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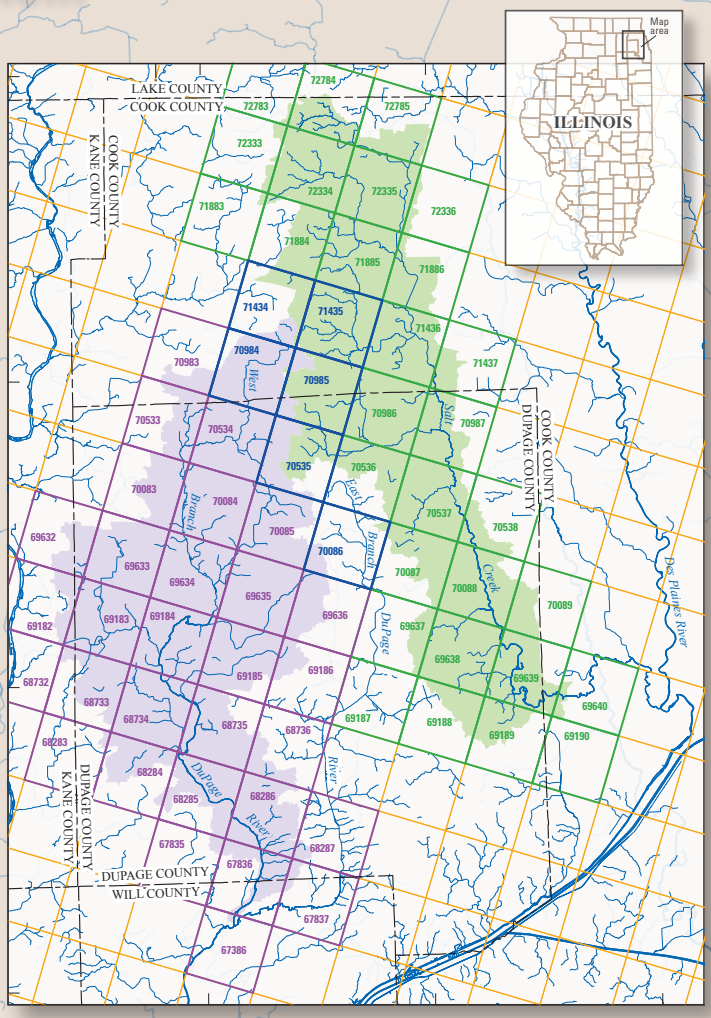
Processing of Next Generation Weather Radar-Multisensor Precipitation Estimates and Quantitative Precipitation Forecast Data for the DuPage County Streamflow Simulation System



Open-File Report 2017–1159

U.S. Department of the Interior
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Cover figure. The next generation weather radar (NEXRAD)-multisensor precipitation estimates (MPE) grid cells within the Salt Creek and West Branch DuPage River drainage basins in DuPage County, Illinois. (A detailed explanation may be found on page 2, figure 1.)

Processing of Next Generation Weather Radar-Multisensor Precipitation Estimates and Quantitative Precipitation Forecast Data for the DuPage County Streamflow Simulation System

By Maitreyee Bera and Terry Ortel

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U.S. Department of the Interior
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U.S. Department of the Interior
RYAN K. ZINKE, Secretary

U.S. Geological Survey
William H. Werkheiser, Deputy Director
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Tables

Conversion Factors

U.S. customary units to International System of Units

Multiply	By	To obtain
	Length	
foot (ft)	0.3048	meter (m)
mile (mi)	1.609	kilometer (km)
	Area	
square mile (mi^2)	259.0	hectare (ha)
square mile (mi^2)	2.590	square kilometer (km^2)

Datum

Horizontal coordinate information is referenced to the North American Datum of 1983 (NAD 83).

Abbreviations

DSN	dataset number
FEQ	Full Equations hydraulic model
HYDHR	Hydrologic Simulation Program–Fortran hourly observations
HSPF	Hydrologic Simulation Program–Fortran
MAGIC	meteorologic and hydrologic genscn (generate scenarios) input converter
MPE	multisensor precipitation estimates
NEXRAD	next generation weather radar
NWS	National Weather Service
QPF	quantitative precipitation forecast
UCI	user-control input
USGS	U.S. Geological Survey
WBDR	West Branch DuPage River
WDM	Watershed Data Management

Processing of Next Generation Weather Radar-Multisensor Precipitation Estimates and Quantitative Precipitation Forecast Data for the DuPage County Streamflow Simulation System

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Abstract

The U.S. Geological Survey, in cooperation with DuPage County Stormwater Management Department, is testing a near real-time streamflow simulation system that assists in the management and operation of reservoirs and other flood-control structures in the Salt Creek and West Branch DuPage River drainage basins in DuPage County, Illinois. As part of this effort, the U.S. Geological Survey maintains a database of hourly meteorological and hydrologic data for use in this near real-time streamflow simulation system. Among these data are next generation weather radar-multisensor precipitation estimates and quantitative precipitation forecast data, which are retrieved from the North Central River Forecasting Center of the National Weather Service. The DuPage County streamflow simulation system uses these quantitative precipitation forecast data to create streamflow predictions for the two simulated drainage basins. This report discusses in detail how these data are processed for inclusion in the Watershed Data Management files used in the streamflow simulation system for the Salt Creek and West Branch DuPage River drainage basins.

Introduction

The U.S. Geological Survey (USGS), in cooperation with the DuPage County Stormwater Management Department, is testing a coupled hydrologic and hydraulic routing model system for two drainage basins in DuPage County, Illinois—the Salt Creek (Ishii and others, 1998) and West Branch DuPage River (hereafter referred to as WBDR) (Ortel, 2015) (fig. 1). For the hydrologic modeling, the Hydrologic Simulation Program–Fortran (HSPF) is used (Bicknell and others, 2001). An hourly time step is used in the HSPF model simulation because the Salt Creek and WBDR are small drainage basins and include large areas of developed urban infrastructure.

The latest available data for next generation weather radar (NEXRAD)-multisensor precipitation estimates (MPE) data (National Weather Service, Advanced Hydrologic Prediction Service, 2017) and data from a tipping-bucket rain gage network are downloaded and stored in the database before running the hydrologic and hydraulic models. The rain gage network is operated by the USGS in cooperation with DuPage County Stormwater Management Department. These two precipitation inputs are supplemented with quantitative precipitation forecast (QPF) data for a period of up to 72 hours beyond the latest available data to create streamflow predictions for the two simulated drainage basins.

The National Weather Service (NWS) has provided NEXRAD–MPE data (National Weather Service, Advanced Hydrologic Prediction Service, 2017) from the Weather Surveillance Radar, 1988 Doppler (WSR–88D) network since the early 1990s (Kitzmiller and others, 2013). The NWS River Forecast Centers routinely use algorithms to combine radar precipitation estimates with rain gage measurements and satellite estimates. This MPE product maintains the high spatial and temporal resolution of the NEXRAD precipitation estimates while incorporating the accuracy of ground-based point observations. The River Forecast Centers produce and distribute the gridded MPE data hourly using a variety of formats. The GRIdded Binary formatted data (National Centers for Environmental Prediction, 2017) used in this report are distributed by the North Central River Forecast Center and use the Hydrologic Rainfall Analysis Project grid (Fulton, 1998).

The NWS QPF file used in the flood-simulation system contains the forecasted 6-hour precipitation totals and are typically available for 72 hours. The forecasted 6-hour precipitation totals are then distributed into hourly values using the meteorologic and hydrologic genscn (generate scenarios) input converter (MAGIC) (Ortel and Martin, 2010). The distributions are based on the 10-, 50-, and 90-percent probability distributions developed by Huff (1990).

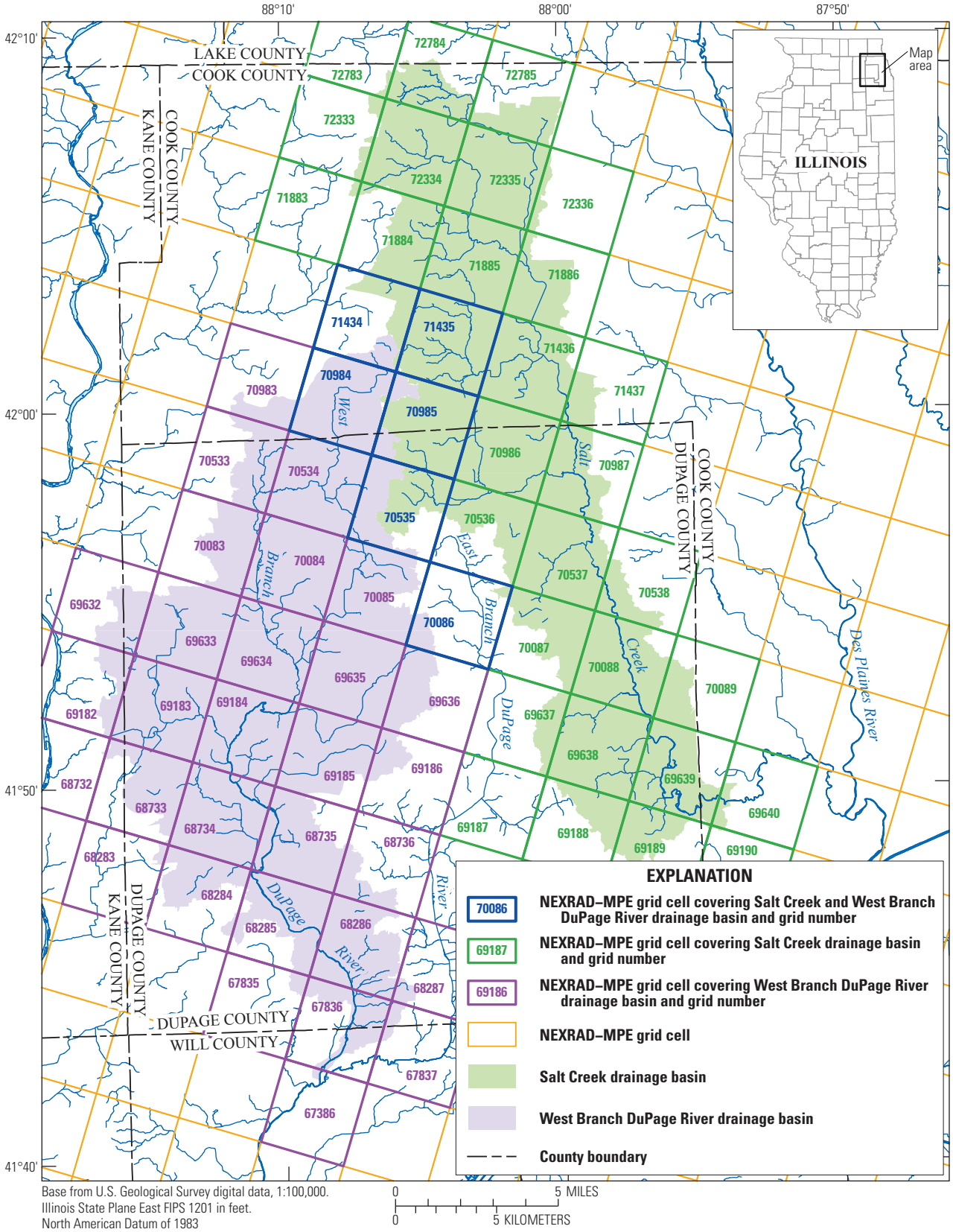

Figure 1. The next generation weather radar (NEXRAD)-multisensor precipitation estimates (MPE) grid cells within the Salt Creek and West Branch DuPage River drainage basins in DuPage County, Illinois.

Purpose and Scope

This report documents the processes used by the USGS to create basin-mean and subbasin-mean model-input precipitation time-series data using the NEXRAD–MPE product. The hydrologic rainfall-runoff model domain for the DuPage County simulation system is divided into subbasins based on the drainage basin and the available observed data (stage and discharge). For this reason, the NEXRAD–MPE gridded data are grouped into regional mean precipitation values, which can be interpreted as hypothetical rain gage measurements representing precipitation for a specific area of the drainage basin. These hypothetical rain gage precipitation measurement data are supplemented with NWS QPF data. These data are used in the DuPage County streamflow simulation system to produce streamflow forecasts across the region defined by the two drainage basins in DuPage County, Ill. This report focuses on the DuPage County, Ill., region, but the techniques used in this study can be applied to other areas planning to use NWS NEXRAD–MPE data in conjunction with the HSPF model.

Next Generation Weather Radar-Multisensor Precipitation Estimates

The HSPF uses a system of Watershed Data Management (WDM) files to store the meteorological and hydrologic data for input to the streamflow simulation system. To distinguish each basin or subbasin precipitation time series, a user-defined dataset number (DSN) is designated within the HSPF user-control input (UCI) files. Within the DuPage County HSPF modeling system, five UCI files and two WDM files are used for each basin to prepare the NEXRAD–MPE data and run the streamflow simulation with the NEXRAD–MPE data represented as a virtual rain gage. Of the two WDM files, one is used to upload the HSPF hourly-observations (HYDHR) formatted NEXRAD–MPE data (Bicknell and others, 2001). This process requires two UCI files for each basin. A third UCI file is used to store the user-defined NEXRAD–MPE data representing a virtual rain gage in the second WDM file. The fourth UCI file is used to append the QPF data to each of these new DSNs created in the second WDM file and, finally, the fifth UCI file pairs the preconfigured land use breakdown (pervious and impervious coverage) for each drainage basin subbasin to the corresponding NEXRAD–MPE DSN associated with each subbasin (fig. 1). The second WDM file is the primary file that contains the required meteorological and hydrologic data for the simulation. For simplicity, the NEXRAD–MPE data are processed separately for the two drainage basins in the DuPage County simulation system.

The NEXRAD–MPE data files are converted to HSPF HYDHR formatted data files and given the file extension (.hsp) as described in detail in Ortel and Spies (2015). The next step in preparing the NEXRAD–MPE data for use in a hydrologic simulation using HSPF is to assign a unique DSN to each HYDHR formatted file and upload those files to a WDM file. The unique DSN is assigned and the data are uploaded to the WDM file by using two UCI files for each basin. The DSNs containing the HYDHR formatted file in SALTNEXRAD.WDM for Salt Creek drainage basin are listed in appendix table 1–1, and the DSNs containing the HYDHR formatted file in WBNEXRAD.WDM for the WBDR drainage basin are listed in appendix table 1–2. These DSNs are grouped based on the user-specified or the drainage basin model-specified subbasin regions, and each NEXRAD–MPE grid cell is assigned a unique DSN. Within each subbasin, a NEXRAD grid cell is assigned a contribution factor based on the fraction of the cell area that is contained in the total subbasin area. The data associated with these new DSNs are appended to the primary WDM containing the other required meteorological and hydrologic data for the simulation, using the third UCI file. The DSNs and the contribution factors assigned to a NEXRAD grid cell for Salt Creek and WBDR drainage basins are listed in appendix tables 1–1 and 1–2, respectively. SEP11.WDM (Bera, 2014) and WBDR13.WDM (Bera, 2017) are the primary WDMs for the Salt Creek and the WBDR drainage basin, respectively. The fourth UCI file is used to append the QPF data to each of these new DSNs created in the primary WDM.

Finally, the fifth UCI file pairs the preconfigured land use breakdown (pervious and impervious coverage) for each drainage basin subbasin to the corresponding NEXRAD–MPE DSN associated with each subbasin (fig. 1). This UCI file contains other input information required to run the HSPF simulation, from which the final output is the rainfall-runoff time series that are input into the Full Equations (FEQ) hydraulic model (Franz and Melching, 1997).

Salt Creek Drainage Basin

The Salt Creek drainage basin has five USGS streamgages (site map identifiers A, B, C, D, and E [table 1; fig. 2]). This drainage basin is subdivided into five subbasins based on the five streamgages at the downstream end of each of the respective subbasins (fig. 2). These 5 subbasins are further subdivided to define 10 NEXRAD–MPE subbasins as listed in table 2, some of which are combinations of others. The subbasin B (DSN 802) is the combination of the two NEXRAD–MPE subbasins with DSNs 808 and 809. This subdivision is based on the Thiessen polygons using rain gages 45 and 70 (Bera, 2014). Similarly, the subbasin C (DSN 807) is the combination of the two NEXRAD–MPE subbasins with the DSNs 805 and 806. This subdivision is based on the Thiessen polygons using rain gages 29 and 50 (Bera, 2014). The DSNs corresponding to the ten NEXRAD–MPE subbasins and the contribution factors assigned to these subbasins are listed in appendix table 1–1, and the NEXRAD–MPE subbasins are shown in figure 2. The processed NEXRAD–MPE grid cell data associated with those DSNs are contained in SEP11.WDM (Bera, 2014).

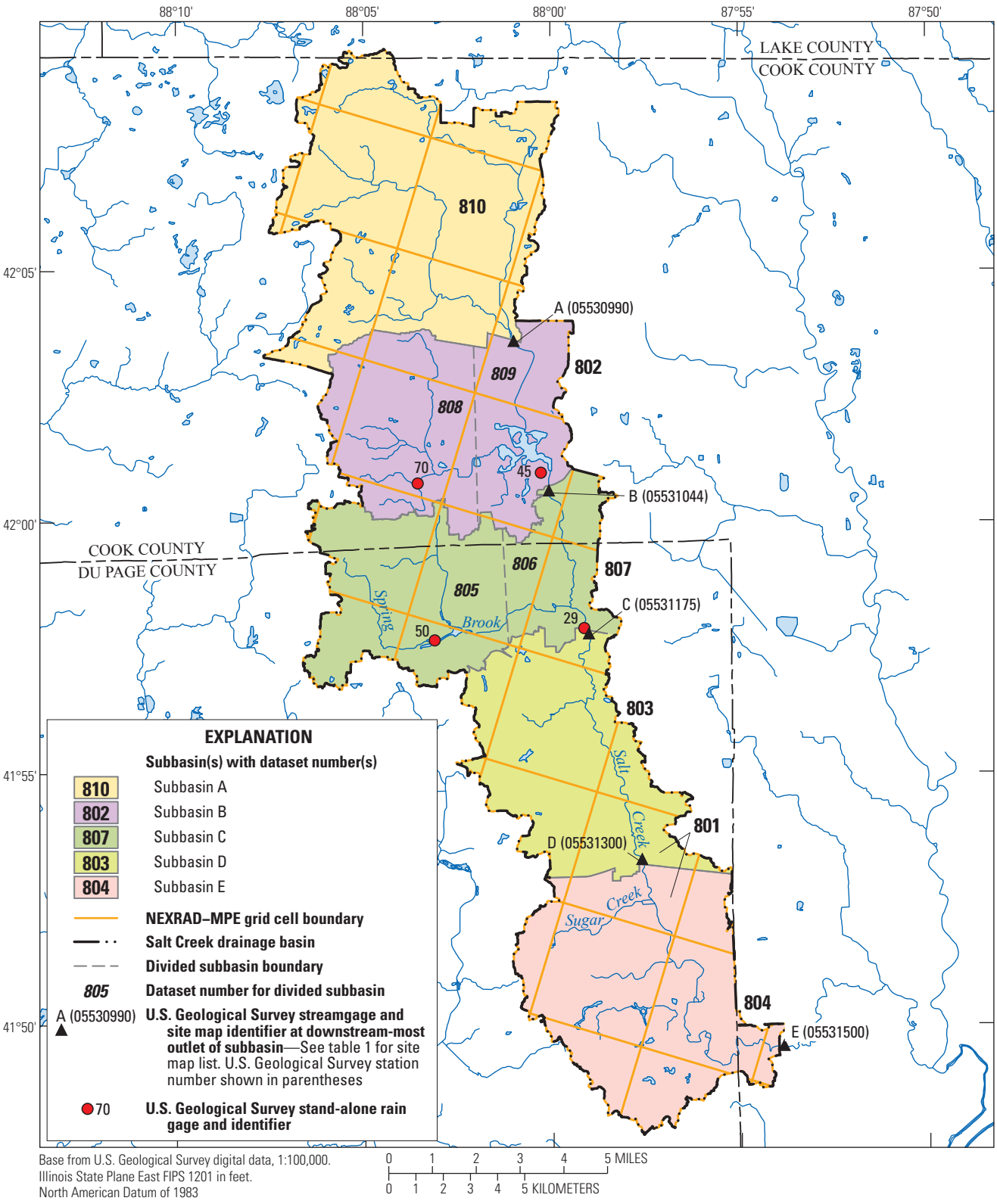

Figure 2. The next generation weather radar (NEXRAD)-multisensor precipitation estimates (MPE) subbasins and the corresponding assigned dataset numbers in the Salt Creek drainage basin in and near DuPage County, Illinois.

Table 1. U.S Geological Survey streamgages in Salt Creek drainage basin.

[USGS, U.S. Geological Survey]

Site map identifier (fig. 2)	Station name	USGS station number
A	Salt Creek at Rolling Meadows, Illinois	05530990
B	Salt Creek near Elk Grove Village, Illinois	05531044
C	Salt Creek at Wood Dale, Illinois	05531175
D	Salt Creek at Elmhurst, Illinois	05531300
E	Salt Creek at Western Springs, Illinois	05531500

Table 2. The next generation weather radar-multisensor precipitation estimates subbasins of the Salt Creek drainage basin and the corresponding dataset number.

[DSN, dataset number; NEXRAD, next generation weather radar; MPE, multisensor precipitation estimates. Subbasins A-D for corresponding streamgages listed in table 1]

DSN	NEXRAD–MPE subbasins	Area (square miles)
801	Total lower Salt Creek subbasin (DSN 803 plus DSN 804)	42.71
802	Subbasin B (DSN 808 plus DSN 809)	21.67
803	Subbasin D	18.75
804	Subbasin E	23.96
805	Subbasin C, Thiessen polygon corresponding to rain gage 50[1] (DSN 150)	14.74
806	Subbasin C, Thiessen polygon corresponding to rain gage 29[1] (DSN 129)	6.95
807	Subbasin C (DSN 805 plus DSN 806)	21.69
808	Subbasin B, Thiessen polygon corresponding to rain gage 70[1] (DSN 170)	13.06
809	Subbasin B, Thiessen polygon corresponding to rain gage 45[1] (DSN 145)	8.62
810	Subbasin A	30.44

[1]These rain gages are shown in figure 2 and the detail processing of the data from these rain gages in SEP11.WDM are described in Bera (2014).

West Branch DuPage River Drainage Basin

The WBDR drainage basin has four USGS streamgages (site map identifiers A, B, C, and D [table 3; fig 3]). This drainage basin is subdivided into 11 subbasins based on 8 tributaries, and the main stem is divided into 3 subbasins—upper, middle, and lower. The upper and middle main stem subbasins are based on the streamgage locations. These 11 subbasins are used as a guide to define 11 NEXRAD–MPE subbasins as listed in table 4 and shown in figure 3. The DSNs corresponding to the 11 NEXRAD–MPE subbasins and the contribution factors assigned to these subbasins are listed in appendix table 1–2. The DSNs 801 through 811 (table 4) contain the NEXRAD–MPE data from those 11 NEXRAD–MPE subbasins. The WDM file WBDR13.WDM (Bera, 2017) for the streamflow simulation system of the WBDR drainage basin contains the data associated with those DSNs.

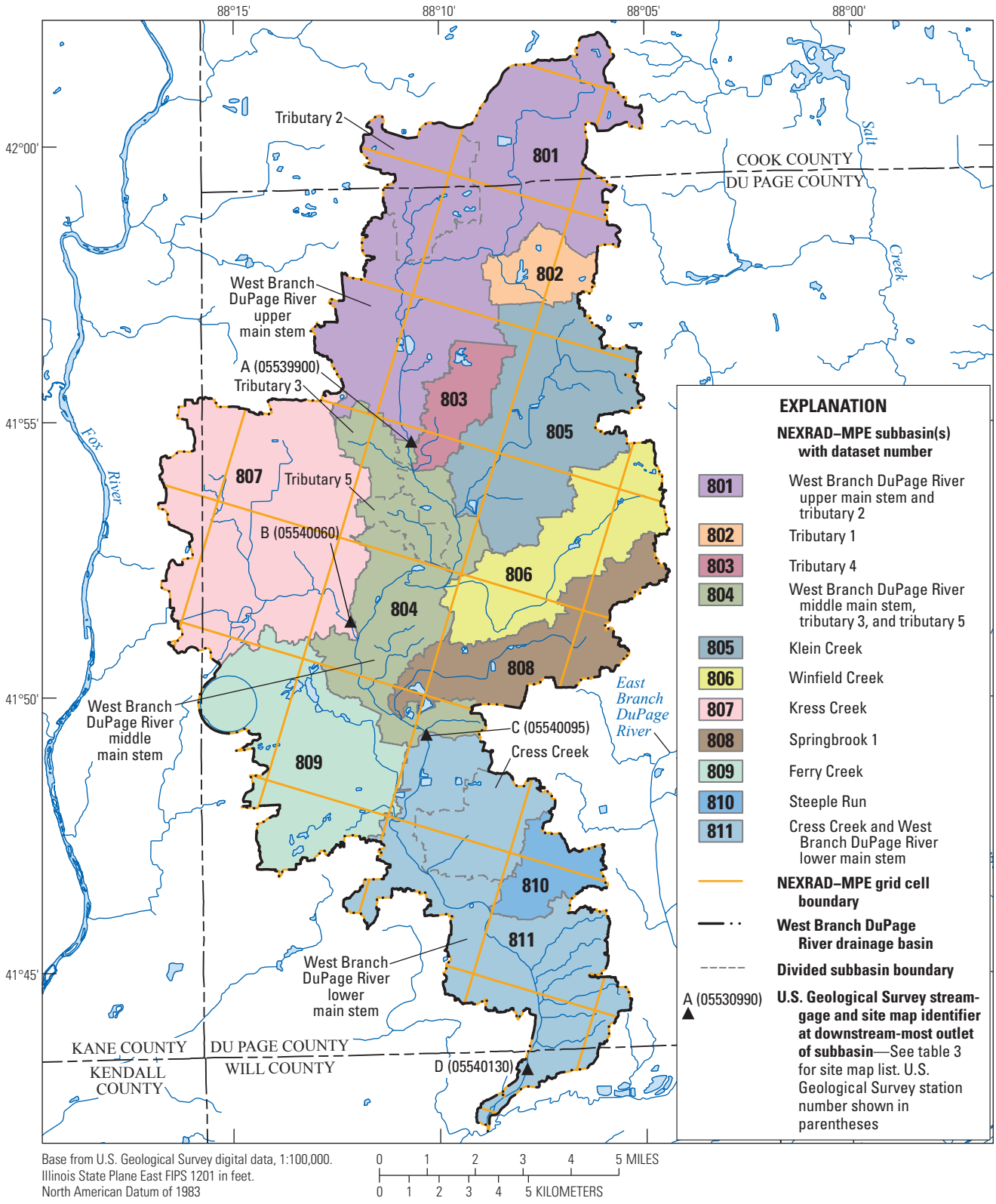

Figure 3. The next generation weather radar (NEXRAD)-multisensor precipitation estimates (MPE) subbasins and the corresponding assigned dataset numbers of the West Branch DuPage River drainage basin in and near DuPage County, Illinois.

Table 3. U.S Geological Survey streamgages in West Branch DuPage River drainage basin.

[USGS, U.S. Geological Survey; WBDR, West Branch DuPage River]

Site map identifier (fig. 3)	Station name	USGS station number
A	WBDR near West Chicago, Illinois	05539900
B	Kress Creek at West Chicago, Illinois	05540060
C	WBDR near Warrenville, Illinois	05540095
D	WBDR near Naperville, Illinois	05540130

Table 4. The next generation weather radar-multisensor precipitation estimates subbasins of the West Branch DuPage River drainage basin and the corresponding dataset number.

[DSN, dataset number; NEXRAD, next generation weather radar; MPE, multisensor precipitation estimates. WBDR, West Branch DuPage River]

DSN	NEXRAD–MPE subbasins	Area (square miles)
801	WBDR upper main stem and tributary 2	25.67
802	Tributary 1	2.69
803	Tributary 4	2.95
804	WBDR middle main stem, tributary 3 and tributary 5	12.73
805	Klein Creek	12.65
806	Winfield Creek	8.47
807	Kress Creek	18.93
808	Springbrook 1	7.69
809	Ferry Creek	12.38
810	Steeple Run	2.75
811	Cress Creek and WBDR lower main stem	18.96

Quantitative Precipitation Forecasts

The QPF data, produced by the NWS Weather Prediction Center, are used operationally by the River Forecast Centers to produce streamflow forecasts across the country. The DuPage County simulation system also uses these QPF data to create streamflow predictions for the two simulated drainage basins. The QPF product is distributed as a basin-mean time series (National Weather Service, North Central River Forecast Center, 2017b). The hydrologic forecast is provided at a location, along a river or stream, called a forecast point. The QPF data obtained for the DuPage County streamflow simulation system applies to the reach upstream from the North Central River Forecast Center forecast points WSPI2 and WRNI2 (National Weather Service, North Central River Forecast Center, 2017a). The USGS streamgage 05531500, Salt Creek at Western Springs, Ill., is represented by WSPI2 and the USGS streamgage 05540095, WBDR at Warrenville, Ill., is represented by WRNI2. The QPF data are lumped into 6-hour accumulated values and are typically available for 72 hours.

To incorporate the basin-mean QPF data into the DuPage County simulation system, MAGIC (Ortel and Martin, 2010) is used to distribute the 6-hour QPF total values into an hourly total value based on the method developed by Huff (1990). This hourly QPF precipitation value is then appended to each of the NEXRAD-derived DSNs corresponding to each subbasin groups in the Salt Creek and the WBDR drainage basins. This method allows for incorporation of the QPF data without changing the spatial configuration of the model.

Summary

Next generation weather radar-multisensor precipitation estimates data provide a high spatial and temporal resolution precipitation input for hydrologic streamflow simulations. This report documents the processes used by the U.S. Geological Survey to create basin-mean and subbasin model-input precipitation time-series data using the next generation weather radar-multisensor precipitation estimates product. Although this report focuses on the DuPage County, Illinois, region, the techniques used in this study can be applied to other areas planning to use National Weather Service next generation weather radar-multisensor precipitation estimates data within the Hydrologic Simulation Program–Fortran model.

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Appendix 1.

Table 1–1. Dataset number assigned to each next generation weather radar (NEXRAD)-multisensor precipitation estimates (MPE) grid cell and the fraction of the NEXRAD–MPE subbasin within the NEXRAD–MPE grid cell used for the contribution factor in Salt Creek drainage basin.

Table 1–2. Dataset number assigned to each next generation weather radar (NEXRAD)-multisensor precipitation estimates (MPE) grid cell and the fraction of the NEXRAD–MPE subbasin within the NEXRAD–MPE grid cell used for the contribution factor in West Branch DuPage River drainage basin.

Table 1–1. Dataset number assigned to each next generation weather radar (NEXRAD)-multisensor precipitation estimates (MPE) grid cell and the fraction of the NEXRAD–MPE subbasin within the NEXRAD–MPE grid cell used for the contribution factor in Salt Creek drainage basin.

[Grid cell numbers are shown in figure 1; DSN, dataset number]

NEXRAD–MPE subbasin DSN in Sep11.WDM		
NEXRAD–MPE grid cell number	**NEXRAD–MPE grid cell DSN in SALTNEXRAD.WDM**	**Fraction of the NEXRAD–MPE subbasin within the NEXRAD–MPE grid cell**
	DSN 801	
69187	8001	0.000012
69188	8002	0.048378
69189	8003	0.060054
69190	8004	0.000502
69637	8005	0.032361
69638	8006	0.162449
69639	8007	0.129109
69640	8008	0.012365
70086	8009	0.003373
70087	8010	0.091490
70088	8011	0.150487
70089	8012	0.044967
70536	8014	0.036188
70537	8015	0.155700
70538	8016	0.044622
70986	8019	0.001277
70987	8020	0.026666
	DSN 802	
70985	8018	0.047091
70986	8019	0.027096
71434	8021	0.054219
71435	8022	0.319419
71436	8023	0.274927
71437	8024	0.000006
71884	8026	0.010240
71885	8027	0.112729
71886	8028	0.154272
	DSN 803	
70086	8009	0.007685
70087	8010	0.198747
70088	8011	0.182799
70089	8012	0.008227
70536	8014	0.082452
70537	8015	0.354754
70538	8016	0.101668
70986	8019	0.002910
70987	8020	0.060758

Table 1–1. Dataset number assigned to each next generation weather radar (NEXRAD)-multisensor precipitation estimates (MPE) grid cell and the fraction of the NEXRAD–MPE subbasin within the NEXRAD–MPE grid cell used for the contribution factor in Salt Creek drainage basin.—Continued

[Grid cell numbers are shown in figure 1; DSN, dataset number]

NEXRAD–MPE subbasin DSN in Sep11.WDM		
NEXRAD–MPE grid cell number	**NEXRAD–MPE grid cell DSN in SALTNEXRAD.WDM**	**Fraction of the NEXRAD–MPE subbasin within the NEXRAD–MPE grid cell**
DSN 804		
69187	8001	0.000021
69188	8002	0.086219
69189	8003	0.107028
69190	8004	0.000895
69637	8005	0.057674
69638	8006	0.289517
69639	8007	0.230098
69640	8008	0.022038
70087	8010	0.007594
70088	8011	0.125211
70089	8012	0.073706
DSN 805		
70535	8013	0.191648
70536	8014	0.157372
70984	8017	0.004974
70985	8018	0.331222
70986	8019	0.311845
71435	8022	0.000559
71436	8023	0.002381
DSN 806		
70536	8014	0.000004
70986	8019	0.247169
70987	8020	0.443731
71436	8023	0.096206
71437	8024	0.212890
DSN 807		
70535	8013	0.130229
70536	8014	0.106939
70984	8017	0.003380
70985	8018	0.225073
70986	8019	0.291118
70987	8020	0.142205
71435	8022	0.000380
71436	8023	0.032450
71437	8024	0.068226

Table 1–1. Dataset number assigned to each next generation weather radar (NEXRAD)-multisensor precipitation estimates (MPE) grid cell and the fraction of the NEXRAD–MPE subbasin within the NEXRAD–MPE grid cell used for the contribution factor in Salt Creek drainage basin.—Continued

[Grid cell numbers are shown in figure 1; DSN, dataset number]

NEXRAD–MPE subbasin DSN in Sep11.WDM		
NEXRAD–MPE grid cell number	**NEXRAD–MPE grid cell DSN in SALTNEXRAD.WDM**	**Fraction of the NEXRAD–MPE subbasin within the NEXRAD–MPE grid cell**
DSN 808		
70985	8018	0.078168
70986	8019	0.029170
71434	8021	0.089999
71435	8022	0.530200
71436	8023	0.084329
71884	8026	0.016998
71885	8027	0.171137
DSN 809		
70986	8019	0.023954
71435	8022	0.000014
71436	8023	0.563748
71437	8024	0.000016
71885	8027	0.024222
71886	8028	0.388046
DSN 810		
71434	8021	0.021510
71883	8025	0.003663
71884	8026	0.121880
71885	8027	0.148594
71886	8028	0.016629
72333	8029	0.019916
72334	8030	0.226214
72335	8031	0.229004
72336	8032	0.020288
72783	8033	0.005616
72784	8034	0.101032
72785	8035	0.085655

Table 1–2. Dataset number assigned to each next generation weather radar (NEXRAD)-multisensor precipitation estimates (MPE) grid cell and the fraction of the NEXRAD–MPE subbasin within the NEXRAD–MPE grid cell used for the contribution factor in West Branch DuPage River drainage basin.

[Grid cell numbers are shown in figure 1; DSN, dataset number]

NEXRAD–MPE subbasin DSN in WBDR13.WDM		
NEXRAD–MPE grid cell number	**NEXRAD–MPE grid cell DSN in WBNEXRAD.WDM**	**Fraction of the NEXRAD–MPE subbasin within the NEXRAD–MPE grid cell**
DSN 801		
71435	9036	0.000816
71434	9035	0.035421
70983	9034	0.052576
70984	9033	0.248382
70985	9032	0.041879
70533	9031	0.130459
70534	9030	0.188894
70535	9029	0.028421
70083	9028	0.135316
70084	9027	0.125707
69633	9023	0.003822
69634	9022	0.008307
DSN 802		
70534	9030	0.65875
70535	9029	0.34125
DSN 803		
70084	9027	0.8139
69634	9022	0.1861
DSN 804		
70084	9027	0.00095
70083	9028	0.00542
69633	9023	0.04913
69634	9022	0.36301
69635	9021	0.02331
69184	9017	0.37942
69185	9016	0.01118
68734	9012	0.10051
68735	9011	0.06707
DSN 805		
70534	9030	0.03169
70535	9029	0.08632
70084	9027	0.10872
70085	9026	0.46808
69634	9022	0.08788
69635	9021	0.21731

Table 1–2. Dataset number assigned to each next generation weather radar (NEXRAD)-multisensor precipitation estimates (MPE) grid cell and the fraction of the NEXRAD–MPE subbasin within the NEXRAD–MPE grid cell used for the contribution factor in West Branch DuPage River drainage basin.—Continued

[Grid cell numbers are shown in figure 1; DSN, dataset number]

NEXRAD–MPE subbasin DSN in WBDR13.WDM		
NEXRAD–MPE grid cell number	**NEXRAD–MPE grid cell DSN in WBNEXRAD.WDM**	**Fraction of the NEXRAD–MPE subbasin within the NEXRAD–MPE grid cell**
DSN 806		
70085	9026	0.05163
70086	9025	0.08968
69635	9021	0.43004
69636	9020	0.15587
69184	9017	0.01636
69185	9016	0.2564
DSN 807		
70083	9028	0.005
69632	9024	0.11803
69633	9023	0.30765
69634	9022	0.02525
69182	9019	0.08113
69183	9018	0.35305
69184	9017	0.07444
68732	9014	0.00106
68733	9013	0.03439
DSN 808		
69635	9021	0.04094
69636	9020	0.18933
69184	9017	0.06405
69185	9016	0.49767
69186	9015	0.16319
68734	9012	0.03474
68735	9011	0.01008
DSN 809		
69183	9018	0.02575
69184	9017	0.00787
68733	9013	0.26725
68734	9012	0.43853
68735	9011	0.00804
68283	9009	0.0147
68284	9008	0.23769
68285	9007	0.00017

Table 1–2. Dataset number assigned to each next generation weather radar (NEXRAD)-multisensor precipitation estimates (MPE) grid cell and the fraction of the NEXRAD–MPE subbasin within the NEXRAD–MPE grid cell used for the contribution factor in West Branch DuPage River drainage basin.—Continued

[Grid cell numbers are shown in figure 1; DSN, dataset number]

NEXRAD–MPE subbasin DSN in WBDR13.WDM		
NEXRAD–MPE grid cell number	**NEXRAD–MPE grid cell DSN in WBNEXRAD.WDM**	**Fraction of the NEXRAD–MPE subbasin within the NEXRAD–MPE grid cell**
	DSN 810	
68736	9010	0.40796
68285	9007	0.00323
68286	9006	0.58881
	DSN 811	
68734	9012	0.00063
68735	9011	0.24416
68736	9010	0.02735
68284	9008	0.01167
68285	9007	0.25635
68286	9006	0.23808
68287	9005	0.02198
67835	9004	0.0164
67836	9003	0.15453
67837	9002	0.0237
67386	9001	0.00514

For more information about this publication, contact
Director, Illinois Water Science Center
U.S. Geological Survey
405 North Goodwin Avenue
Urbana, IL 61801-2347
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