NOAA National Data Center Climate Data Online For Use in Research and Atmospheric Icing Studies

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Abstract

During 1998-1999, the National Climatic Data Center developed the NOAA National Data Center Climate Data Online (NNDC CDO) System to a) provide fast, easy online access to a variety of climatic datasets; b) provide the climatic support and backbone for the NNDC Server (in development); and c) facilitate migration from a Unisys mainframe customer support environment to an open systems unix environment.

This system includes both recent and historical data, useful for studies of particular weather and icing events, and for historical analysis of data for statistical and other research purposes. The types of data currently included in the system, which continues to be populated, are surface daily and monthly data, hourly precipitation data, and 15-minute precipitation data. Both United States and worldwide data are included, so it is useful for research involving US interests and those of other countries. The system will be greatly expanded this year, with global surface hourly and global upper air data to be added.
The system URL is:
http://www5.ncdc.noaa.gov:7777/plclimprod/plsql/poemain.poe.

The NNDC CDO backbone is an Oracle relational database system, using structured query language and other programming languages to retrieve data. Data are accessible and selectable by region, country, state (US), county (US), climate division (US), and station, and by time period (year, month, day, hour). The data are available free of charge to U.S. educational institutions, with charges applied for other users. However, charges are greatly reduced as compared to traditional off-line delivery of climatic data. This paper describes the system, its application for icing studies and climatologies, and specific use of the system to evaluate an icing event.

Discussion

The climatic data currently accessible are:

- Daily (primarily U.S.) for full period of digital record, typically 1948 to present, over 19,000 stations historically, over 8000 currently active.
- Monthly (primarily U.S.) for full period of digital record, typically 1948 to present, over 18,000 stations historically, over 8000 currently active.
- Global monthly for 1987 to present, over 3000 stations historically, over 1000 currently active.
- Hourly precipitation (primarily U.S.) for full period of digital record, typically 1948 to present, over 6000 stations historically, over 2000 currently active.
- 15-minute precipitation (primarily U.S.) for full period of digital record, typically 1971 to present, over 6000 stations historically, over 2000 currently active.

The main user interface (Figure 1) allows initial selection by region, by country, or by data type. So, you can select, for example, one country to see what types of data are available for that country. Or, you can select one data type to see what countries and stations have data available for that type of data.

The next "page" (Figure 2) allows selection of the entire dataset ('worldwide'), selection by region, by country, or by station number range. Selection of United States as the country then leads to an interface (Figure 3) allowing selection by entire state, climate division, county, or individual station(s). This is quite flexible in that you can select, for example, all stations in a county, or just pick selected stations from a particular state.
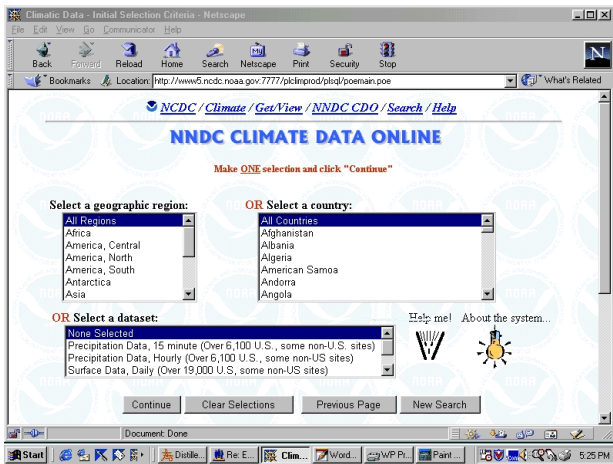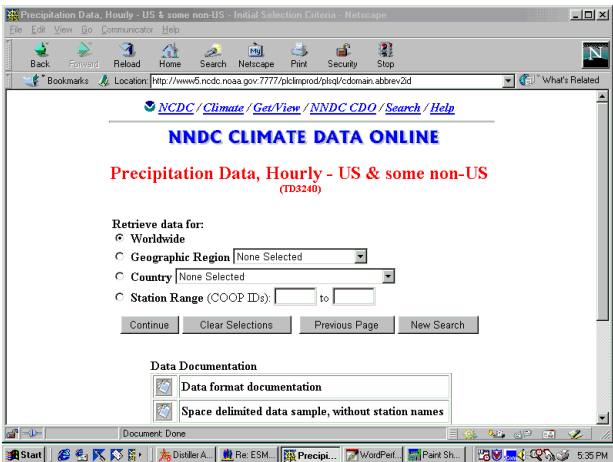
Figure 1

Figure 2

Figure 3

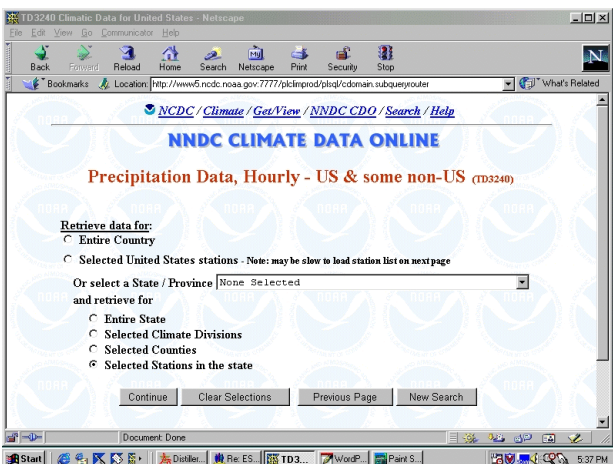The next "page" will vary depending on what you selected so far. For example, if you choose "climate division" as your criteria, you'll then see a map of the divisions for that state (Figure 4). If you choose "county" as your criteria, you'll see a list of counties (Figure 5). If you choose station as your criteria, you'll see a full list of stations for the state (Figure 6).
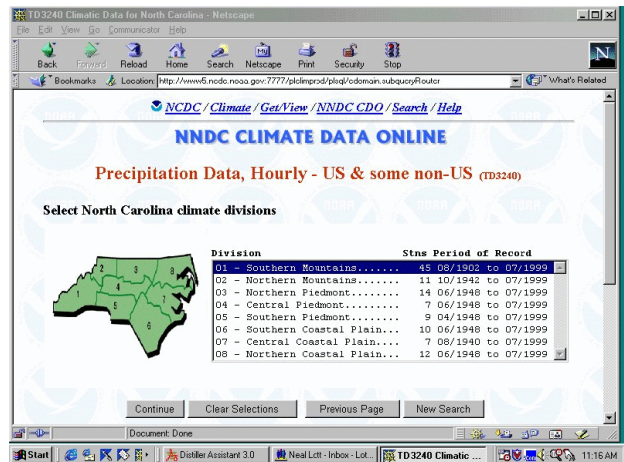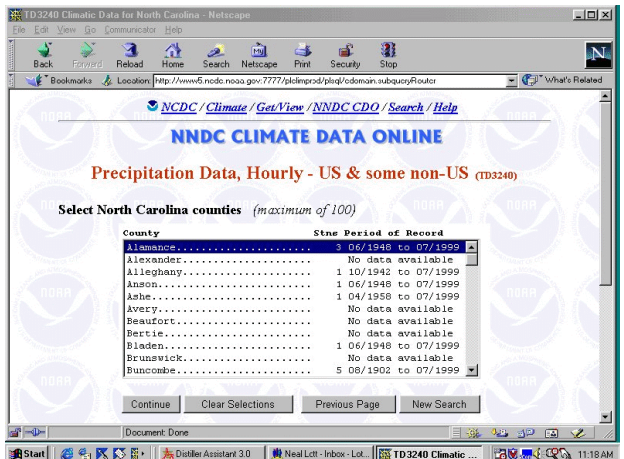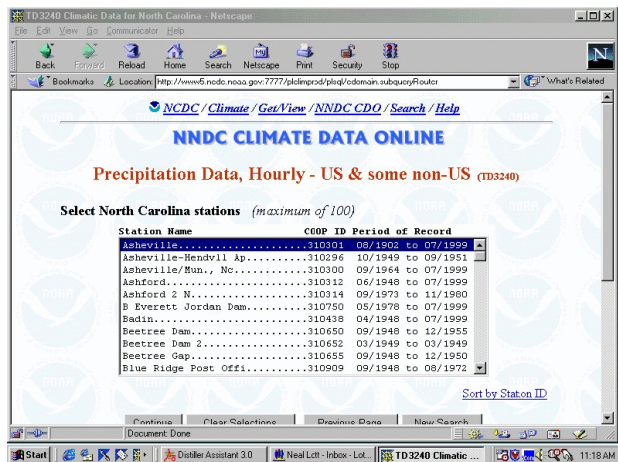
Figure 4

Figure 5

Figure 6

The next "page" (Figure 7) then provides for selection of the period/dates you require and the output format desired. Also, some datasets (e.g., daily, monthly) provide element selection capability on this page, so that you can select just the desired weather elements (e.g., precipitation, temperature). Our basic format options (for most datasets) are:

Space-delimited with station name in each data record
Space-delimited without station name
Comma-delimited with station name in each data record
Comma-delimited without station name
The standard (archive) variable length format for that particular dataset
The standard fixed length format for that particular dataset

Figure 7
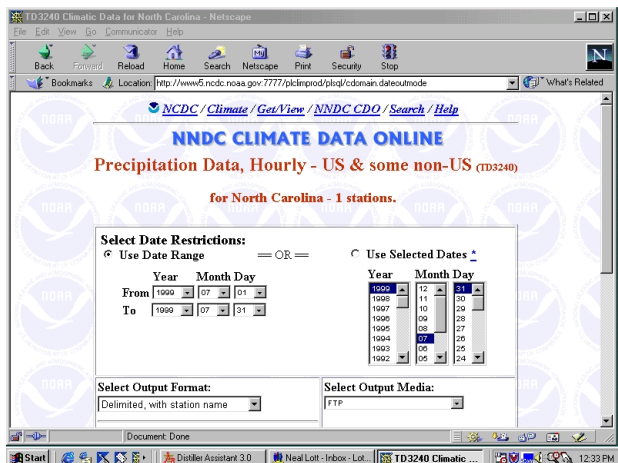
Most users prefer one of the delimited formats. Comma-delimited is often better for import into a spreadsheet. Space-delimited is easier on the eyes and easy to write a program for, such as with Fortran or C++. The standard dataset formats are often required by users with application programs previously written for those specific NCDC formats.

The next "page" will provide a summary of your request and will then direct you into our Online Store, unless you have free access as mentioned above. The Online Store then requests payment information, with a similar interface as you would see for other online systems. At present, payment by credit card is the only option, but we plan to add a subscription option, whereby users will be able to subscribe to the system for a year at a fixed price.

Finally, you're directed to an html address with a list of files that have been produced, or are being produced. Your data file may already be available, so you can click on the file to see if it's there. If not, just bookmark the page for future reference. Also, you're "double-covered" in that we send you an email with directions to your data when your order has finished processing. You'll have access to the data file, an inventory for your selection, a station list, and data format documentation. Most small orders (e.g, a few mb) complete processing in a few minutes. However, some larger orders require a few hours to process, so keep that in mind after placing your order. Of course, if our system is quite busy, run times will be longer; and if the internet "lines" in your path to NCDC are busy, your time required to ftp the data files will be longer.

A complete help system is included (http://www5.ncdc.noaa.gov/cdo/info.html) with a data price schedule, general system information, detailed system help for diagnosing problems (e.g., inability to connect due to firewall on user end), format documentation, data samples, station lists, utility software, etc.

An Icing Application

The January 1998 ice storm was a memorable one for the northeastern U.S. and southeastern Canada. Precipitation amounts approached 100 mm in some locations, mostly in the form of freezing rain. Overall damages for the area were in the $2-3 billion range.

Let's say you wanted to look over the precipitation amounts for the state of Maine for this event. You can use the NNDC CDO system to select the daily dataset (vs

hourly precipitation shown in example above). Select the state of Maine and the month of January 1998, for the climatic element precipitation. If you desire to load the data into a spreadsheet, the comma-delimited format is the best option.

I ran this myself and received a data file in about 10 seconds. I then loaded the data into a spreadsheet (MS Excel) and removed any columns not needed. In this case, I removed columns containing data flags (information about the data) and columns containing days other than January 5-10 – the period for the ice storm. Since data are reported and stored in hundredths of inches for each day, I added two columns to the table–one for a summation of days 5 to 10, and one for a conversion to millimeters (for our international audience).

The results are shown below. The highest reported precipitation amount occurred in Eustis with 96 mm for the event. This would equate to approximately 30 mm of equivalent radial thickness, assuming all precipitation fell as freezing rain (generally true in Maine for this storm).

Of course, you can also select other climatic elements such as maximum and minimum temperatures. You could also make use of other datasets to study such an event, such as hourly precipitation. For worldwide applications, other datasets will be added to this system this year, including global hourly surface observations (which include precipitation amounts, precipitation type, temperatures, wind direction and speed, and many other types of data), and global upper air observations.

Conclusion

Although with limited publicity, this system has proven to be quite popular since its online implementation in June 1999. Customers for the available datasets are now frequently using this system rather than placing off-line orders by phone for later delivery by mail. However, when off-line orders are placed, NCDC uses NNDC CDO to fill the order and provide the data on the requested media (e.g., CDROM, zip disk, magnetic tape, ftp delivery). This means we only have to maintain one system for both online and off-line support for these datasets, and future datasets that will be added. That translates into substantial cost savings to the government.

We currently limit the data volume for a specific user-requested file to 40 mb, which is then compressed (gzip) to 5 mb or so. We plan to increase that limit in the near future, as bandwidth improvements allow. Of course, you can place several orders (i.e., for several files) in one web session to retrieve all of the required data. For the immediate future, we suggest that requirements for large data volumes (over ~ 100 mb) be placed as an off-line order by phone (828-271-4800) or email (orders@ncdc.noaa.gov).

Again, the system URL is: http://www5.ncdc.noaa.gov:7777/plclimprod/plsql/poemain.poe. We encourage you to give it a try and provide feedback to us. We continue to implement enhancements to the system, with user feedback being a key to that process. Our long-term plan is for this system to be NCDC's primary method of delivering in-situ data to weather and climate data customers.

January 5-10, 1998 Precipitation in Maine, During Severe Ice Storm
Daily amounts in hundredths of inches
Summation (sum) in hundredths of inches, and converted to millimeters (mm)

Location	05	06	07	08	09	10	Sum	mm
ACADIA NATIONAL PARK	23	24	25	148	86	37	343	87
ALBION	0	21	15	112	101	22	271	69
ALLAGASH	0	24	25	41	61	51	202	51
AUGUSTA AIRPORT	15	10	35	116	29	0	205	52
BARNARD	0	55	26	82	135	35	333	85
BATH	0	3	12	69	118	12	214	54
BELFAST	8	20	0	210	0	0	238	60
BINGHAM WYMAN DAM	14	5	58	141	31	11	260	66
BLANCHARD	2	50	15	86	116	25	294	75
BRASSUA DAM	4	59	48	46	130	37	324	82
BRIDGEWATER	34	64	7	122	85	19	331	84
BRIDGTON 3 NW	0	0	26	152	87	25	290	74
BRUNSWICK	0	14	23	120	5	0	162	41
CARIBOU MUNICIPAL ARPT	15	50	15	95	55	9	239	61
CLAYTON LAKE	20	50	41	35	116	40	302	77
CORINNA	0	44	12	102	110	47	315	80
DANFORTH	0	68	40	80	149	26	363	92
DOVER-FOXCROFT	0	3	0	189	0	70	262	67
DURHAM	0	3	8	128	59	20	218	55
EAST HIRAM	9	3	8	127	94	21	262	67
EASTPORT	34	30	5	144	57	13	283	72
ELIOT	0	2	0	107	0	3	112	28
EUSTIS	7	59	27	91	168	26	378	96
FARMINGTON	2	22	14	145	73	27	283	72
FORT KENT	3	29	33	46	75	49	235	60
FRYEBURG	12	2	17	127	152	18	328	83
GRAND ISLE	1	19	18	43	57	36	174	44
GRAND LAKE STREAM	0	70	24	79	120	39	332	84
GRAY	1	9	57	153	32		252	64
GUILFORD	0	54	21	74	142	41	332	84
HARMONY	0	39	12	100	143	24	318	81
HARRIS STATION	25	41	19	130	48	6	269	68
HOLLIS	9	0	12	158	68	27	274	70
HOULTON INTL AIRPORT	24	57	10	126	86	11	314	80
HOULTON 5 N	20	61	7	104	89	37	318	81
JACKMAN	7	58	15	47	156	42	325	83
JONESBORO	6	62	25		75	0	168	43
KENNEBUNKPORT	0	2	11	128	40	16	197	50
KINGFIELD	6	26	10	102	123	30	297	75
LEWISTON	8	11	125	69	16	0	229	58
LEWISTON 2	1	8	16	144	72	0	241	61
LONG FALLS DAM	2	47	16	92	130	23	310	79
MACHIAS	0	49	20	80	113	42	304	77
MADISON	0	21	10	94	80	25	230	58
MIDDLE DAM	11	46	18	103	122	16	316	80
MILLINOCKET	0	65	36	57	123	34	315	80
MOOSEHEAD	0	66	28	50	132	31	307	78
NEWCASTLE	3	15	8	86	59	4	175	44
NEW SHARON	1	27	11	151	103	34	327	83
PATTEN 2	2	59	36	67	130	46	340	86
PHILLIPS	10	21	21	103	100	27	282	72
PITTSTON FARM	6	65	38	37	145	40	331	84
PORT CLYDE	8	23	10	155	48	20	264	67
PORTLAND INTL JETPORT		12	47	122	20	0	201	51

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PRESQUE ISLE                    19   36    3   69   35   38  200   51
RANGELEY                        12   46   26   88  143    2  317   81
RANGELEY 2 NW                   19   56   24   88  131   20  338   86
ROBBINSTON                      45   36   26  189   45    6  347   88
RUMFORD 1 SSE                    6   18   32  125   16   43  240   61
SANFORD 2 NNW                    7   35   30  132   56    2  262   67
SCARBOROUGH                      0    9   43  113   14    0  179   45
SEBEC LAKE                       2   53   17   75  133   38  318   81
SPRINGFIELD                      2   50   25   58   73   19  227   58
SQUA PAN DAM                     0   53   32   50  115   52  302   77
VAN BUREN 2                      0   31   25   45   70   53  224   57
VANCEBORO 2                      0   71   33   93   95   39  331   84
WATERBORO                        7   11   10  157  103    7  295   75
WATERVILLE TREATMENT PLANT       0   24   10  118  101   32  285   72
WEST BUXTON 2 NNW                4   12   73  108   29    0  226   57
WEST PARIS                       5   14   10  135   65   33  262   67
WEST ROCKPORT 1 NNW              0    3   16  142   66   17  244   62
WOODLAND                         0   57   16   73  162   48  356   90
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