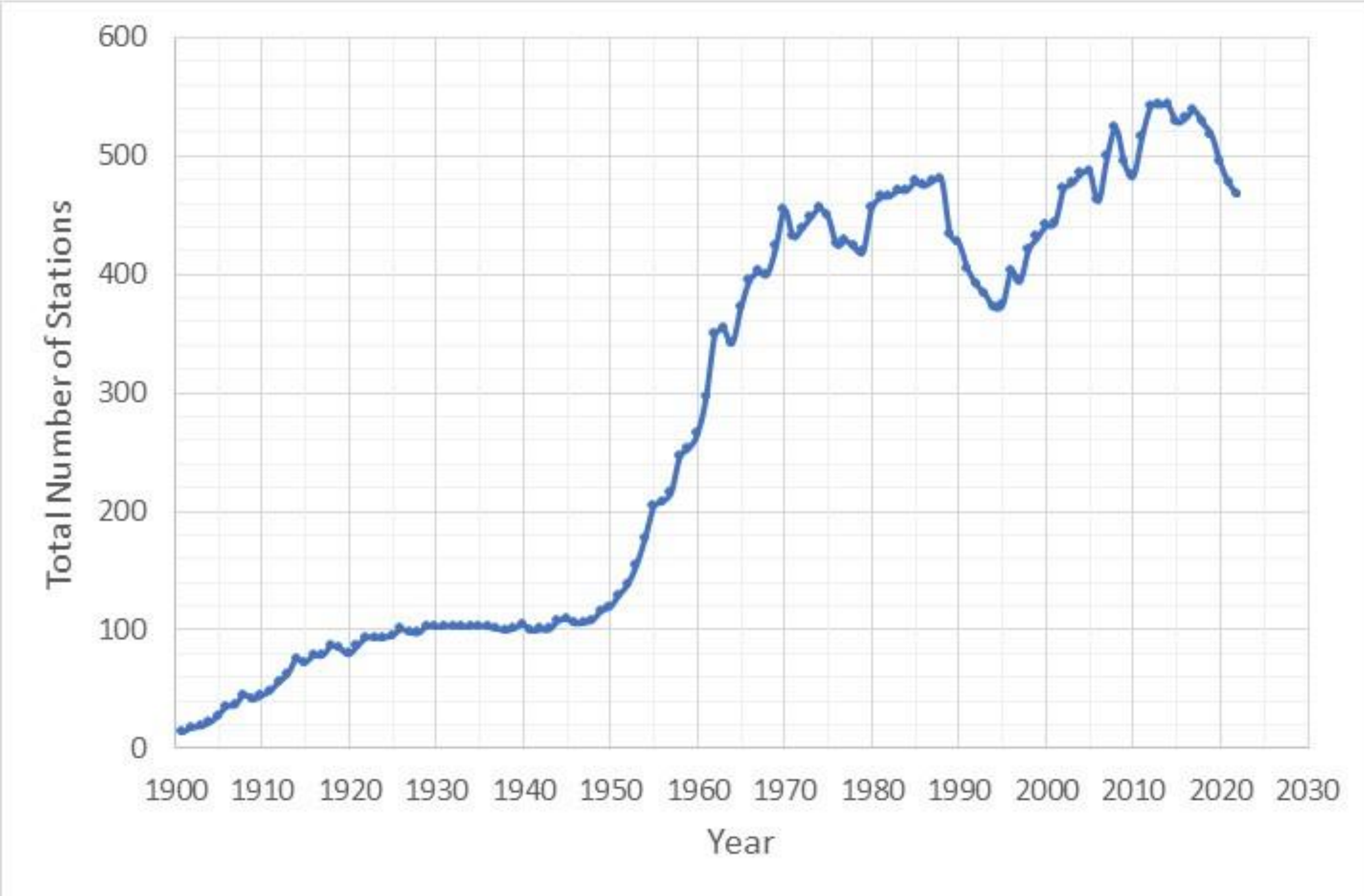


Figure 1. Number of stations used in the interpolation scheme counted by total stations per year

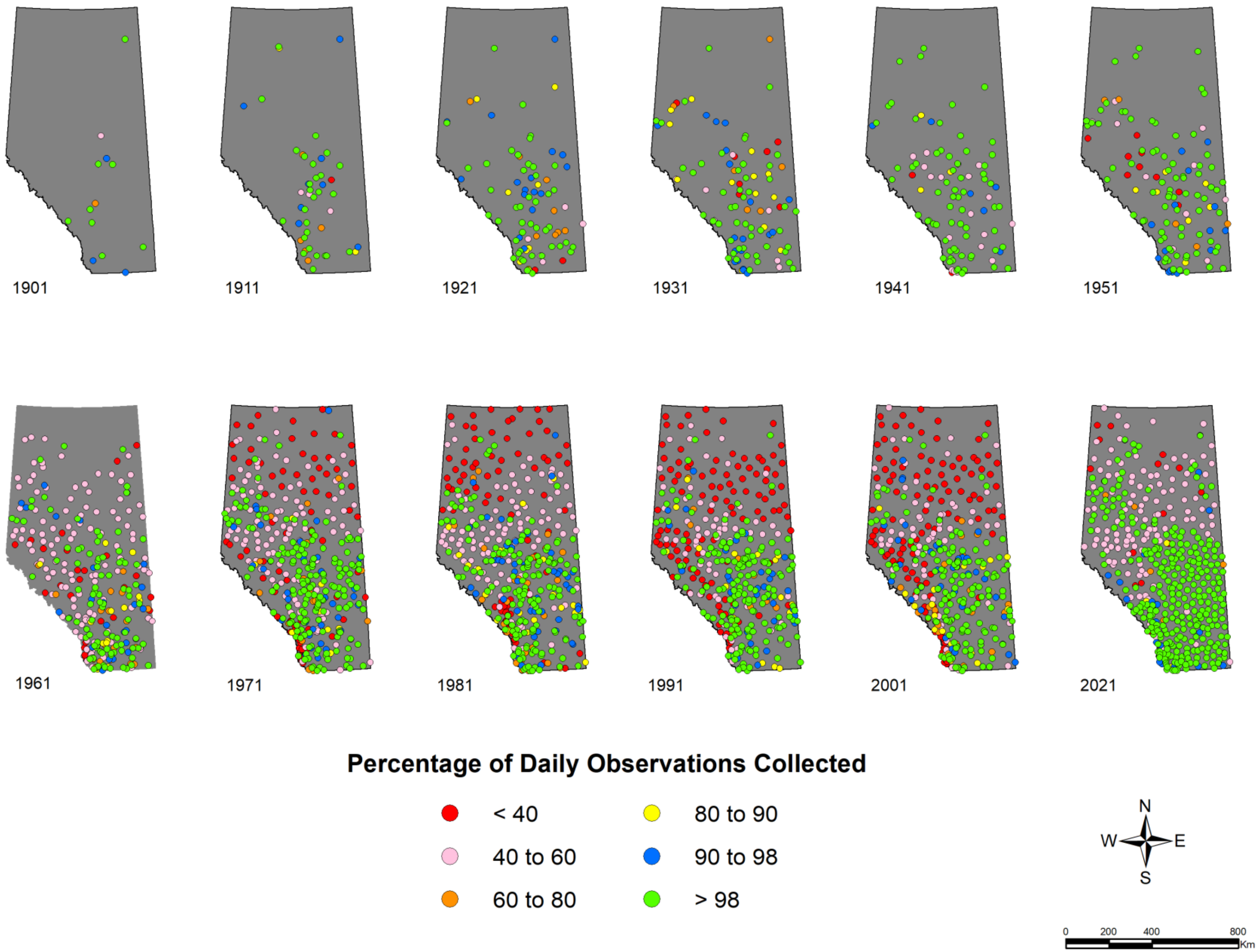
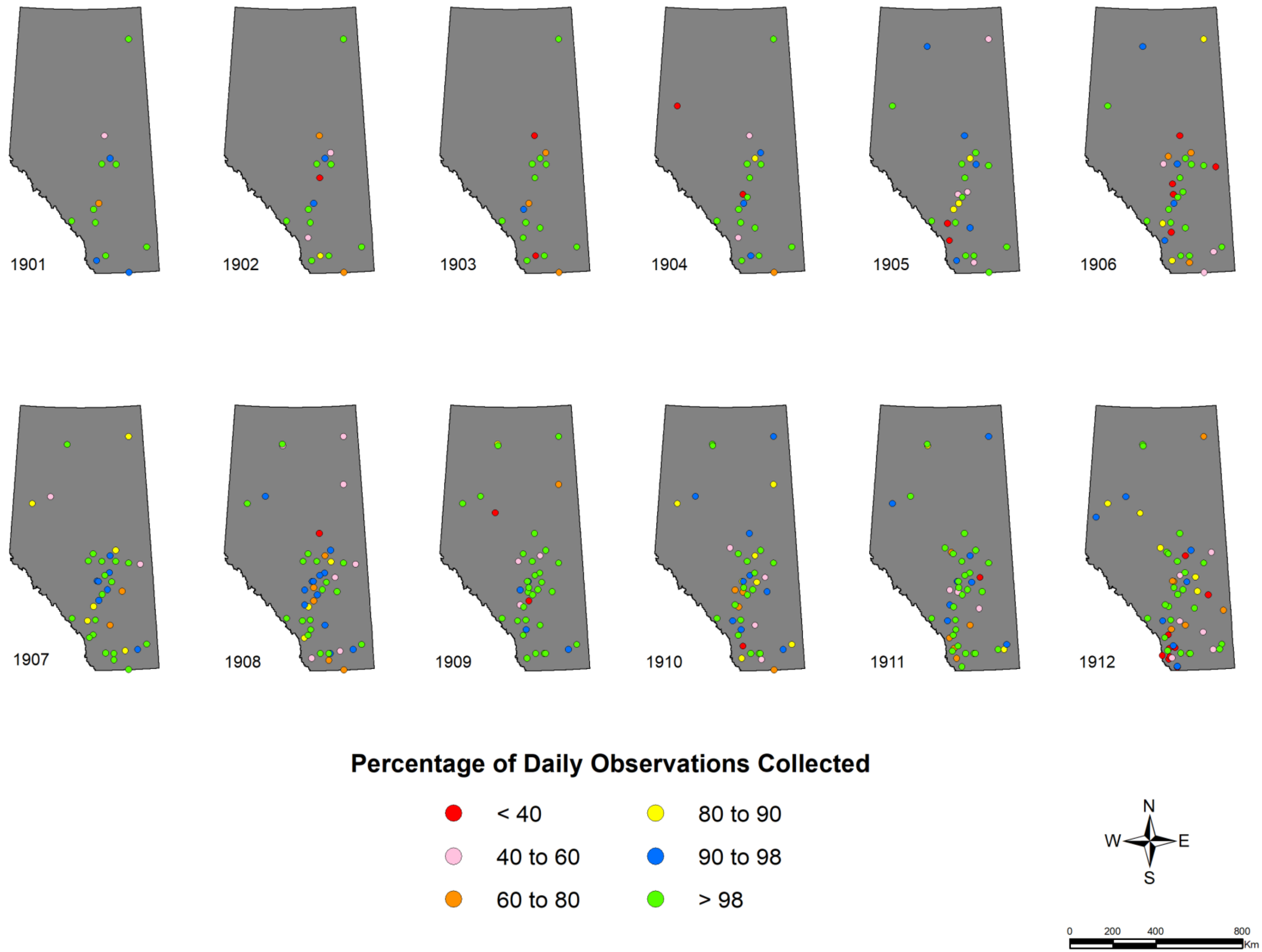

1901
1911
1921
1931
1941
1951
1961
1971
1981
1991
2001
2021
Percentage of Daily Observations Collected
< 40
40 to 60
60 to 80
80 to 90
90 to 98
> 98
N
W
E
S
0
200
400
800
Km

Figure 2. Station density and percentage of observations collected in each year, for the period 1901 to 2021



Classification: Public

Figure 3 Station density and percentage of observations collected in each year, for the period 1901 to 1912.

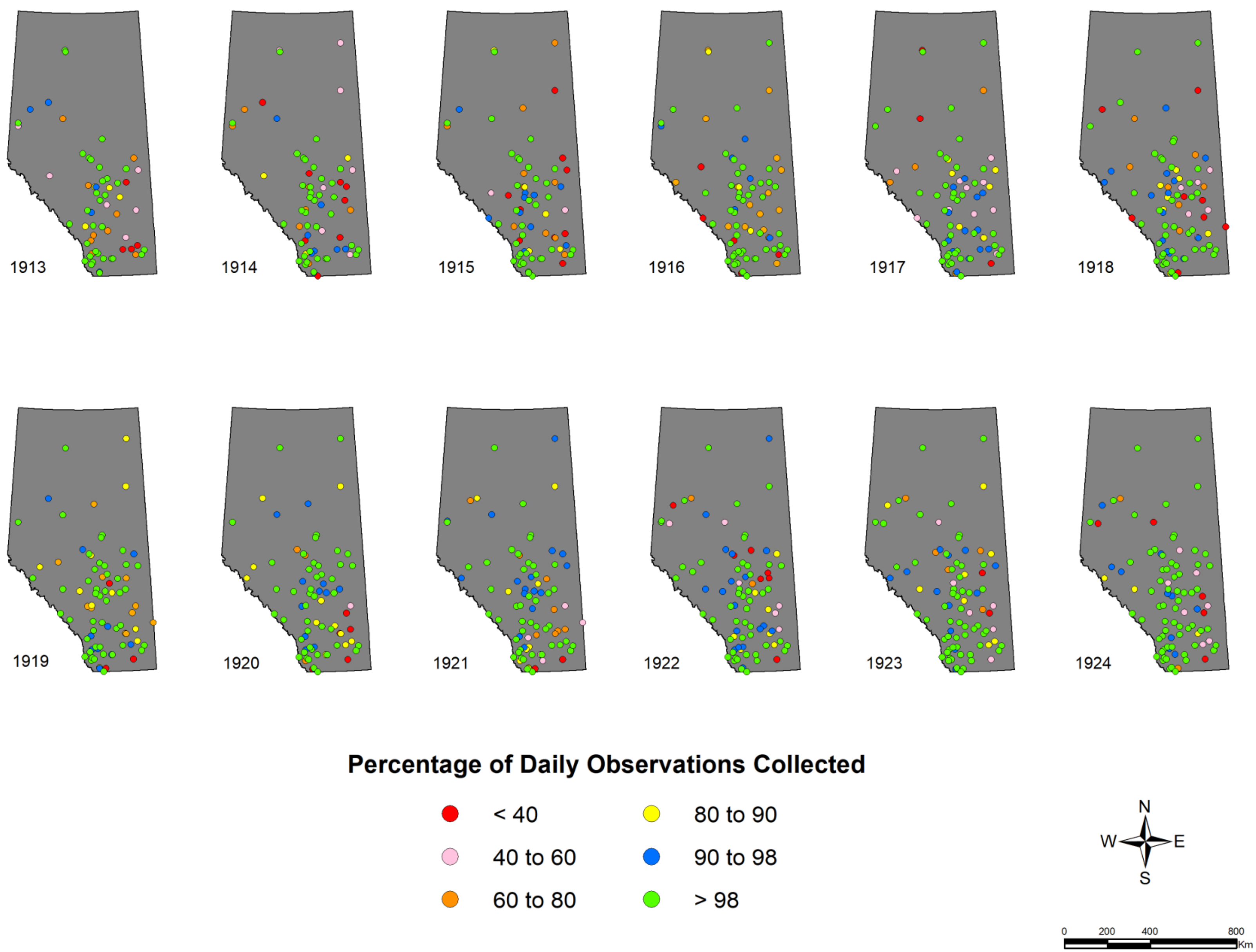
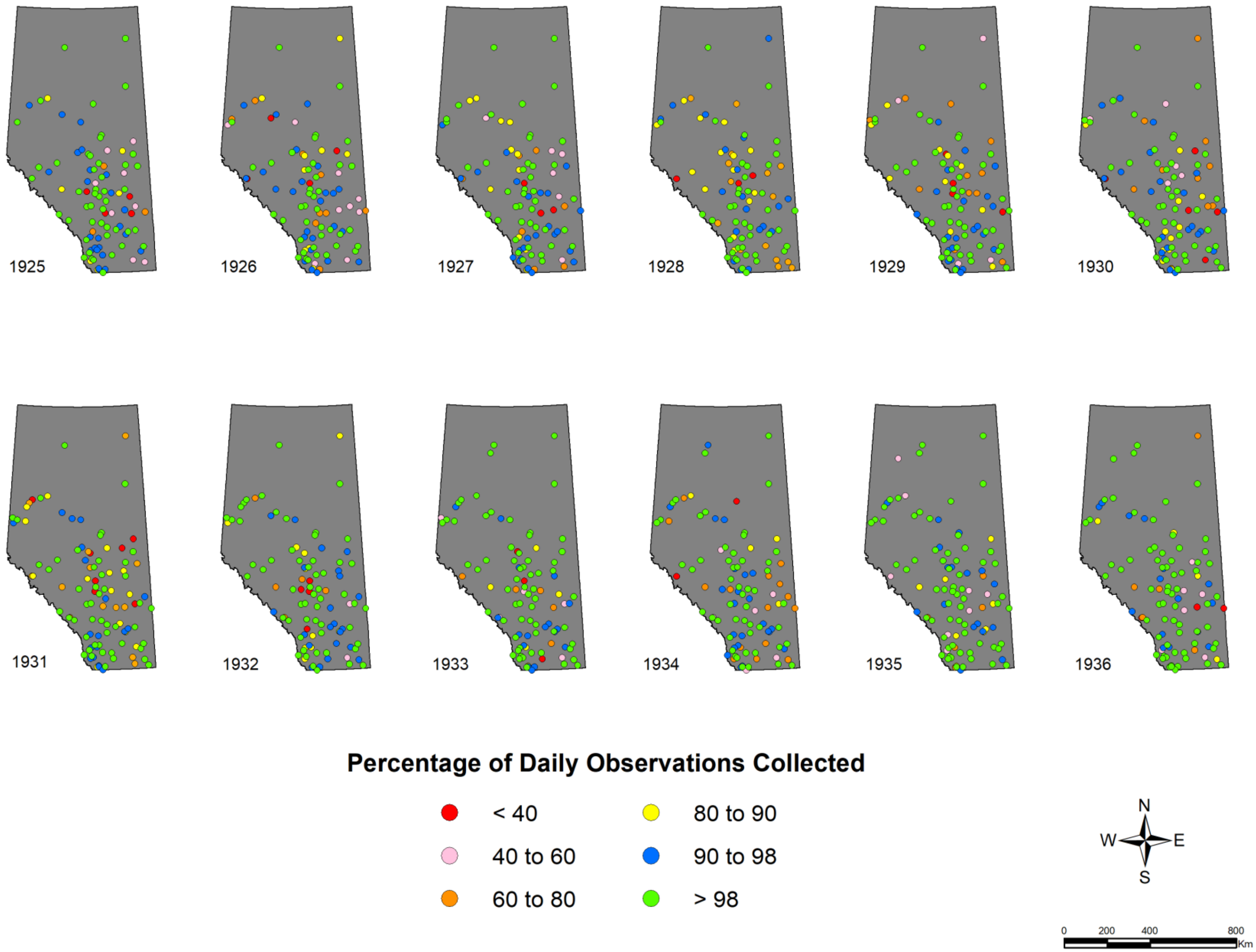

1913
1914
1915
1916
1917
1918
1919
1920
1921
1922
1923
1924
Percentage of Daily Observations Collected
< 40
40 to 60
60 to 80
80 to 90
90 to 98
> 98
N
W
E
S
0
200
400
800
Km

Figure 4. Station density and percentage of observations collected in each year, 1913 to 1924



Classification: Public

Figure 5. Station density and percentage of observations collected in each year, 1925 to 1936

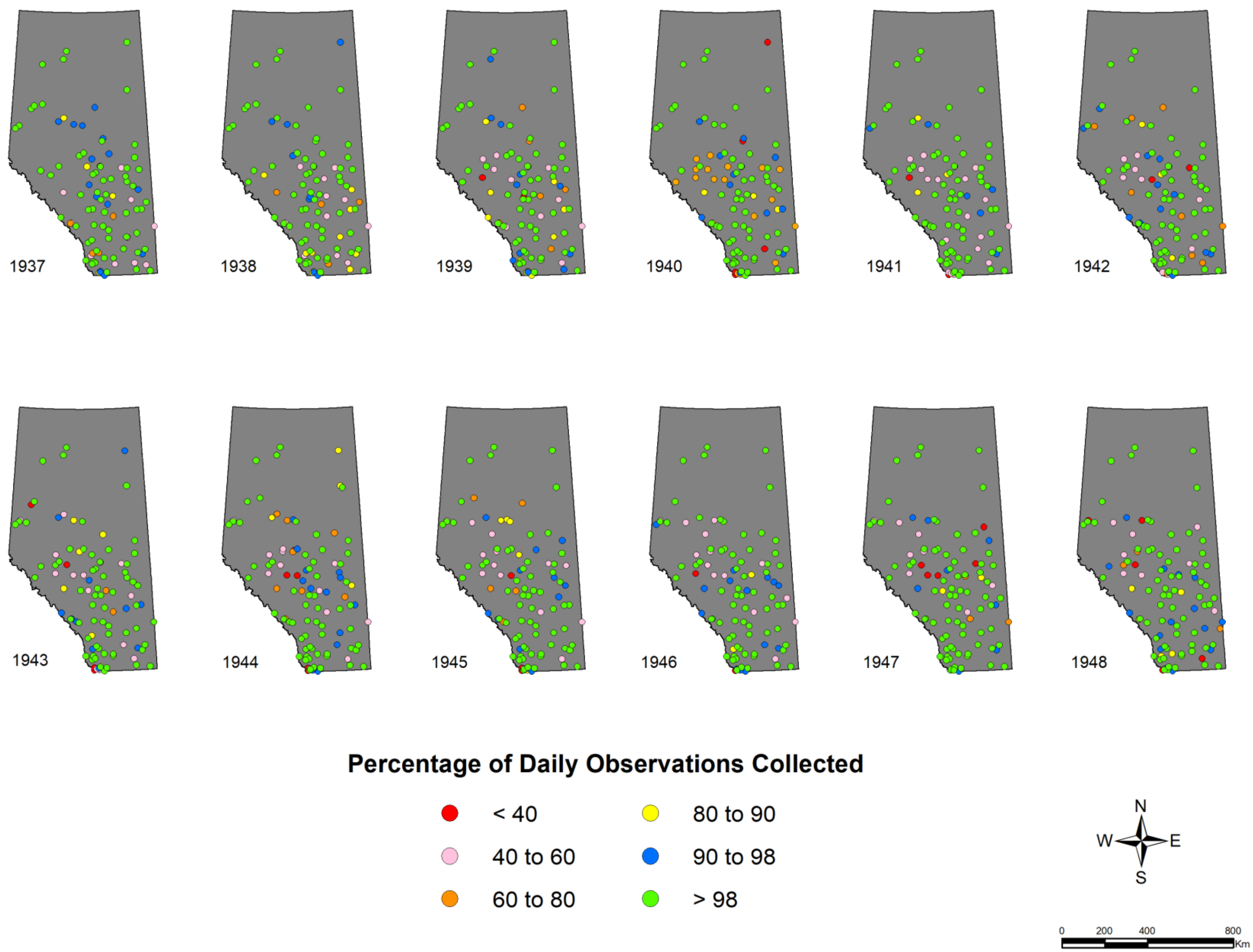


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Figure 6. Station density and percentage of observations collected in each year, 1937 to 1948

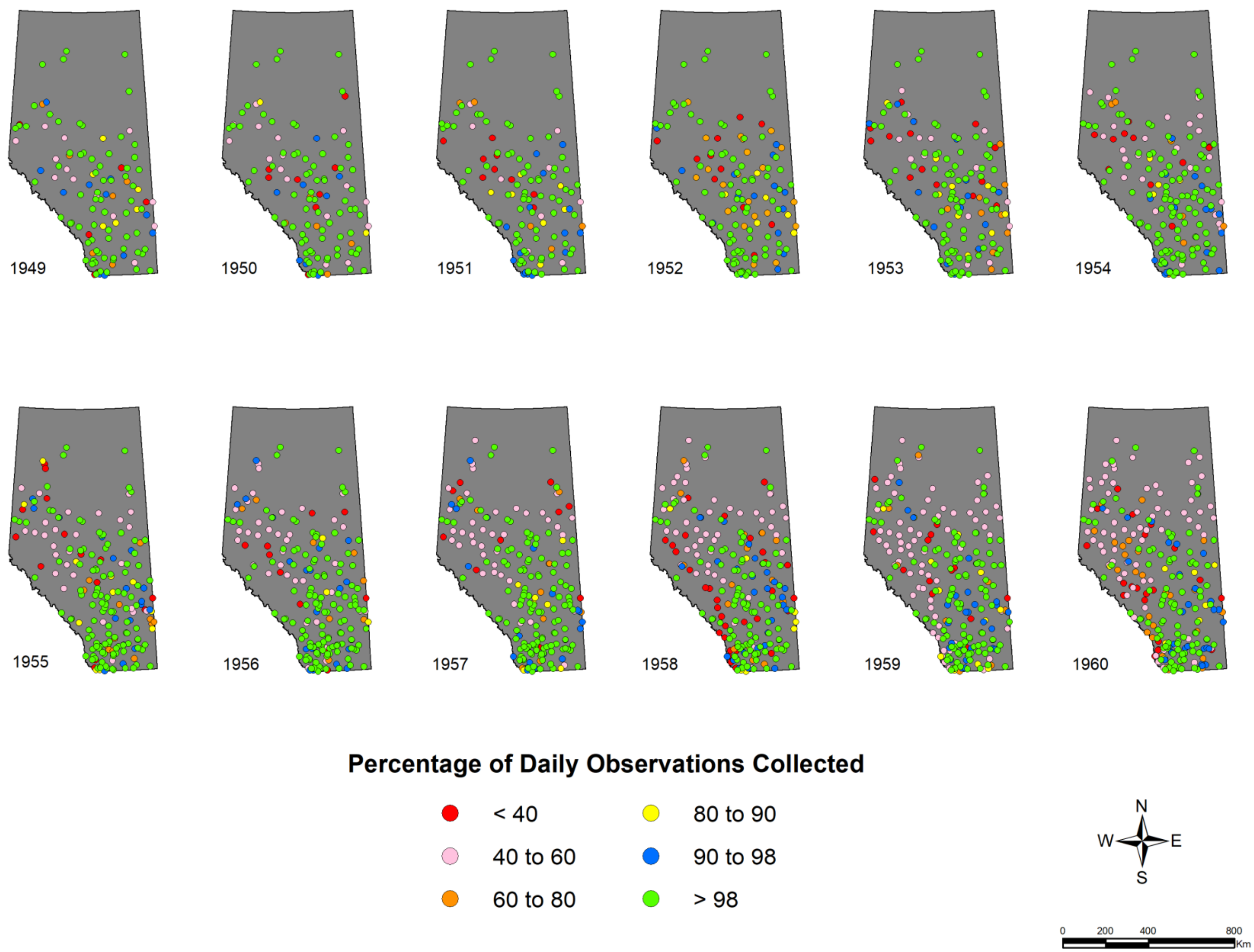

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Figure 7. Station density and percentage of observations collected in each year, 1949 to 1960

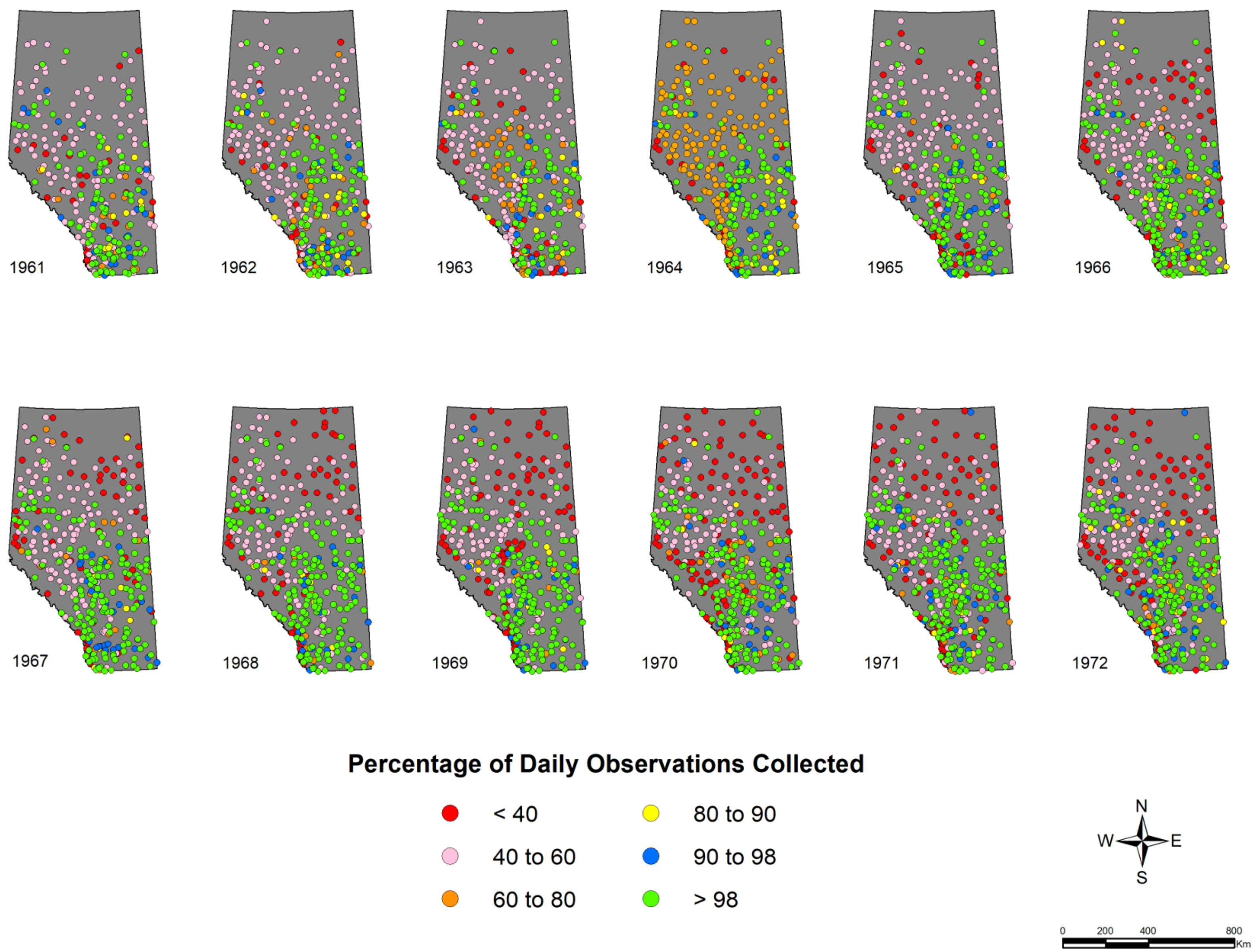

1961
1962
1963
1964
1965
1966
1967
1968
1969
1970
1971
1972
Percentage of Daily Observations Collected
< 40
40 to 60
60 to 80
80 to 90
90 to 98
> 98
N
W
E
S
0
200
400
800
Km

Figure 8. Station density and percentage of observations collected in each year, 1961 to 1972

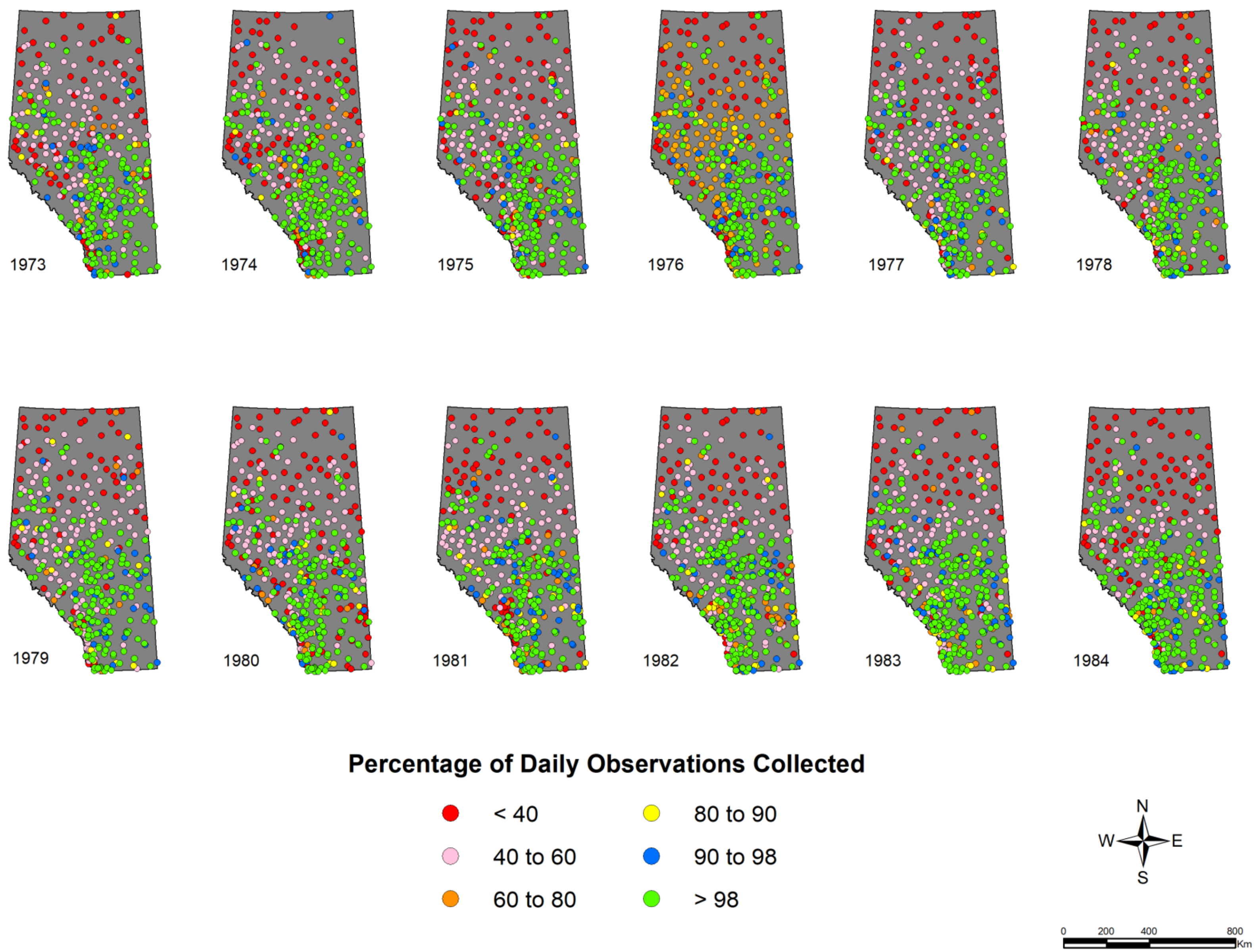
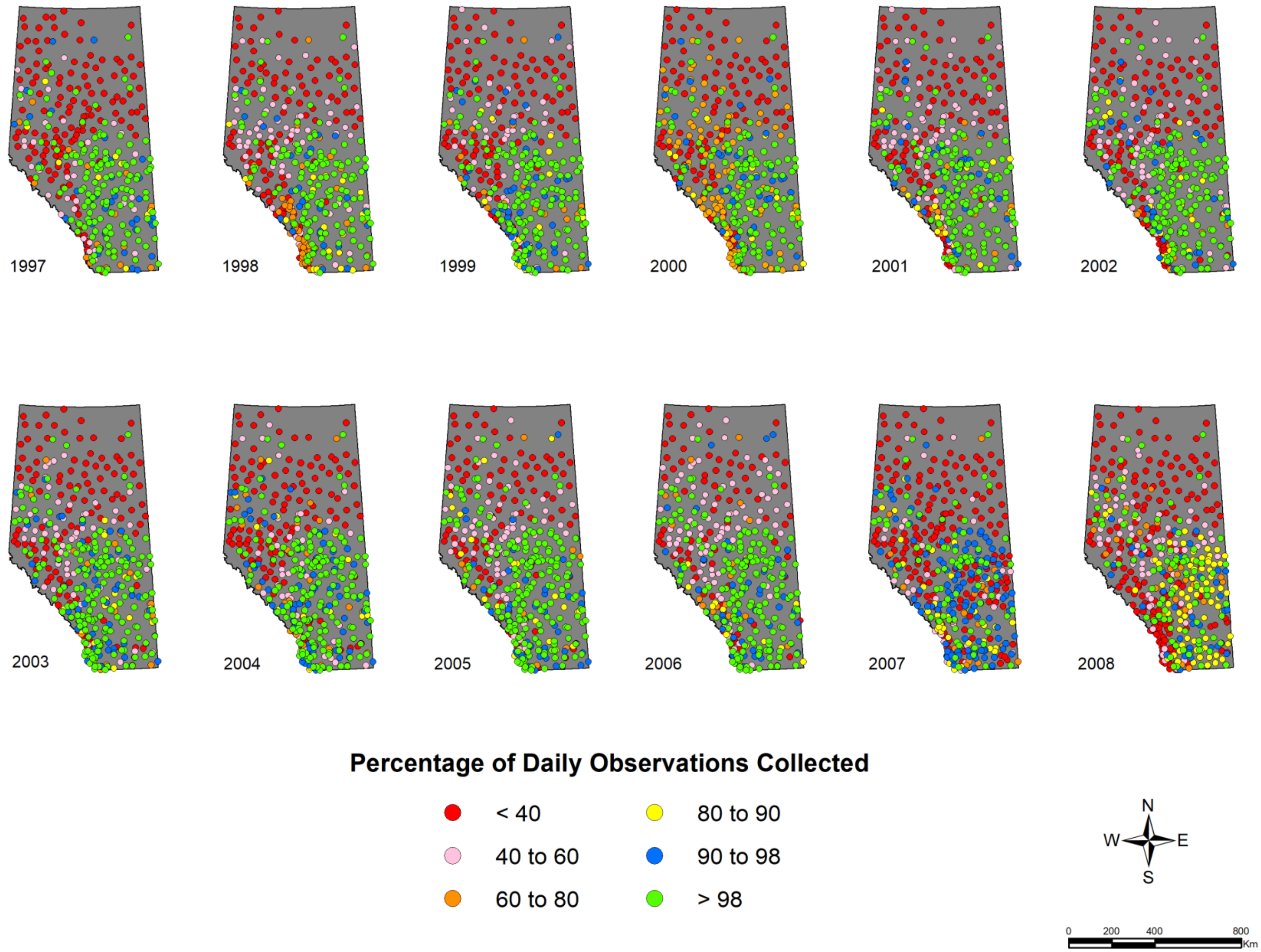

1973
1974
1975
1976
1977
1978
1979
1980
1981
1982
1983
1984
Percentage of Daily Observations Collected
< 40
40 to 60
60 to 80
80 to 90
90 to 98
> 98
N
W
E
S
0
200
400
800
Km

Figure 9. Station density and percentage of observations collected in each year, 1973 to 1984


1985
1986
1987
1988
1989
1990
1991
1992
1993
1994
1995
1996
Percentage of Daily Observations Collected
< 40
40 to 60
60 to 80
80 to 90
90 to 98
> 98
N
W
E
S
0
200
400
800
Km

Figure 10. Station density and percentage of observations collected in each year, 1985 to 1996



Classification: Public

Figure 11. Station density and percentage of observations collected in each year, 1997 to 2008

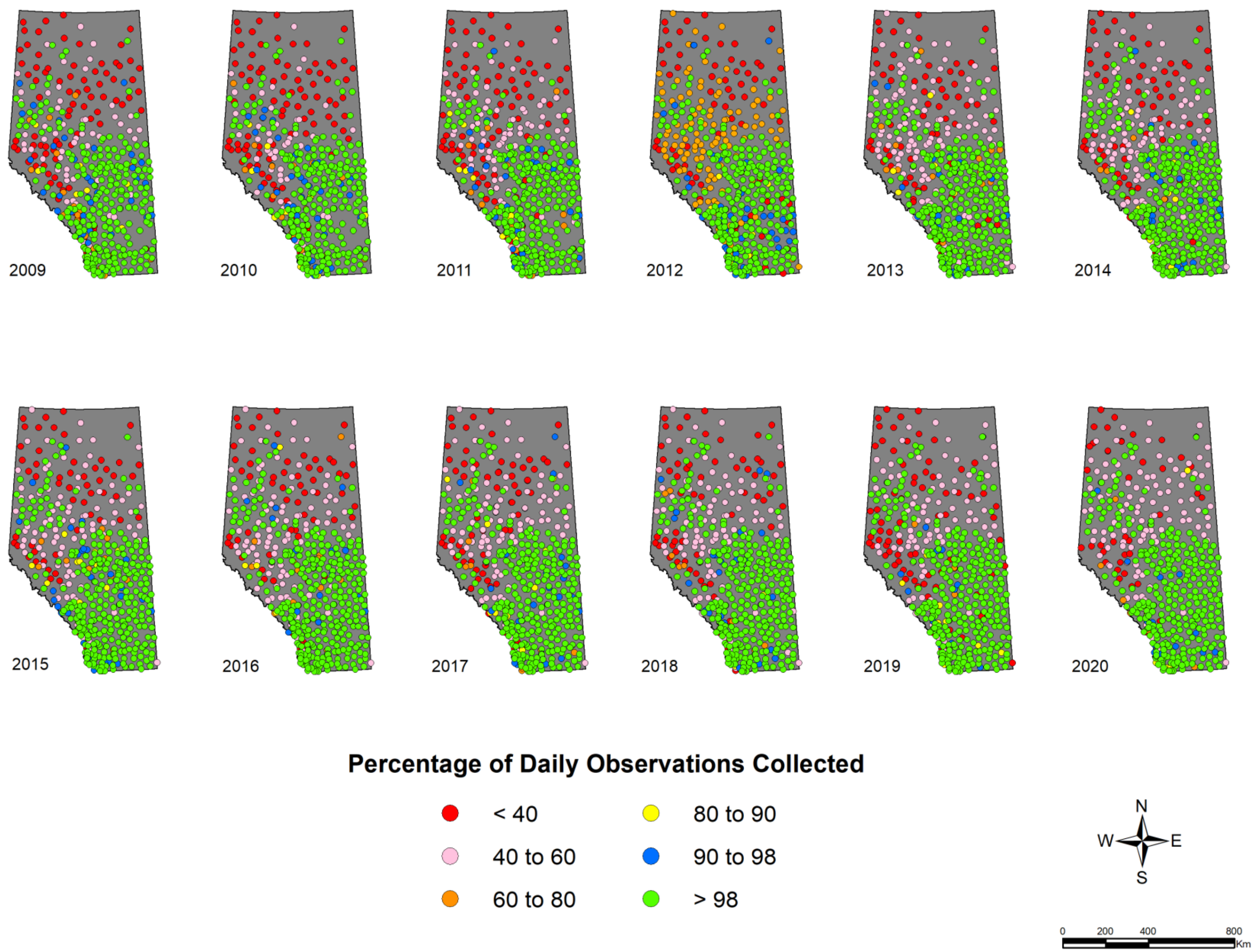


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Figure 12. Station density and percentage of observations collected in each year, 2009 to 2020

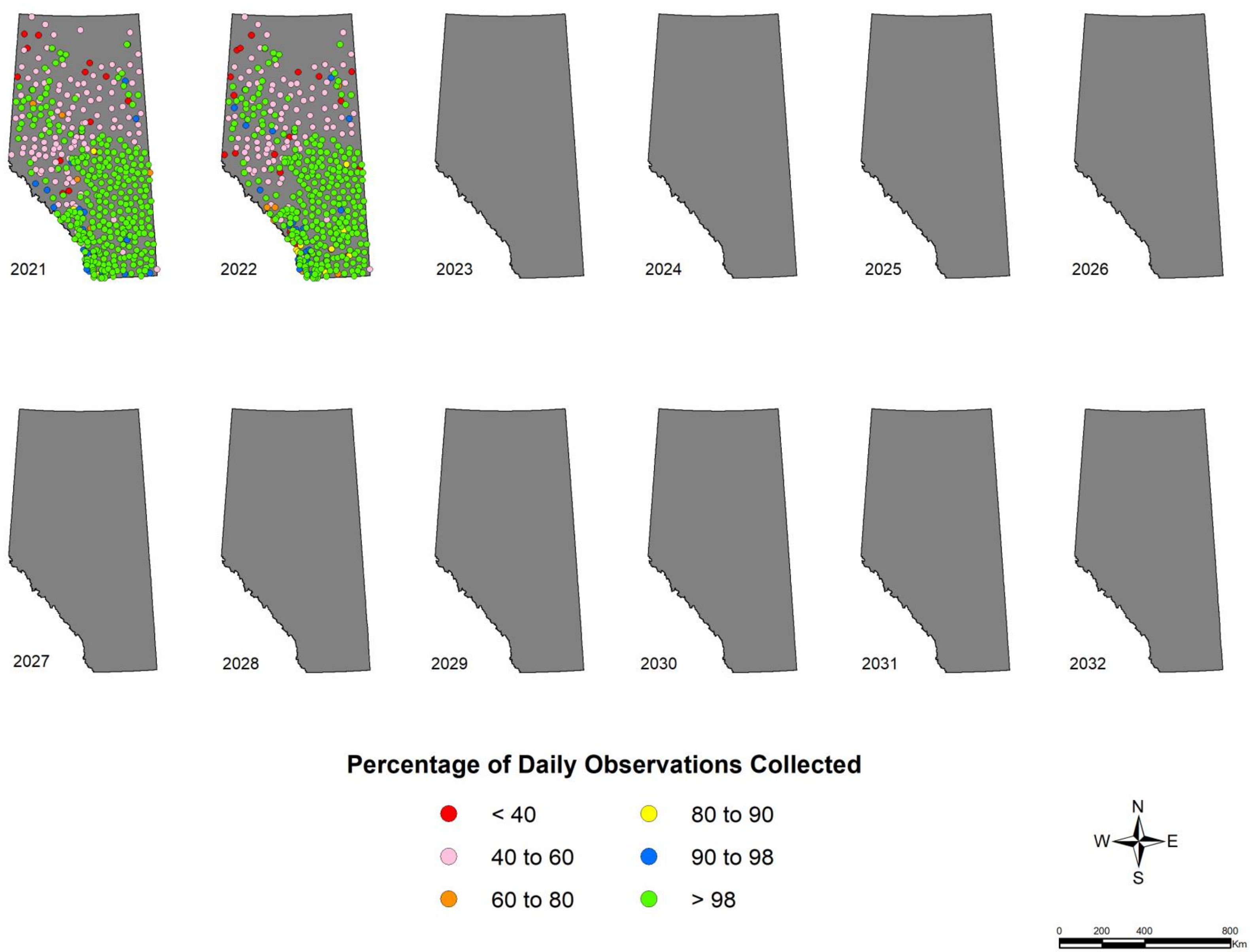

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Figure 13. Station density and percentage of observations collected in each year, 2021 to 2032 (last updated 2022)