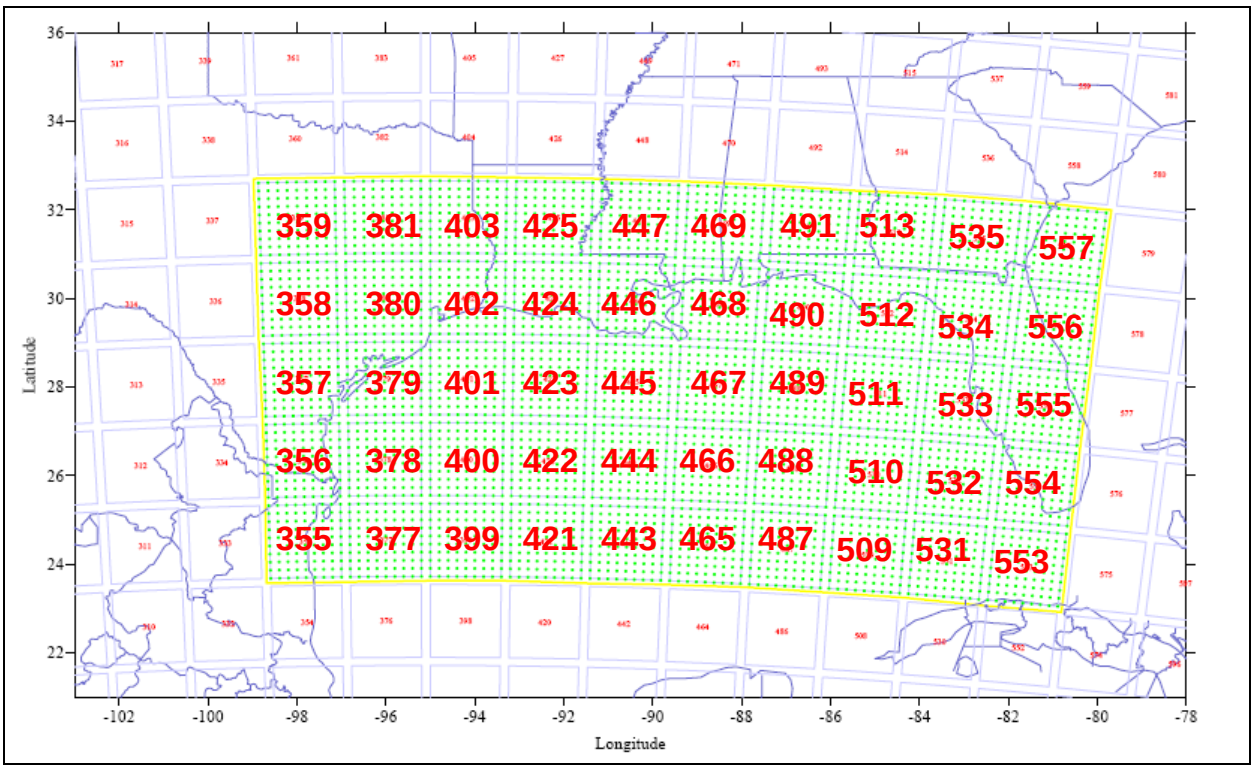
OCS Study
MMS 2008-029

Five-Year Meteorological Datasets for CALMET/CALPUFF and OCD5 Modeling of the Gulf of Mexico Region



U.S. Department of the Interior
Minerals Management Service
Gulf of Mexico OCS Region

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Five-Year Meteorological Datasets for CALMET/CALPUFF and OCD5 Modeling of the Gulf of Mexico Region

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ABOUT THE COVER

The graphic on the cover depicts the location and numbering scheme of the RUC tiles contained in the GOM 5-year dataset. (Source: Earth Tech, Inc., 2006)

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1.0 INTRODUCTION

The Minerals Management Service (MMS) is the designated federal agency with the authority to regulate oil and gas exploration and development activities in the central and western planning areas of the Gulf of Mexico Outer Continental Shelf (OCS) region. In addition to managing oil and gas resources in the region, the MMS is also charged with environmental management responsibilities, including those related to air quality. The National Environmental Policy Act (NEPA) mandates the type of environmental reviews or assessments that need to be conducted in the area to assess potential on-shore air quality impacts of exploration, development, production, and pipeline right of way activities. Some assessments require the application of air quality dispersion models to evaluate potential impacts. Such analyses in the past were conducted using the updated Offshore and Coastal Dispersion (OCD5) model and often relied on a pre-processed, two-year meteorological dataset (1991-1993) as input. This dataset is now somewhat outdated. MMS expects that future air quality modeling efforts will rely on more recent and comprehensive datasets that include onshore surface and upper-air data, offshore buoy data, and output from prognostic meteorological models. MMS also plans to adopt the use of the EPA-approved CALMET/CALPUFF Version 5.8 modeling system (dated June 23, 2007). In this study, we have prepared an up-to-date five-year meteorological dataset for the Gulf of Mexico OCS region that can be used to run air quality models for a variety of environmental assessments. Geographically, the dataset covers the Gulf of Mexico (GOM) region, including both onshore and offshore areas. Given the disruption (to environmental monitors and activities) in the GOM caused by Hurricanes Katrina and Rita in late August 2005, the data were prepared for the period 2000-2004.

The five-year dataset consists of two subsets of files. One set of files is formatted for use with the CALMET/CALPUFF modeling system (Earth Tech, 2006). The CALMET/CALPUFF input data files were constructed using a combination of onshore surface and upper-air data from the National Weather Service (NWS), offshore buoy data from the National Data Buoy Center (NDBC), and model output from the Rapid Update Cycle (RUC) model. Ozone data were also compiled as part of this dataset and these data were obtained from the EPA Air Quality System (AQS).

The second set of files is formatted for use with the updated Offshore Coastal Dispersion (OCD5) model (Chang and Hahn, 1997). The OCD5 files were prepared using onshore surface and upper-air data from the NWS, mixing height estimates obtained from the National Climatic Data Center (NCDC), and offshore buoy data from the NDBC.

The datasets are intended for use by MMS and the OCS oil-gas, sand-gravel or alternative energy industry to assess potential impacts of future offshore oil and gas development in the GOM region, using either the CALMET/CALPUFF or OCD5 modeling systems. The data, data processing methods, quality assurance procedures, and output file formats and contents are described in the remainder of this report.

2.0 SURFACE, UPPER-AIR, BUOY, PRECIPITATION, AND OZONE DATASETS FOR USE WITH CALMET/CALPUFF

The database discussed in this section supplements the CALMET/CALPUFF input data set for 2003 that is described in detail by Earth Tech (2006). In preparing the meteorological and ozone datasets for use with the CALMET/CALPUFF modeling system, we followed the procedures established by Earth Tech and outlined in their report. Since the files for 2003 had been prepared as part of this previous study, the files prepared for this study are for 2000-2002 and 2004 only. For consistency with the 2003 dataset, we included the same sites as for 2003. Note, however, that, in some cases, data availability does vary from year to year.

2.1. SURFACE METEOROLOGICAL DATA

Surface meteorological data are used by CALMET to generate gridded fields of near surface meteorological conditions including wind, temperature, and cloud-cover fields and to calculate a variety of boundary layer and dispersion parameters (using wind speed, cloud cover, and ground surface characteristics). In this study, the surface meteorological data files contain data for onshore sites only. Offshore data are contained in the buoy data files, which are discussed in Section 2.3.

2.1.1. Surface Sites and Data Availability

The surface meteorological data files for 2000-2004 include hourly data for 230 NWS surface monitoring sites. The sites are listed in Table 1 and the locations of the sites are displayed in Figure 1. Note that the table and plot are from the original data compilation report (Earth Tech, Inc., 2006). In Figure 1, the area outlined in yellow is the primary area of interest for this study. Although some sites are outside this area, data from these sites may still be included in the CALMET interpolation schemes used to prepare the gridded input fields. The parameters included in the data files are:

- Wind speed (ms^{-1})
- Wind direction (degrees)
- Ceiling height (hundreds of feet)
- Opaque sky cover (tenths)
- Temperature (K)
- Relative humidity (percent)
- Station pressure (mb)
- Precipitation code indicating no precipitation or type of precipitation (unitless).

The units for each parameter are given in parentheses.

Table 1

List of Surface Meteorological Monitoring Sites for the GOM 5-Year Dataset.

WBAN # (if applicable)	Station ID	Station Name	State	Lat (deg)	Lon (deg)	Elev (m)
13894	KMOB	MOBILE REGIONAL AP	AL	30.683	-88.250	65.5
13838	KBFM	MOBILE DOWNTOWN AP	AL	30.633	-88.067	7.9
13895	KMGM	MONTGOMERY DANNELLY FIELD	AL	32.300	-86.400	61.6
13821	KMXF	MAXWELL AFB	AL	32.383	-86.350	53.0
3878	KTOI	TROY AF	AL	31.867	-86.017	120.1
	KDHN	DOTHAN MUNICIPAL	AL	31.317	-85.450	97.8
3850	KOZR	CAIRNS FIELD FORT RUCKER	AL	31.267	-85.717	91.1
	K79J	ANDALUSIA/OPP ARPT	AL	31.317	-86.400	94.0
	KGZH	EVERGREEN	AL	31.417	-87.050	78.0
13876	KBHM	BIRMINGHAM MUNICIPAL AP	AL	33.567	-86.750	189.0
	KAUO	AUBURN-OPELIKA APT	AL	32.616	-85.433	236.0
93806	KTCL	TUSCALOOSA MUNICIPAL AP	AL	33.217	-87.617	51.2
13871	KANB	ANNISTON METROPOLITAN AP	AL	33.583	-85.850	186.2
53864	KEET	SHELBY CO ARPT	AL	33.167	-86.767	178.0
	DPIA1	DAUPHIN ISLAND	AL	30.250	-88.083	8.0
13977	KTXK	TEXARKANA WEBB FIELD	AR	33.450	-94.000	110.0
93992	KELD	EL DORADO GOODWIN FIELD	AR	33.217	-92.817	76.8
	KLLQ	MONTICELLO MUNI	AR	33.567	-91.717	36.0
12836	KEYW	KEY WEST INTL ARPT	FL	24.550	-81.750	1.2
	KISM	ORLANDO/KISSIMMEE	FL	28.283	-81.433	25.0
	KVVG	THE VILLAGES	FL	28.950	-81.850	27.0
	KBKV	BROOKSVILLE	FL	28.467	-82.450	23.0
12850	KNQX	KEY WEST NAS	FL	24.583	-81.683	7.0
	KMTH	MARATHON AIRPORT	FL	24.733	-81.050	2.0
12839	KMIA	MIAMI INTL AP	FL	25.817	-80.300	10.7
	KVDF	TAMPA/VANDENBURG	FL	28.017	-82.350	7.0
	KBCT	BOCA RATON	FL	26.383	-80.100	4.0
	KOPF	MIAMI/OPA LOCKA	FL	25.900	-80.283	3.0
12849	KFLL	FORT LAUDERDALE HOLLYWOOD INT	FL	26.067	-80.150	3.4
12826	KHST	HOMESTEAD AFB	FL	25.483	-80.383	4.9
	KTMB	MIAMI/KENDALL-TAMIA	FL	25.650	-80.433	3.0
12844	KPBI	WEST PALM BEACH INTL ARPT	FL	26.683	-80.100	5.5
	KPGD	PUNTA GORDA	FL	26.917	-81.983	7.0
	KHWO	HOLLYWOOD/N. PERRY	FL	26.000	-80.233	3.0
12897	KAPF	NAPLES MUNICIPAL	FL	26.150	-81.767	3.0

WBAN # (if applicable)	Station ID	Station Name	State	Lat (deg)	Lon (deg)	Elev (m)
	KFXE	FORT LAUDERDALE	FL	26.200	-80.167	4.0
12838	KMLB	MELBOURNE REGIONAL	FL	28.100	-80.650	10.7
12843	KVRB	VERO BEACH MUNICIPAL ARPT	FL	27.650	-80.417	7.3
	KTIX	TITUSVILLE	FL	28.517	-80.800	11.0
	KPMP	POMPANO BEACH	FL	26.233	-80.100	6.0
12815	KMCO	ORLANDO INTL ARPT	FL	28.433	-81.333	29.3
12841	KORL	ORLANDO EXECUTIVE AP	FL	28.550	-81.333	32.9
	KOCF	OCALA MUNI (AWOS)	FL	29.167	-82.217	27.0
12834	KDAB	DAYTONA BEACH INTL AP	FL	29.183	-81.067	8.8
12854	KSFB	ORLANDO SANFORD AIRPORT	FL	28.783	-81.250	16.8
13889	KJAX	JACKSONVILLE INTL ARPT	FL	30.500	-81.700	7.9
93837	KNIP	JACKSONVILLE NAS	FL	30.233	-81.667	9.1
3853	KNRB	MAYPORT NS	FL	30.400	-81.417	4.9
93832	KNZC	JACKSONVILLE CECIL FLD NAS	FL	30.217	-81.883	27.1
	KCRG	JACKSONVILLE/CRAIG	FL	30.333	-81.517	12.0
	KFPR	FT PIERCE/ST LUCIE	FL	27.500	-80.367	7.0
92806	KSPG	ST PETERSBURG ALBERT WHITTED	FL	27.767	-82.633	2.4
12835	KFMY	FORT MYERS PAGE FIELD	FL	26.583	-81.867	4.6
	KRSW	FT MYERS/SW FLORIDA	FL	26.533	-81.750	9.0
12842	KTPA	TAMPA INTERNATIONAL AP	FL	27.967	-82.533	5.8
	KSRQ	SARASOTA-BRADENTON	FL	27.400	-82.550	9.0
	KPIE	SAINT PETERSBURG	FL	27.917	-82.683	3.0
	KLAL	LAKELAND REGIONAL	FL	27.983	-82.017	43.0
12833	KCTY	CROSS CITY AIRPORT	FL	29.617	-83.100	11.6
	KBOW	BARTOW MUNICIPAL	FL	27.950	-81.783	39.0
93805	KTLH	TALLAHASSEE REGIONAL AP	FL	30.400	-84.350	16.8
12816	KGNV	GAINESVILLE REGIONAL AP	FL	29.700	-82.283	40.8
12832	KAQQ	APALACHICOLA MUNI AP	FL	29.733	-85.033	6.1
13858	KVPS	VALPARAISO ELGIN AFB	FL	30.483	-86.517	20.1
	KSGJ	ST AUGUSTINE ARPT	FL	29.967	-81.333	3.0
	KLEE	LEESBURG MUNI ARPT	FL	28.817	-81.800	23.0
13884	KCEW	CRESTVIEW BOB SIKES AP	FL	30.783	-86.517	57.9
13899	KPNS	PENSACOLA REGIONAL AP	FL	30.483	-87.183	34.1
	K40J	PERRY FOLEY ARPT	FL	30.067	-83.567	13.0
3855	KNPA	PENSACOLA FOREST SHERMAN NAS	FL	30.350	-87.317	10.1
93841	KNSE	WHITING FIELD NAAS	FL	30.717	-87.017	53.9
	KPFN	PANAMA CITY/BAY CO.	FL	30.217	-85.683	6.0
	KEGI	DUKE FLD/EGLIN AUX	FL	30.650	-86.517	57.9

WBAN # (if applicable)	Station ID	Station Name	State	Lat (deg)	Lon (deg)	Elev (m)
13846	KPAM	TYNDALL AFB	FL	30.067	-85.583	7.0
3818	KMAI	MARIANNA	FL	30.833	-85.183	34.0
3852	KHRT	VALPARAISO HURLBURT	FL	30.417	-86.683	11.9
12810	KMCF	MACDILL AFB	FL	27.850	-82.517	7.9
	KGIF	WINTERHAVEN	FL	28.050	-81.750	44.0
	KTTS	NASA SHUTTLE FCLTY	FL	28.617	-80.717	3.0
12867	KCOF	COCOA BEACH PATRICK AFB	FL	28.233	-80.600	3.0
	LKWF1	LAKE WORTH	FL	26.617	-80.033	6.0
	VENF1	VENICE PIER	FL	27.067	-82.450	4.0
	CSBF1	CAPE SAN BLAS	FL	29.667	-85.367	2.0
	SPGF1	SETTLEMENT POINT	FL	26.683	-79.000	2.0
	SAUF1	ST. AUGUSTINE	FL	29.867	-81.267	8.0
	MLRF1	MOLASSES REEF	FL	25.017	-80.383	0.0
	SMKF1	SOMBRERO KEY	FL	24.633	-81.133	0.0
	FWYF1	FOWEY ROCKS	FL	25.583	-80.100	29.0
	SANF1	SAND KEY	FL	24.467	-81.883	6.0
	LONF1	LONG KEY	FL	24.833	-80.867	6.0
	DRYF1	DRY TORTUGAS	FL	24.633	-82.867	5.0
	CDRF1	CEDAR KEY	FL	29.133	-83.033	3.0
	KTNF1	KEATON BEACH	FL	29.817	-83.583	3.0
	KDTS	DESTIN FT. WALTON	GA	30.400	-86.467	7.0
3822	KSAV	SAVANNAH INTL AP	GA	32.117	-81.200	14.0
	KLHW	FT STEWART/WRIGHT	GA	31.883	-81.567	14.0
13861	KAYS	WAYCROSS WARE CO AP	GA	31.250	-82.400	42.7
	KVDI	VIDALIA MUNI ARPT	GA	32.183	-82.367	84.0
13870	KAMG	ALMA BACON COUNTY AP	GA	31.533	-82.500	62.8
	KBQK	BRUNSWICK/GLYNCO	GA	31.250	-81.467	8.0
13878	KSSI	BRUNSWICK MALCOLM MCKINNON AP	GA	31.150	-81.383	4.3
13869	KABY	ALBANY DOUGHERTY COUNTY AP	GA	31.533	-84.183	57.9
93845	KVLD	VALDOSTA WB AIRPORT	GA	30.783	-83.283	61.0
3813	KMCN	MACON MIDDLE GA REGIONAL AP	GA	32.683	-83.650	107.9
13860	KWRB	WARNER ROBINS AFB	GA	32.633	-83.600	92.0
	KCCO	NEWNAN	GA	33.317	-84.767	296.0
3820	KAGS	AUGUSTA BUSH FIELD	GA	33.367	-81.967	40.2
	KDNL	AUGUSTA\DANIEL FLD	GA	33.466	-82.033	134.0
	KFFC	ATLANTA (NEXRAD)	GA	33.367	-84.550	296.0
	KLSF	FORT BENNING	GA	32.333	-85.000	88.1
93842	KCSG	COLUMBUS METROPOLITAN ARPT	GA	32.517	-84.950	119.5

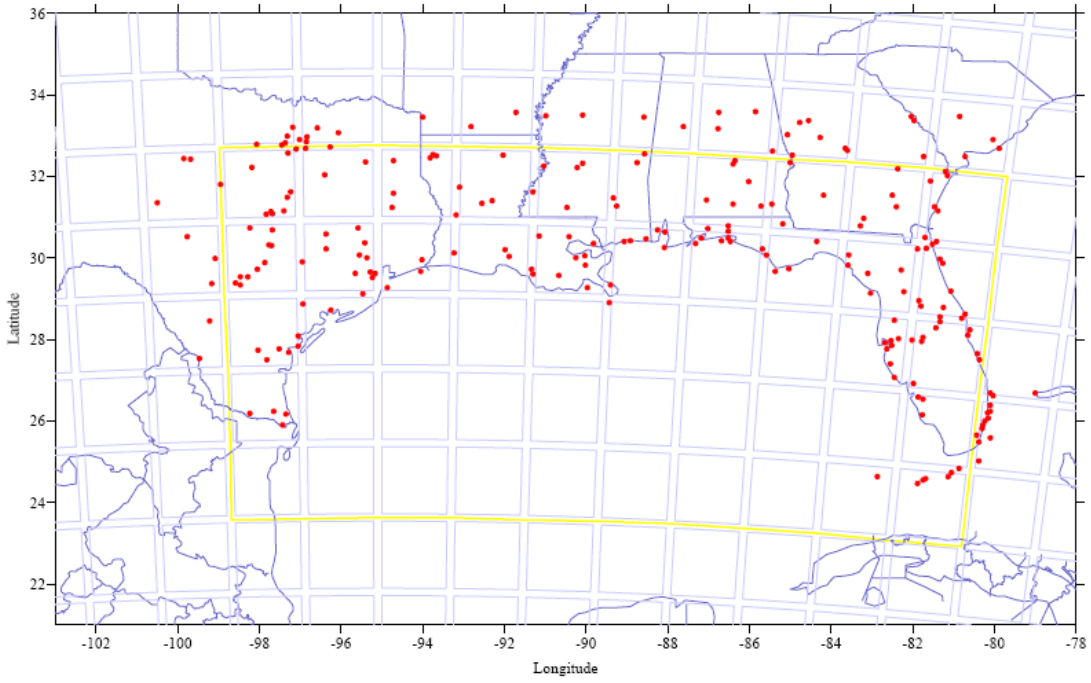
WBAN # (if applicable)	Station ID	Station Name	State	Lat (deg)	Lon (deg)	Elev (m)
	KSVN	HUNTER (AAF)	GA	32.017	-81.150	13.0
	KTBR	STATESBORO	GA	32.482	-81.733	57.0
	KOPN	THOMASTON	GA	32.950	-84.267	243.0
	KLGC	LA GRANGE	GA	33.017	-85.067	211.0
	KVAD	MOODY AFB/VALDOSTA	GA	30.967	-83.200	71.0
12916	KMSY	NEW ORLEANS INTL ARPT	LA	30.000	-90.250	1.2
	KHDC	HAMMOND	LA	30.517	-90.417	13.0
3934	KARA	NEW IBERIA NAAS	LA	30.033	-91.883	7.9
53917	KNEW	NEW ORLEANS LAKEFRONT AP	LA	30.050	-90.033	2.7
12958	KNBG	NEW ORLEANS ALVIN CALLENDER F	LA	29.817	-90.017	1.5
13970	KBTR	BATON ROUGE RYAN ARPT	LA	30.533	-91.150	19.5
	KIER	NATCHITOCHES	LA	31.733	-93.100	37.0
12884	BVE	BOOTHVILLE WSCMO CIT	LA	29.333	-89.400	0.0
	KPTN	PATTERSON MEMORIAL	LA	29.717	-91.333	3.0
	KASD	SLIDELL	LA	30.350	-89.817	8.0
3931	KPOE	FORT POLK AAF	LA	31.050	-93.183	102.1
3937	KLCH	LAKE CHARLES REGIONAL ARPT	LA	30.117	-93.233	4.6
	KP92	SALT POINT (RAMOS)	LA	29.600	-91.300	3.0
13976	KLFT	LAFAYETTE REGIONAL AP	LA	30.200	-91.983	11.6
	KHUM	HOUMA-TERREBONNE	LA	29.567	-90.667	3.0
13957	KSHV	SHREVEPORT REGIONAL ARPT	LA	32.450	-93.817	77.4
53905	KDTN	SHREVEPORT DOWNTOWN	LA	32.533	-93.750	55.0
13944	KBAD	BARKSDALE AFB	LA	32.500	-93.667	53.9
13942	KMLU	MONROE REGIONAL AP	LA	32.517	-92.033	40.5
13935	KESF	ALEXANDRIA ESLER REGIONAL AP	LA	31.400	-92.300	34.1
	KTVR	VICKSBURG\TALLULAH	LA	32.250	-91.033	23.0
	KAEX	ALEXANDRIA INT	LA	31.333	-92.550	27.1
	BURL1	SOUTHWEST PASS	LA	28.900	-89.433	0.0
	GDIL1	GRAND ISLE	LA	29.267	-89.967	2.0
13865	KMEI	MERIDIAN KEY FIELD	MS	32.333	-88.750	89.6
3866	KNMM	MERIDIAN NAAS	MS	32.550	-88.567	82.6
	HBG	HATTIESBURG MUNI	MS	31.267	-89.250	46.0
	KPIB	PINE BELT RGNL AWOS	MS	31.467	-89.333	91.0
3940	KJAN	JACKSON INTERNATIONAL AP	MS	32.317	-90.083	94.5
	KHKS	HAWKINS FIELD	MS	32.213	-90.217	104.0
13939	KGLH	GREENVILLE MUNICIPAL	MS	33.483	-90.983	42.1
	KHEZ	NATCHEZ/HARDY(AWOS)	MS	31.617	-91.300	83.0
93919	KMCB	MCCOMB PIKE COUNTY AP	MS	31.233	-90.467	125.9

WBAN # (if applicable)	Station ID	Station Name	State	Lat (deg)	Lon (deg)	Elev (m)
13978	KGWO	GREENWOOD LEFLORE ARPT	MS	33.500	-90.083	47.2
	KGTR	GOLDEN TRI(AWOS)	MS	33.450	-88.583	80.0
	KGPT	GULFPORT-BILOXI	MS	30.400	-89.067	9.0
13820	KBIX	KEESLER AFB	MS	30.417	-88.917	7.9
	KPQL	PASCAGOULA	MS	30.467	-88.533	5.0
13880	KCHS	CHARLESTON INTL ARPT	SC	32.900	-80.033	12.2
93831	KNBC	BEAUFORT MCAS	SC	32.483	-80.717	10.1
53854	KOGB	ORANGEBURG	SC	33.467	-80.850	60.0
	FBIS1	FOLLY ISLAND	SC	32.683	-79.883	3.0
13910	KDYS	ABILENE DYESS AFB	TX	32.433	-99.850	545.0
12917	KBPT	PORT ARTHUR JEFFERSON COUNTY	TX	29.950	-94.017	4.9
12971	KBAZ	NEW BRAUNFELS	TX	29.717	-98.050	197.0
12923	KGLS	GALVESTON/SCHOLES	TX	29.267	-94.867	2.0
	KLVJ	HOUSTON/CLOVER FLD	TX	29.517	-95.233	13.0
	KDWH	HOUSTON/D.W. HOOKS	TX	30.067	-95.550	46.0
12960	KIAH	HOUSTON BUSH INTERCONTINENTAL	TX	30.000	-95.367	29.0
12918	KHOU	HOUSTON WILLIAM P HOBBY AP	TX	29.650	-95.283	13.4
12906	KEFD	HOUSTON ELLINGTON AFB	TX	29.617	-95.167	11.9
	KCXO	CONROE	TX	30.367	-95.417	75.0
3904	KCLL	COLLEGE STATION EASTERWOOD FL	TX	30.583	-96.367	95.7
93987	KLFK	LUFKIN ANGELINA CO	TX	31.233	-94.750	85.6
	KUTS	HUNTSVILLE	TX	30.733	-95.583	111.0
13972	KTYR	TYLER/POUNDS FLD	TX	32.350	-95.400	166.0
	KCRS	CORSICANA	TX	32.033	-96.400	136.0
3901	KGGG	LONGVIEW GREGG COUNTY AP	TX	32.383	-94.717	124.0
	KGKY	ARLINGTON	TX	32.667	-97.100	192.0
	KTRL	TERRELL	TX	32.717	-96.267	144.0
	KOCH	NACOGDOCHES (AWOS)	TX	31.583	-94.717	108.0
12919	KBRO	BROWNSVILLE S PADRE ISL INTL	TX	25.900	-97.433	5.8
12904	KHRL	HARLINGEN RIO GRANDE VALLEY I	TX	26.233	-97.650	10.4
12959	KMFE	MCALLEN MILLER INTL AP	TX	26.183	-98.233	30.5
	KPIL	PORT ISABEL/CAMERON	TX	26.167	-97.350	5.8
12924	KCRP	CORPUS CHRISTI INTL ARPT	TX	27.767	-97.517	13.4
12926	KNGP	CORPUS CHRISTI NAS	TX	27.683	-97.283	6.1
12928	KNQI	KINGSVILLE	TX	27.500	-97.817	17.1
12932	KALI	ALICE INTL AP	TX	27.733	-98.033	52.7
12920	KLRD	LAREDO INTL AP	TX	27.533	-99.467	150.6
12970	KSSF	SAN ANTONIO/STINSON	TX	29.333	-98.467	176.0

WBAN # (if applicable)	Station ID	Station Name	State	Lat (deg)	Lon (deg)	Elev (m)
	KRKP	ROCKPORT/ARANSAS CO	TX	28.083	-97.050	8.0
12947	KCOT	COTULLA FAA AP	TX	28.450	-99.217	141.1
	KLBX	ANGLETON/LAKE JACKS	TX	29.117	-95.467	8.0
12921	KSAT	SAN ANTONIO INTL AP	TX	29.533	-98.467	246.6
12962	KHDO	HONDO MUNICIPAL AP	TX	29.367	-99.167	280.4
12909	KSKF	SAN ANTONIO KELLY FIELD AFB	TX	29.383	-98.583	207.9
12911	KRND	RANDOLPH AFB	TX	29.533	-98.283	231.6
	KERV	KERRVILLE MUNICIPAL	TX	29.983	-99.083	493.0
	KHYI	SAN MARCOS MUNI	TX	29.883	-97.867	182.0
13904	KATT	AUSTIN MUELLER MUNICIPAL AP	TX	30.300	-97.700	189.3
	KTKI	MCKINNEY MUNI ARPT	TX	33.183	-96.583	176.0
	KBMQ	BURNET MUNI.	TX	30.733	-98.233	391.0
	KSGR	HOUSTON\SUGAR LAND	TX	29.617	-95.650	25.0
13958	KATT	CAMP MABRY	TX	30.317	-97.767	198.0
	KGTU	GEORGETOWN (AWOS)	TX	30.683	-97.683	240.0
12912	KVCT	VICTORIA REGIONAL AP	TX	28.867	-96.933	35.1
	K11R	BRENHAM	TX	30.217	-96.367	94.0
	K3T5	LAGRANGE	TX	29.900	-96.950	99.0
12935	KPSX	PALACIOS MUNICIPAL AP	TX	28.717	-96.250	4.9
13959	KACT	WACO REGIONAL AP	TX	31.617	-97.233	152.4
	KPWG	MC GREGOR (AWOS)	TX	31.483	-97.317	180.0
3933	KHLR	FORT HOOD	TX	31.133	-97.717	280.1
	KILE	KILLEEN MUNI (AWOS)	TX	31.083	-97.683	258.0
3902	KGRK	ROBERT GRAY AAF	TX	31.067	-97.833	312.1
	KTPL	TEMPLE/MILLER(AWOS)	TX	31.150	-97.400	208.0
13960	KDAL	DALLAS LOVE FIELD	TX	32.850	-96.850	134.1
	KGVT	GREENVILLE/MAJORS	TX	33.067	-96.067	163.0
	KDTO	DENTON (ASOS)	TX	33.200	-97.183	197.0
3927	KDFW	DALLAS-FORT WORTH INTL AP	TX	32.900	-97.017	170.7
	KFWS	DFW NEXRAD	TX	32.567	-97.300	233.0
	KAFW	FORT WORTH/ALLIANCE	TX	32.983	-97.317	220.0
13911	KNFW	FORT WORTH NAS	TX	32.767	-97.450	185.3
13961	KFTW	FORT WORTH MEACHAM	TX	32.817	-97.367	209.4
93985	KMWL	MINERAL WELLS MUNICIPAL AP	TX	32.783	-98.067	283.5
	KADS	DALLAS/ADDISON ARPT	TX	32.967	-96.833	196.0
	KRBD	DALLAS/REDBIRD ARPT	TX	32.683	-96.867	201.0
3969	SEP	STEPHENVILLE CLARK FIELD	TX	32.217	-98.183	398.7
23034	KSJT	SAN ANGELO MATHIS FIELD	TX	31.350	-100.500	584.0

WBAN # (if applicable)	Station ID	Station Name	State	Lat (deg)	Lon (deg)	Elev (m)
13962	KABI	ABILENE REGIONAL AP	TX	32.417	-99.683	545.6
	KBWD	BROWNWOOD MUNICIPAL	TX	31.800	-98.950	422.0
13973	KJCT	JUNCTION KIMBLE COUNTY AP	TX	30.517	-99.767	533.1
	PTAT2	PORT ARANSAS	TX	27.833	-97.050	5.0
	SRST2	SABINE	TX	29.667	-94.050	1.0

Source: Earth Tech, Inc. (2006).



Source: Earth Tech, Inc. (2006).

Figure 1. Locations of Surface Meteorological Monitoring Sites for the GOM 5-Year Dataset.

2.1.2. Data Processing Procedures

Processing of the surface data included several steps:

- Surface data for the sites listed in Table 1 were obtained from NCDC, primarily retrieved from CDs that were provided. For some sites, the data were not available from the CDs and were retrieved via download from the web-based NCDC data archive. The format of the data from the NCDC CDs is Integrated Surface Hourly Data (ISHD). The format of the data obtained from the web-based

NCDC archive is SA/METAR. (Note: METAR is the international standard code format for hourly surface weather observations and is analogous to the SA coding currently used in the US.) The address of the NCDC web site is http://www.ncdc.noaa.gov/oa/ncdc.html and access to the data is by subscription.

- The data were organized by location and date, reformatted as needed for input to the CALMET surface data preprocessor, and processed using the SMERGE surface data preprocessor. The resulting files conform to the format of the standard CALMET surface data (SURF.DAT) files.
- Quality assurance checks were performed to ensure that all available data were incorporated into the surface data files, that selected processed data values matched those in the raw data files, and that the format of the files is correct.

2.1.3. File Naming Convention

Each surface file contains data for all sites for one year. The file names are:

surface_yyyy.dat

where yyyy is the four-digit year.

This naming convention is different than that used for the 2003 files prepared by Earth Tech, Inc. (2006), since we needed to differentiate among the different years. We also explicitly include the file type in the file name so that the user can readily identify the contents of each of the data files.

2.1.4. Content and Format of Surface Data Files

The content and format of the surface meteorological data files are described in detail by Earth Tech, Inc. (2006). Specifically Section E.4 of Volume 2 of this report describes the contents and Table E-12 of the report provides the formats for the surface data files.

2.1.5. Notes on Possible Data Quality Issues and Limitations

The amount and type of missing data varied by year and by site. Missing data are designated by 9999 (and 9999.000) in the surface data files. Users of the dataset should confirm data availability for each site, year, and parameter selected for use.

2.2. UPPER-AIR METEOROLOGICAL DATA

Upper-air meteorological data are used by CALMET to generate gridded three-dimensional fields of wind and temperature for each model layer. The upper-air data are also used to calculate a variety of boundary layer (e.g., mixing heights) and dispersion parameters.

2.2.1. Upper-Air Sites and Data Availability

The upper-air meteorological dataset for 2000-2004 includes twice-daily sounding data for 21 NWS upper-air monitoring sites. The sites are listed in Table 2 and the locations of the sites are displayed in Figure 2. Note that the table and plot are from the original data compilation report (Earth Tech, Inc., 2006). The parameters included in the data files are:

- Pressure (mb)
- Height above sea level (m)
- Temperature (K)
- Wind direction (degrees)
- Wind speed (ms^{-1}).

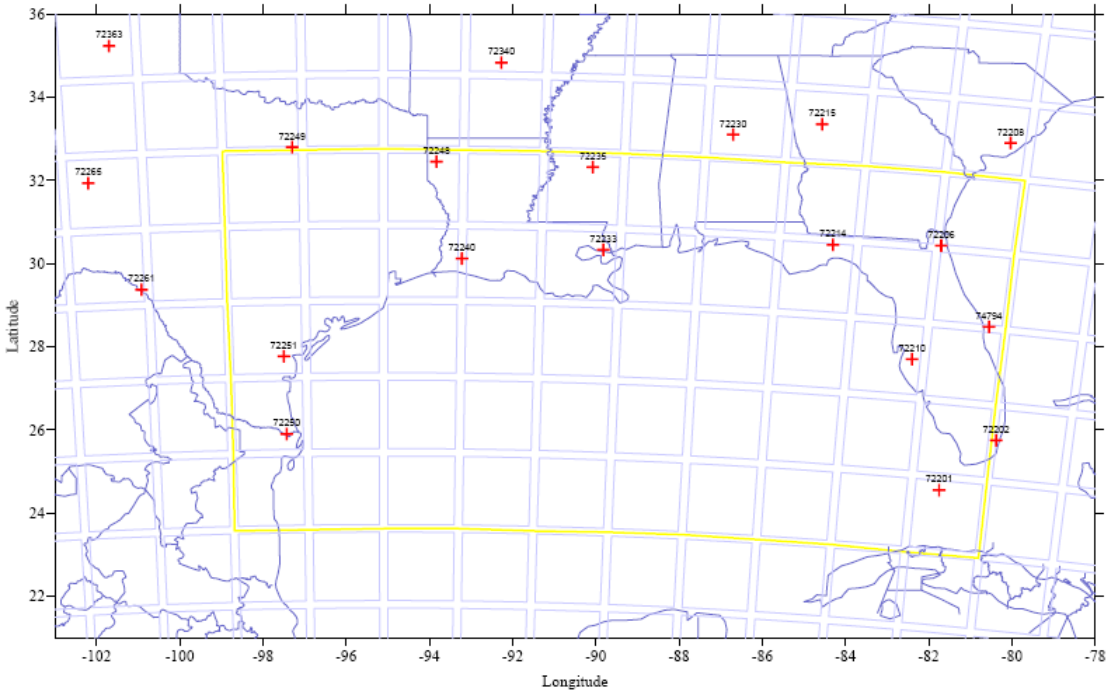
This information is provided for each mandatory and significant sounding level. The units for each parameter are given in parentheses.

Table 2

List of Upper-Air Meteorological Monitoring Sites for the GOM 5-Year Dataset.

WBAN #	Station ID	Station Name	State	Lat (deg)	Lon (deg)
53823	BMX	Birmingham Shelby AP	AL	33.10	-86.70
3952	LZK	N Little Rock	AR	34.83	-92.27
12836	EYW	Key West Intl AP	FL	24.55	-81.75
92803	MFL	Miami Intl Univ	FL	25.75	-80.38
13889	JAX	Jacksonville	FL	30.43	-81.70
12842	TBW	Tampa Bay/Ruskin	FL	27.70	-82.40
93805	TLH	Tallahassee	FL	30.45	-84.30
12868	XMR	Cape Kennedy	FL	28.48	-80.55
53819	FFC	Peachtree City	GA	33.35	-84.56
53813	SIL	Slidell	LA	30.33	-89.82
3937	LCH	Lake Charles	LA	30.12	-93.22
13957	SHV	Shreveport Regional AP	LA	32.45	-93.83
3940	JAN	Jackson/Thompson Fld	MS	32.32	-90.07
13880	CHS	Charleston	SC	32.90	-80.03
3990	FWD	Ft Worth	TX	32.80	-97.30
12919	BRO	Brownsville	TX	25.90	-97.43
12924	CRP	Corpus Christi	TX	27.77	-97.50
22010	DRT	Del Rio	TX	29.37	-100.92
23023	MAF	Midland	TX	31.93	-102.20
23047	AMA	Amarillo	TX	35.23	-101.70

Source: Earth Tech, Inc. (2006).



Source: Earth Tech, Inc. (2006).

Figure 2. Locations of Upper-Air Meteorological Monitoring Sites for the GOM 5-Year Dataset.

2.2.2. Data Processing Procedures

Processing of the upper-air data included several steps:

Upper-air sounding data for the sites listed in Table 2 were obtained from NCDC, via download from the web-based NCDC data archive http://raob.fsl.noaa.gov/ and access to the data is by subscription.

The data were organized by site, date and time, reformatted as needed for input to the CALMET upper-air meteorological data preprocessor, and processed using the READ62 upper-air data preprocessor. The resulting files conform to the format of the standard CALMET upper-air data (UP1.DAT, UP2.DAT…) files.

Quality assurance checks were performed to ensure that all available data were incorporated into the upper-air data files, that selected processed data values matched those in the raw data files, and that the format of the files is correct. We also checked reasonableness of the calculated mixing heights.

2.2.3. File Naming Convention

Each upper-air data file contains data for one site for one year. The file names are:

upper_sss_yyyy.dat

where sss is a three-letter station identifier that matches that given in Table 2 and yyyy is the four-digit year.

2.2.4. Content and Format of Upper-Air Data Files

The content and format of the upper-air meteorological data files are described in detail by Earth Tech, Inc. (2006). Specifically Section E.3 of Volume 2 of this report describes the contents and Table E-10 of the report provides the formats for the upper-air data files.

2.2.5. Notes on Possible Data Quality Issues and Limitations

The amount and type of missing data varied by year and by site. Missing data are designated by 999 and 999.9 in the upper-air data files. Users of the dataset should confirm data availability for each site, year, and parameter selected for use.

2.3. BUOY DATA

Buoy data are used by CALMET to specify wind, temperature, stability, and dispersion conditions over water portions of the modeling domain.

2.3.1. Buoy Sites and Data Availability

The buoy meteorological dataset for 2000-2004 includes hourly data for 13 buoy stations. The stations are listed in Table 3 and the locations of the buoys are displayed in Figure 3. Note that the table and plot are copied from the original data compilation report (Earth Tech, Inc., 2006). In Figure 3, the red dashed lines are used to group buoys that represent different portions of the GOM region. Data from one or more of the other buoys in a grouping could possibly be used as a substitute for missing data. The parameters included in the data files are:

- Air-sea surface temperature different (K)
- Air temperature (K)
- Over-water mixing height (m)
- Temperature lapse rate below the mixing height (K/m)
- Wind speed (ms^{-1})
- Wind direction (degrees)
- Dominant wave period (hrs)
- Significant wave period (hrs).

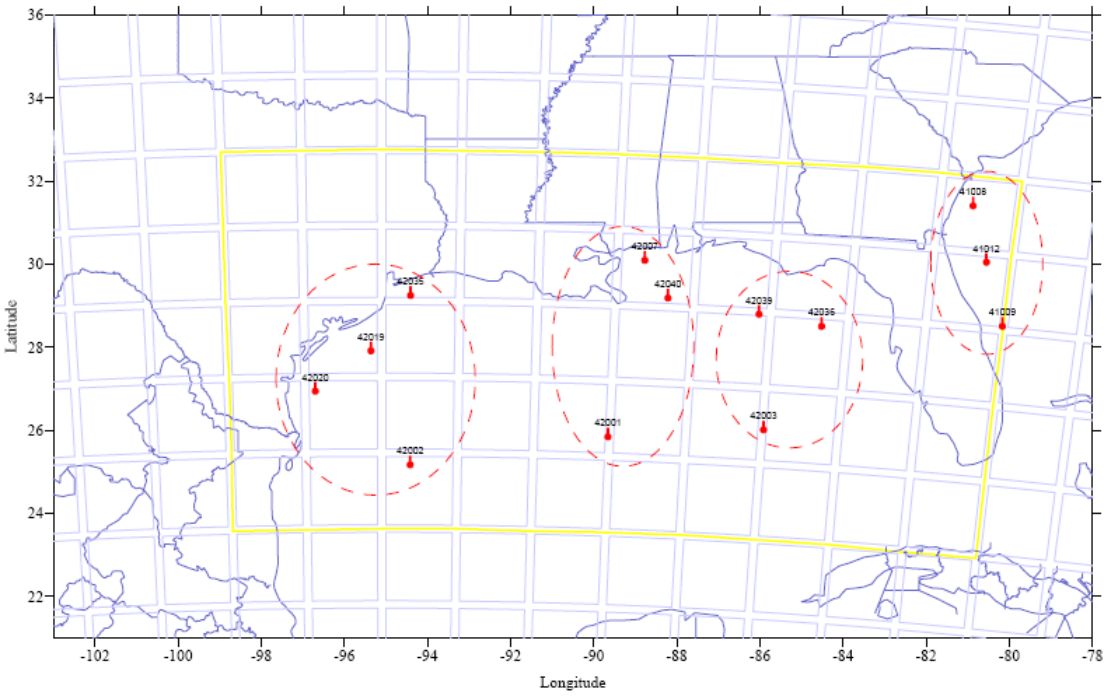
The units for each parameter are given in parentheses.

Table 3

List of Buoy Meteorological Monitoring Sites for the GOM 5-Year Dataset.

WBAN #	Station Name	State	Lat (deg)	Lon (deg)
41008	Gray's Reef (SE of Savannah)	GA	31.40	-80.87
41012	St. Augustine (ENE of St. Augustine)	FL	30.00	-80.50
41009	Canaveral East (E of Cape Canaveral)	FL	28.50	-80.18
42039	W. Tampa (WNW of Tampa)	FL	28.80	-86.06
42036	Pensacola (ESE of Pensacola)	FL	28.51	-84.51
42003	East Gulf (S of Panama City)	FL	25.94	-85.93
42007	Biloxi (SSE of Biloxi)	MS	30.09	-88.77
42040	Mobile South (S of Dauphin Island)	AL	29.21	-88.20
42001	Mid Gulf (S of Southwest Pass)	LA	25.87	-89.67
42035	Galveston (E of Galveston)	TX	29.25	-94.41
42019	Freeport (S of Freeport)	TX	27.92	-95.36
42020	Corpus Christi (SE of Corpus Christi)	TX	26.95	-96.70
42002	West Gulf (SSE of Sabine Pass)	TX	25.17	-94.42

Source: Earth Tech, Inc. (2006).



Source: Earth Tech, Inc. (2006).

Figure 3. Locations of Buoy Meteorological Monitoring Sites for the GOM 5-Year Dataset.

2.3.2. Data Processing Procedures

Processing of the buoy data included several steps:

- Buoy data for the sites listed in Table 3 were retrieved from the NCDC, via download from the web-based NCDC data archive. NCDC archives these data for the NDBC. The web site address is http://www.ndbc.noaa.gov.
- The data were organized by station, date, and time, reformatted as needed for input to the CALMET buoy meteorological data preprocessor, and processed using the BUOY over-water data preprocessor (BUOY). The resulting files conform to the format of the standard CALMET buoy data (SEA1.DAT, SEA2.DAT…) files.
- Quality assurance checks were performed to ensure that all available data were incorporated into the buoy data files, that selected processed data values matched those in the raw data files, and that the format of the files is correct.

2.3.3. File Naming Convention

Each buoy file contains data for one site for one year. The file names are:

buoy_ bbbbb_yyyy.dat

where bbbbb is a five-digit buoy identifier that matches the WBAN number provided in Table 3 and yyyy is the four-digit year.

2.3.4. Content and Format of Buoy Data Files

The content and format of the buoy data files is described in detail by Earth Tech, Inc. (2006). Specifically Section E.5 of Volume 2 of this report describes the contents and Table E-14 of the report provides the formats for the buoy data files.

2.3.5. Notes on Possible Data Quality Issues and Limitations

The amount and type of missing data varied by year and by site. Missing data are designated by 9999.0 in the buoy data files. Users of the dataset should confirm data availability for each site, year, and parameter selected for use. For buoy 42003, there are no data for the years 2000 and 2001.

The locations of the buoys may vary during 2000-2004 period. Data for each separate location were processed separately and then merged, thus the different coordinates appear in the CALMET-ready files. Each record has the proper coordinates.

Note that upper-air data and mixing heights are not available for the buoy locations. Mixing heights can be calculated by CALMET or specified using defaults or other means (there is currently no EPA-approved algorithm for calculating over-water mixing heights). Default values are used for the lapse rates below and above the mixing height.

2.4. PRECIPITATION DATA

Precipitation data are used by CALMET to generate gridded fields of precipitation for the modeling domain. This precipitation information is then used by CALPUFF to simulate wet deposition of pollutants.

2.4.1. Precipitation Sites and Data Availability

The precipitation data files for 2000-2004 include hourly precipitation data for 271 NWS precipitation monitoring sites. The sites are listed in Table 4 and the locations of the sites are displayed in Figure 4. Note that the table and plot are copied from the original data compilation report (Earth Tech, Inc., 2006). Precipitation is given in terms of a precipitation rate and the units are millimeters/hour (mm/hr).

Table 4

List of Precipitation Monitoring Sites for the GOM 5-Year Dataset.

COOP #	Station Name	State	Lat (deg)	Lon (deg)
10008	ABBEVILLE	AL	31.57	-85.25
10140	ALBERTA	AL	32.24	-87.43
10252	ANDALUSIA 3 W	AL	31.31	-86.52
10369	ASHLAND 2 E	AL	33.28	-85.79
10402	ATMORE STATE NURSERY	AL	31.17	-87.44
10425	AUBURN NO 2	AL	32.60	-85.47
12124	DADEVILLE 2	AL	32.86	-85.74
12172	DAUPHIN ISLAND #2	AL	30.25	-88.08
12377	DOTHAN	AL	31.19	-85.37
12675	ENTERPRISE 5 NNW	AL	31.38	-85.90
13519	GREENVILLE	AL	31.79	-86.61
14193	JACKSON	AL	31.53	-87.93
15112	MARION 7 NE	AL	32.70	-87.27
15397	MIDWAY	AL	32.08	-85.52
15478	MOBILE REGIONAL AP	AL	30.69	-88.25
15550	MONTGOMERY DANNELLY FIELD	AL	32.30	-86.41
15553	MONTGOMERY 6 SW	AL	32.26	-86.22
16370	PETERMAN	AL	31.59	-87.27
18178	THOMASVILLE	AL	31.54	-87.88
18209	THORSBY EXP STATION	AL	32.92	-86.67
18323	TROY	AL	31.81	-85.97
18385	TUSCALOOSA OLIVER DAM	AL	33.21	-87.59
18673	WARRIOR LOCK AND DAM	AL	32.77	-87.83
32300	EL DORADO GOODWIN FLD	AR	33.22	-92.81

COOP #	Station Name	State	Lat (deg)	Lon (deg)
34548	MAGNOLIA	AR	33.25	-93.23
80845	BOCA RATON	FL	26.37	-80.11
80975	BRANFORD	FL	29.96	-82.91
81048	BROOKSVILLE 7 SSW	FL	28.48	-82.44
81986	CRESTVIEW BOB SIKES AP	FL	30.78	-86.52
82008	CROSS CITY 2 WNW	FL	29.65	-83.17
82158	DAYTONA BEACH INTL AP	FL	29.18	-81.05
82229	DELAND 1 SSE	FL	29.02	-81.31
82391	DOWLING PARK 1 W	FL	30.25	-83.26
83186	FORT MYERS PAGE FIELD AP	FL	26.59	-81.86
83326	GAINESVILLE REGIONAL AP	FL	29.69	-82.28
83538	GRACEVILLE 1 SW	FL	30.96	-85.53
84095	HOMESTEAD GEN AVIATION	FL	25.50	-80.55
84273	INGLIS 3 E	FL	29.03	-82.62
84358	JACKSONVILLE INTL AP	FL	30.50	-81.69
84570	KEY WEST INTL AP	FL	24.55	-81.76
84802	LAKELAND 2	FL	27.99	-82.01
85076	LISBON	FL	28.87	-81.79
85237	LYNNE	FL	29.20	-81.93
85391	MARINELAND	FL	29.67	-81.22
85612	MELBOURNE WFO	FL	28.10	-80.65
85663	MIAMI INTL AP	FL	25.79	-80.32
85879	MONTICELLO WTP	FL	30.56	-83.86
85895	MOORE HAVEN LOCK 1	FL	26.84	-81.09
86240	NICEVILLE	FL	30.53	-86.49
86323	NORTH NEW RVR CANAL 2	FL	26.33	-80.54
86628	ORLANDO INTL AP	FL	28.43	-81.33
86842	PANAMA CITY 5 N	FL	30.25	-85.66
86880	PARRISH	FL	27.61	-82.35
86988	PENNSUCO 5 WNW	FL	25.93	-80.45
86997	PENSACOLA REGIONAL AP	FL	30.48	-87.19
87440	RAIFORD STATE PRISON	FL	30.07	-82.19
87851	SAINT LEO	FL	28.34	-82.26
87886	ST PETERSBURG	FL	27.76	-82.63
88758	TALLAHASSEE WSO AP	FL	30.39	-84.35
88780	TAMIAMI TRAIL 40 MI BEND	FL	25.76	-80.82
88788	TAMPA WSCMO AP	FL	27.96	-82.54
88841	TAVERNIER	FL	25.01	-80.52
89010	TRAIL GLADE RANGES	FL	25.76	-80.48

COOP #	Station Name	State	Lat (deg)	Lon (deg)
89176	VENICE	FL	27.10	-82.44
89184	VENUS	FL	27.14	-81.33
89219	VERO BEACH 4 SE	FL	27.65	-80.40
89415	WAUSAU	FL	30.65	-85.59
89525	WEST PALM BEACH INT AP	FL	26.68	-80.10
89795	WOODRUFF DAM	FL	30.72	-84.87
90010	ABBEVILLE 4 S	GA	31.94	-83.31
90211	ALMA BACON COUNTY AP	GA	31.54	-82.51
90586	BAINBRIDGE INTL PAPER CO	GA	30.82	-84.62
91345	BRUNSWICK MCKINNON AP	GA	31.15	-81.39
91340	BRUNSWICK	GA	31.17	-81.50
92166	COLUMBUS METRO AP	GA	32.52	-84.94
92361	CRISP CO POWER DAM	GA	31.85	-83.96
92844	DUBLIN 2	GA	32.56	-82.90
93028	EDISON	GA	31.57	-84.73
93312	FARGO	GA	30.69	-82.56
93460	FOLKSTON 3 SW	GA	30.80	-82.02
93570	FRANKLIN	GA	33.28	-85.10
94204	HAZLEHURST	GA	31.89	-82.58
94671	JESUP	GA	31.61	-81.88
95314	LOUISVILLE 1 E	GA	33.01	-82.39
95394	LUMPKIN 2 SE	GA	32.03	-84.78
95443	MACON MIDDLE GA REGIONAL AP	GA	32.68	-83.65
95876	MILLEDGEVILLE DARDC	GA	33.09	-83.22
96879	PEARSON	GA	31.29	-82.84
97847	SAVANNAH INTL AP	GA	32.13	-81.21
98517	SYLVANIA 2 SSE	GA	32.73	-81.62
98657	THE ROCK	GA	32.96	-84.24
98974	VALDOSTA 4 NW	GA	30.86	-83.35
99291	WEST POINT	GA	32.87	-85.19
160103	ALEXANDRIA 5 SSE	LA	31.25	-92.45
160537	BASTROP	LA	32.77	-92.01
160548	BATON ROUGE CONCORD	LA	30.42	-91.13
160549	BATON ROUGE METRO AP	LA	30.54	-91.15
161246	BRUSLY 2 W	LA	30.39	-91.27
161287	BUNKIE	LA	30.96	-92.18
161411	CALHOUN RESEARCH STN	LA	32.51	-92.35
161899	CLINTON 5 SE	LA	30.82	-90.97
162534	DONALDSONVILLE 4 SW	LA	30.07	-91.03

COOP #	Station Name	State	Lat (deg)	Lon (deg)
164030	HAMMOND 5 E	LA	30.50	-90.37
164407	HOUMA	LA	29.58	-90.73
164696	JENA 4 WSW	LA	31.67	-92.20
164700	JENNINGS	LA	30.20	-92.67
164739	JONESVILLE LOCKS	LA	31.48	-91.86
165021	LAFAYETTE	LA	30.22	-92.07
165078	LAKE CHARLES AP	LA	30.12	-93.23
165287	LEESVILLE 6 SSW	LA	31.05	-93.28
165620	LSU BEN HUR FARM	LA	30.37	-91.17
165624	LSU CITRUS RESEARCH STN	LA	29.58	-89.82
165874	MANSFIELD	LA	32.04	-93.71
166244	MINDEN	LA	32.61	-93.29
166303	MONROE REGIONAL AP	LA	32.52	-92.04
166314	MONROE ULM	LA	32.53	-92.07
166394	MORGAN CITY	LA	29.68	-91.18
166582	NATCHITOCHES	LA	31.77	-93.10
166664	NEW ORLEANS AUDUBON	LA	29.92	-90.13
166660	NEW ORLEANS INTL AP	LA	29.99	-90.25
167738	RED RIVER RESEARCH STN	LA	32.42	-93.64
168440	SHREVEPORT AP	LA	32.45	-93.82
168539	SLIDELL	LA	30.27	-89.77
168163	ST JOSEPH 3 N	LA	31.95	-91.23
169357	VIDALIA 2	LA	31.57	-91.43
169803	WINNFIELD 2 W	LA	31.93	-92.67
169806	WINNSBORO 5 SSE	LA	32.10	-91.70
220797	BILOXI 9 WNW	MS	30.44	-89.03
221094	BROOKHAVEN CITY	MS	31.54	-90.46
221389	CANTON 4 N	MS	32.67	-90.04
221852	COLLINS	MS	31.64	-89.56
221900	CONAHATTA 1 NE	MS	32.46	-89.27
222281	DE KALB	MS	32.78	-88.68
222658	EDINBURG	MS	32.80	-89.34
222870	ETHEL	MS	33.12	-89.47
223920	HAZLEHURST 5 SW	MS	31.83	-90.45
224472	JACKSON WSFO AIRPORT	MS	32.32	-90.08
224778	KOSCIUSKO 13 SE	MS	32.98	-89.39
224966	LEAKESVILLE	MS	31.15	-88.55
225062	LEXINGTON 2 NNW	MS	33.13	-90.07
225074	LIBERTY 2 E	MS	31.16	-90.77

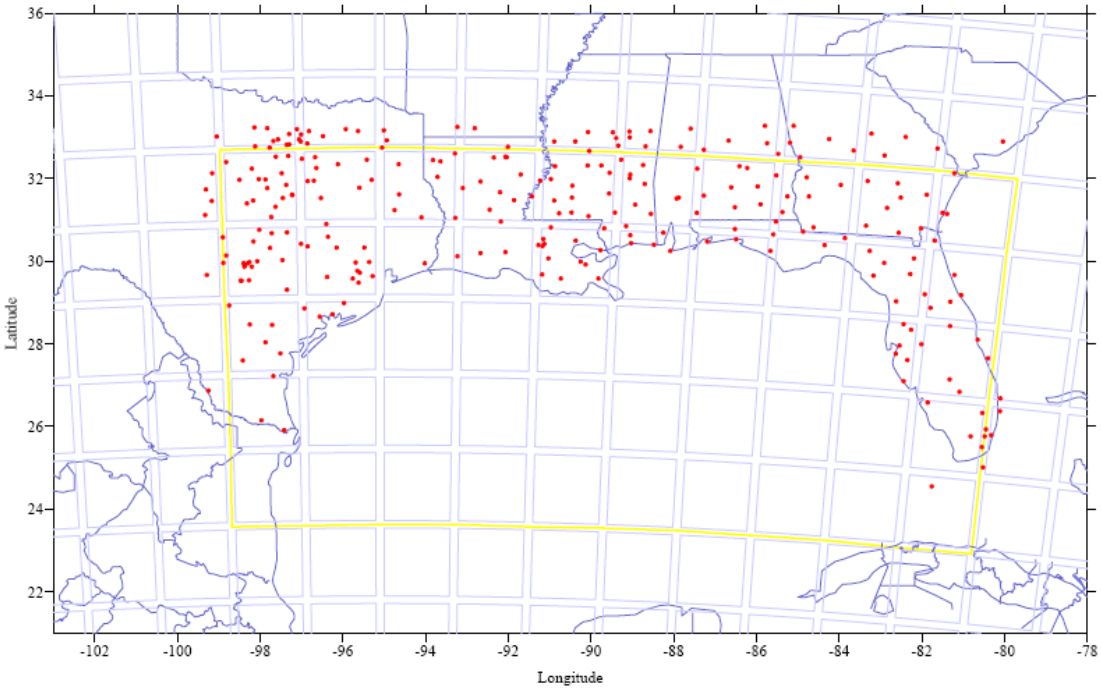
COOP #	Station Name	State	Lat (deg)	Lon (deg)
225247	LOUISVILLE	MS	33.14	-89.07
225361	MACON 3 N	MS	33.15	-88.56
225614	MCCOMB AIRPORT	MS	31.18	-90.47
225704	MEADVILLE	MS	31.47	-90.89
225776	MERIDIAN AIRPORT	MS	32.33	-88.74
226400	NOXAPATER 1 N	MS	33.00	-89.06
226718	PASCAGOULA 3 NE	MS	30.40	-88.48
226750	PAULDING	MS	32.01	-89.06
226816	PELAHATCHIE 3 E	MS	32.32	-89.75
227132	PORT GIBSON 1 NE	MS	31.99	-90.97
227220	PURVIS 2 N	MS	31.18	-89.42
227276	RALEIGH 6 N	MS	32.14	-89.55
227444	RICHTON 1 N	MS	31.37	-88.93
227560	ROLLING FORK	MS	32.90	-90.89
227592	ROSE HILL 4 SW	MS	32.10	-89.05
227840	SAUCIER EXP FOREST	MS	30.63	-89.05
228053	SHUBUTA	MS	31.87	-88.70
229048	TYLERTOWN 5 ESE	MS	31.09	-90.06
229218	VICKSBURG WATERWAYS EXP ST	MS	32.30	-90.87
229617	WHITE SAND	MS	30.80	-89.68
229648	WIGGINS RANGER STN	MS	30.85	-89.15
229860	YAZOO CITY 5 NNE	MS	32.90	-90.38
381544	CHARLESTON INTL AP	SC	32.90	-80.04
410428	AUSTIN CAMP MABRY	TX	30.32	-97.76
410509	BANKERSMITH	TX	30.14	-98.82
410518	BARDWELL DAM	TX	32.26	-96.64
410569	BAY CITY WATERWORKS	TX	28.99	-95.97
410639	BEEVILLE 5 NE	TX	28.46	-97.71
410690	BENAVIDES 2	TX	27.60	-98.42
410738	BERTRAM 3 ENE	TX	30.76	-98.02
411017	BRADY	TX	31.12	-99.34
411136	BROWNSVILLE INTL AP	TX	25.91	-97.42
411246	BURLESON	TX	32.55	-97.32
411433	CANYON DAM NO 3	TX	29.95	-98.40
411434	CANYON DAM NO 4	TX	29.91	-98.37
411436	CANYON DAM 6	TX	29.95	-98.30
411429	CANYON DAM	TX	29.87	-98.20
411541	CEDAR CREEK 4 SE	TX	30.03	-97.46
411663	CHARLOTTE 5 NNW	TX	28.93	-98.75

COOP #	Station Name	State	Lat (deg)	Lon (deg)
411671	CHEAPSIDE	TX	29.31	-97.35
411720	CHOKE CANYON DAM	TX	28.47	-98.25
411889	COLLEGE STA EASTERWOOD AP	TX	30.59	-96.36
411920	COMFORT 2	TX	29.96	-98.89
411921	COMMERCE 4 SW	TX	33.20	-95.93
411956	CONROE	TX	30.33	-95.48
412015	CORPUS CHRISTI WSFO AP	TX	27.77	-97.51
412086	CRANFILLS GAP	TX	31.77	-97.83
412088	CRAWFORD	TX	31.53	-97.45
412096	CRESSON	TX	32.53	-97.62
412131	CROSS PLAINS 2	TX	32.13	-99.16
412206	CYPRESS	TX	29.97	-95.69
412242	DAL-FTW INTL AP	TX	32.90	-97.02
412244	DALLAS LOVE FIELD	TX	32.85	-96.86
412404	DENTON 2 SE	TX	33.20	-97.11
412462	DIME BOX	TX	30.36	-96.85
412676	EAGLE LAKE RESCH CTR	TX	29.62	-96.38
412715	EASTLAND	TX	32.40	-98.82
413005	EVANT 1 SSW	TX	31.47	-98.17
413133	FERRIS	TX	32.52	-96.67
413156	FISCHERS STORE	TX	29.98	-98.26
413171	FLAT	TX	31.32	-97.63
413285	FORT WORTH WSFO	TX	32.83	-97.30
413284	FORT WORTH MEACHAM FIELD	TX	32.82	-97.36
413370	FRISCO	TX	33.15	-96.82
413507	GEORGETOWN LAKE	TX	30.68	-97.72
413546	GILMER 4 WNW	TX	32.75	-95.05
413686	GRANGER DAM	TX	30.70	-97.35
413691	GRAPEVINE DAM	TX	32.95	-97.06
413771	GROESBECK 2	TX	31.53	-96.53
414137	HICO	TX	31.99	-98.03
414307	HOUSTON HOBBY AP	TX	29.64	-95.28
414300	HOUSTON BUSH INTL AP	TX	29.98	-95.36
414311	HOUSTON ALIEF	TX	29.72	-95.59
414309	HOUSTON ADDICKS	TX	29.77	-95.65
414476	IREDELL	TX	31.98	-97.87
414520	JACKSBORO 1 NNE	TX	33.24	-98.14
414679	JUSTIN	TX	33.08	-97.30
414792	KILLEEN 3 S	TX	31.07	-97.73

COOP #	Station Name	State	Lat (deg)	Lon (deg)
414866	KOPPERL 5 NNE	TX	32.13	-97.48
414972	LAKE BRIDGEPORT DAM	TX	33.23	-97.83
415094	LAVON DAM	TX	33.03	-96.48
415192	LEWISVILLE DAM	TX	33.07	-97.01
415193	LEXINGTON	TX	30.42	-97.01
415348	LONGVIEW 11 SE	TX	32.35	-94.65
415424	LUFKIN ANGELINA CO AP	TX	31.24	-94.75
415463	MABANK 4 SW	TX	32.35	-96.12
415528	MALONE 3ENE	TX	31.94	-96.85
415661	MATHIS 4 SSW	TX	28.04	-97.87
415897	MIDLOTHIAN 2	TX	32.48	-96.99
415957	MINERAL WELLS 1 SSW	TX	32.78	-98.12
415996	MOLINE	TX	31.40	-98.32
416108	MOUNT PLEASANT	TX	33.17	-95.01
416177	NACOGDOCHES	TX	31.62	-94.65
416210	NAVARRO MILLS DAM	TX	31.95	-96.70
416335	NEW SUMMERFIELD 2 W	TX	31.97	-95.30
416750	PALACIOS MUNICIPAL AP	TX	28.72	-96.25
416757	PALESTINE 2 NE	TX	31.78	-95.60
417066	PITTSBURG 5 S	TX	32.93	-94.94
417140	POINT COMFORT	TX	28.66	-96.56
417174	PORT ARTHUR AP	TX	29.95	-94.02
417243	PRAIRIE MOUNTAIN	TX	30.58	-98.90
417300	PROCTOR RESERVOIR	TX	31.97	-98.50
417422	RANDOLPH FIELD	TX	29.54	-98.27
417556	RENO	TX	32.95	-97.57
417594	RICHMOND	TX	29.58	-95.76
417936	SAM RAYBURN DAM	TX	31.06	-94.10
417945	SAN ANTONIO INTL AP	TX	29.53	-98.47
417947	SAN ANTONIO 8 NNE	TX	29.53	-98.45
418047	SANTA ANNA	TX	31.74	-99.31
418081	SARITA 7 E	TX	27.22	-97.68
418531	SPICEWOOD	TX	30.48	-98.16
418544	SPRING BRANCH 2 SE	TX	29.87	-98.38
418563	SPRINGTOWN 4 S	TX	32.91	-97.68
418623	STEPHENVILLE 1 N	TX	32.25	-98.20
418743	SULPHUR SPRINGS	TX	33.15	-95.63
418778	SWAN 4 NW	TX	32.46	-95.42
418845	TARPLEY	TX	29.67	-99.29

COOP #	Station Name	State	Lat (deg)	Lon (deg)
418996	THOMPSONS 3 WSW	TX	29.48	-95.62
419364	VICTORIA ASOS	TX	28.86	-96.93
419419	WACO REGIONAL AP	TX	31.61	-97.23
419417	WACO DAM	TX	31.60	-97.22
419491	WASHINGTON STATE PARK	TX	30.33	-96.15
419532	WEATHERFORD	TX	32.75	-97.77
419588	WESLACO 2 E	TX	26.15	-97.97
419665	WHEELOCK	TX	30.90	-96.40
419715	WHITNEY DAM	TX	31.85	-97.37
419815	WIMBERLEY 1 NW	TX	30.00	-98.07
419817	WINCHELL	TX	31.46	-99.17
419893	WOODSON	TX	33.02	-99.05
419976	ZAPATA 3 SW	TX	26.87	-99.25

Source: Earth Tech, Inc. (2006).



Source: Earth Tech, Inc. (2006).

Figure 4. Locations of Precipitation Monitoring Sites for the GOM 5-Year Dataset.

2.4.2. Data Processing Procedures

Processing of the precipitation data included several steps:

- Precipitation data for the sites listed in Table 4 were obtained from the NCDC, via ftp in TD 3240 format.
- The data were extracted from the precipitation data files using the PXTRACT program and then processed using the PMERGE precipitation data preprocessor program. The resulting files conform to the format of the standard CALMET precipitation data (PRECIP.DAT) files.
- Quality assurance checks were performed to ensure that all available data were incorporated into the precipitation files, that selected processed data values matched those in the raw data files, and that the format of the files is correct.

2.4.3. File Naming Convention

Each precipitation file contains data for all sites for one year. The file names are:

precip_yyyy.dat

where yyyy is the four-digit year.

2.4.4. Content and Format of Precipitation Data Files

The content and format of the surface meteorological data files is described in detail by Earth Tech, Inc. (2006). Specifically Section E.6 of Volume 2 of this report describes the contents and Table E-16 of the report provides the formats for the precipitation data.

2.4.5. Notes on Possible Data Quality Issues and Limitations

The amount and type of missing data varied by year and by site. Missing data are designated by 9999.0 in the precipitation data files. Users of the dataset should confirm data availability for each site and year selected for use.

There are no over-water precipitation data and this will limit the ability of CALPUFF to account for wet deposition over water.

2.5. OZONE DATA

Ozone data are used by CALPUFF chemical mechanism to determine the rate of sulfate and nitrate formation.

2.5.1. Ozone Sites and Data Availability

The ozone data files for 2000-2004 include hourly ozone data for 201 AQS and CASTNet monitoring sites. The sites are listed in Table 5 and the locations of the sites are displayed in Figure 5. Note that the table and plot are copied from the original data compilation report (Earth Tech, Inc., 2006). The units for ozone are parts per billion (ppb).

Table 5

List of Ozone Monitoring Sites for the GOM 5-Year Dataset.

Station ID	Station Type	State	Lat (deg)	Lon (deg)
10030010	AIRS	AL	30.5	87.88
10270001	AIRS	AL	33.28	85.8
10510001	AIRS	AL	32.5	86.14
10550011	AIRS	AL	33.9	86.05
10731003	AIRS	AL	33.49	86.91
10731005	AIRS	AL	33.33	87
10731009	AIRS	AL	33.27	87.18
10731010	AIRS	AL	33.55	86.55
10732006	AIRS	AL	33.39	86.8
10735002	AIRS	AL	33.7	86.67
10735003	AIRS	AL	33.48	86.56
10736002	AIRS	AL	33.58	86.77
10970003	AIRS	AL	30.77	88.09
10972005	AIRS	AL	30.47	88.14
11011002	AIRS	AL	32.41	86.26
11130002	AIRS	AL	32.47	85.08
11170004	AIRS	AL	33.32	86.82
11190002	AIRS	AL	32.36	88.2
11250010	AIRS	AL	33.09	87.46
SND152	CASTNet	AL	34.29	85.97
CAD150	CASTNet	AR	34.18	93.1
120010025	AIRS	FL	29.68	82.49
120013011	AIRS	FL	29.55	82.3
120030002	AIRS	FL	30.2	82.45
120050006	AIRS	FL	30.13	85.73
120090007	AIRS	FL	28.05	80.63
120094001	AIRS	FL	28.31	80.62
120110031	AIRS	FL	26.27	80.29
120112003	AIRS	FL	26.29	80.1
120118002	AIRS	FL	26.09	80.11
120210004	AIRS	FL	26.27	81.71
120230002	AIRS	FL	30.18	82.62
120310077	AIRS	FL	30.48	81.59
120310100	AIRS	FL	30.26	81.45
120330004	AIRS	FL	30.53	87.2
120330018	AIRS	FL	30.37	87.27

Station ID	Station Type	State	Lat (deg)	Lon (deg)
120330024	AIRS	FL	30.4	87.28
120550003	AIRS	FL	27.19	81.34
120570081	AIRS	FL	27.74	82.47
120570110	AIRS	FL	27.78	82.16
120571035	AIRS	FL	27.93	82.45
120571065	AIRS	FL	27.89	82.54
120574004	AIRS	FL	27.99	82.13
120590004	AIRS	FL	30.85	85.6
120690002	AIRS	FL	28.53	81.72
120712002	AIRS	FL	26.55	81.98
120713002	AIRS	FL	26.45	81.94
120730012	AIRS	FL	30.44	84.35
120730013	AIRS	FL	30.48	84.2
120813002	AIRS	FL	27.63	82.55
120814012	AIRS	FL	27.48	82.62
120814013	AIRS	FL	27.45	82.52
120830003	AIRS	FL	29.17	82.1
120860021	AIRS	FL	25.92	80.45
120860027	AIRS	FL	25.73	80.16
120860029	AIRS	FL	25.59	80.33
120860030	AIRS	FL	25.39	80.68
120950008	AIRS	FL	28.45	81.38
120952002	AIRS	FL	28.6	81.36
120972002	AIRS	FL	28.35	81.64
120990009	AIRS	FL	26.73	80.23
120992004	AIRS	FL	26.47	80.07
121010005	AIRS	FL	28.33	82.31
121012001	AIRS	FL	28.2	82.76
121030004	AIRS	FL	27.95	82.73
121030018	AIRS	FL	27.79	82.74
121035002	AIRS	FL	28.09	82.7
121056005	AIRS	FL	27.94	82
121056006	AIRS	FL	28.03	81.97
121111002	AIRS	FL	27.39	80.4
121130014	AIRS	FL	30.41	86.89
121151005	AIRS	FL	27.31	82.57
121151006	AIRS	FL	27.35	82.48
121152002	AIRS	FL	27.09	82.36
121171002	AIRS	FL	28.75	81.31

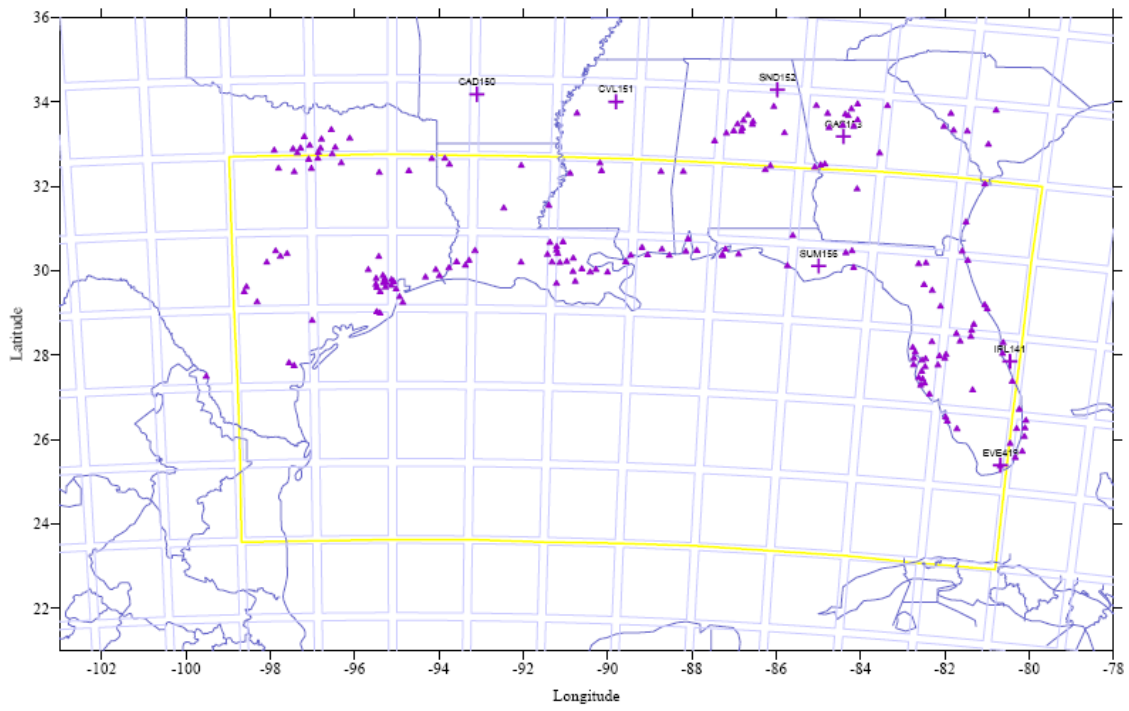
Station ID	Station Type	State	Lat (deg)	Lon (deg)
121272001	AIRS	FL	29.11	80.99
121275002	AIRS	FL	29.21	81.05
121290001	AIRS	FL	30.09	84.16
EVE419	CASTNet	FL	25.39	80.68
IRL141	CASTNet	FL	27.85	80.46
SUM156	CASTNet	FL	30.11	84.99
130210012	AIRS	GA	32.8	83.54
130510021	AIRS	GA	32.07	81.05
130590002	AIRS	GA	33.92	83.36
130770002	AIRS	GA	33.4	84.75
130890002	AIRS	GA	33.69	84.29
130893001	AIRS	GA	33.85	84.21
130970004	AIRS	GA	33.74	84.78
131130001	AIRS	GA	33.46	84.42
131210055	AIRS	GA	33.72	84.36
131270006	AIRS	GA	31.17	81.5
131350002	AIRS	GA	33.96	84.07
131510002	AIRS	GA	33.43	84.16
132150008	AIRS	GA	32.52	84.94
132151003	AIRS	GA	32.54	84.84
132230003	AIRS	GA	33.93	85.05
132450091	AIRS	GA	33.43	82.02
132470001	AIRS	GA	33.59	84.07
132611001	AIRS	GA	31.95	84.08
GAS153	CASTNet	GA	33.18	84.41
220050004	AIRS	LA	30.23	90.97
220110002	AIRS	LA	30.49	93.14
220150008	AIRS	LA	32.53	93.75
220170001	AIRS	LA	32.68	93.86
220190002	AIRS	LA	30.14	93.37
220190008	AIRS	LA	30.26	93.28
220190009	AIRS	LA	30.23	93.58
220330003	AIRS	LA	30.42	91.18
220330013	AIRS	LA	30.7	91.06
220331001	AIRS	LA	30.59	91.21
220430001	AIRS	LA	31.5	92.46
220470007	AIRS	LA	30.4	91.43
220470009	AIRS	LA	30.22	91.32
220470012	AIRS	LA	30.21	91.13

Station ID	Station Type	State	Lat (deg)	Lon (deg)
220511001	AIRS	LA	30.04	90.28
220550005	AIRS	LA	30.22	92.05
220570004	AIRS	LA	29.76	90.77
220630002	AIRS	LA	30.31	90.81
220730004	AIRS	LA	32.51	92.05
220770001	AIRS	LA	30.68	91.37
220870002	AIRS	LA	29.98	90
220890003	AIRS	LA	29.98	90.41
220930002	AIRS	LA	29.99	90.82
220950002	AIRS	LA	30.06	90.61
221010003	AIRS	LA	29.72	91.21
221210001	AIRS	LA	30.5	91.21
CVL151	CASTNet	MA	34	89.8
280010004	AIRS	MS	31.56	91.39
280110001	AIRS	MS	33.75	90.72
280450001	AIRS	MS	30.23	89.57
280450002	AIRS	MS	30.38	89.45
280470008	AIRS	MS	30.39	89.05
280470009	AIRS	MS	30.57	89.18
280490010	AIRS	MS	32.39	90.14
280590006	AIRS	MS	30.38	88.53
280590007	AIRS	MS	30.52	88.71
280750003	AIRS	MS	32.36	88.73
280890002	AIRS	MS	32.56	90.18
281490004	AIRS	MS	32.32	90.89
450030003	AIRS	SC	33.34	81.79
450110001	AIRS	SC	33.32	81.47
450290002	AIRS	SC	33.01	80.96
450370001	AIRS	SC	33.74	81.85
450790021	AIRS	SC	33.82	80.78
480290032	AIRS	TX	29.51	98.62
480290052	AIRS	TX	29.63	98.57
480290059	AIRS	TX	29.28	98.31
480391003	AIRS	TX	29.01	95.4
480391004	AIRS	TX	29.52	95.39
480391016	AIRS	TX	29.04	95.47
480850005	AIRS	TX	33.13	96.79
480850010	AIRS	TX	33.36	96.55
481130069	AIRS	TX	32.82	96.86

Station ID	Station Type	State	Lat (deg)	Lon (deg)
481130075	AIRS	TX	32.92	96.81
481130087	AIRS	TX	32.68	96.87
481133003	AIRS	TX	32.78	96.53
481210034	AIRS	TX	33.19	97.19
481390015	AIRS	TX	32.44	97.03
481670014	AIRS	TX	29.26	94.86
481671002	AIRS	TX	29.4	94.93
481830001	AIRS	TX	32.38	94.71
482010024	AIRS	TX	29.9	95.33
482010026	AIRS	TX	29.8	95.13
482010029	AIRS	TX	30.04	95.68
482010046	AIRS	TX	29.83	95.28
482010047	AIRS	TX	29.83	95.49
482010051	AIRS	TX	29.62	95.47
482010055	AIRS	TX	29.69	95.49
482010062	AIRS	TX	29.63	95.27
482010070	AIRS	TX	29.73	95.32
482011015	AIRS	TX	29.76	95.08
482011035	AIRS	TX	29.73	95.26
482011039	AIRS	TX	29.67	95.13
482011041	AIRS	TX	29.75	95.08
482011050	AIRS	TX	29.58	95.02
482030002	AIRS	TX	32.67	94.17
482090614	AIRS	TX	30.21	98.08
482210001	AIRS	TX	32.44	97.8
482311006	AIRS	TX	33.15	96.12
482450009	AIRS	TX	30.04	94.07
482450011	AIRS	TX	29.89	93.99
482450022	AIRS	TX	29.86	94.32
482510003	AIRS	TX	32.36	97.43
482570005	AIRS	TX	32.57	96.32
483390078	AIRS	TX	30.35	95.43
483550025	AIRS	TX	27.77	97.43
483550026	AIRS	TX	27.83	97.56
483611001	AIRS	TX	30.08	93.76
483670081	AIRS	TX	32.87	97.91
483970001	AIRS	TX	32.94	96.46
484230007	AIRS	TX	32.34	95.42
484390075	AIRS	TX	32.9	97.46

Station ID	Station Type	State	Lat (deg)	Lon (deg)
484391002	AIRS	TX	32.81	97.36
484392003	AIRS	TX	32.92	97.28
484393009	AIRS	TX	32.98	97.06
484393011	AIRS	TX	32.66	97.09
484530014	AIRS	TX	30.35	97.76
484530020	AIRS	TX	30.48	97.87
484530613	AIRS	TX	30.42	97.6
484690003	AIRS	TX	28.84	97.01
484790016	AIRS	TX	27.51	99.52

Source: Earth Tech, Inc. (2006).



Source: Earth Tech, Inc. (2006).

Figure 5. Locations of Ozone Monitoring Sites for the GOM 5-Year Dataset.

2.5.2. Data Processing Procedures

Processing of the ozone data included several steps:

- Hourly ozone data for the sites listed in Table 5 were retrieved electronically from the EPA AQS at http://www.epa.gov/ttn/airs/airsaqs/detaildata/downloadaqsdata.htm. Additional data were obtained from the CASTNet web site at http://www.epa.gov/castnet/index.html.
- The data were organized and formatted to conform to the format of the standard time-variant CALPUFF ozone data (OZONE.DAT) files.
- Quality assurance checks were performed to ensure that all available data were included in the ozone files, that selected data values matched those in the raw data files, and that the format of the files matched that given in the CALPUFF user's guide.

2.5.3. File Naming Convention

Each ozone data file contains data for all sites for one year. The file names are:

ozone_yyyy.dat

where yyyy is the four-digit year.

2.5.4. Content and Format of Ozone Data Files

The content and format of the ozone data files are described in detail by Earth Tech, Inc. (2006). Specifically Section F.9 of Volume 2 of this report describes the contents of the ozone files. The formats are provided in Tables F-36 (header) and F-37 (data).

2.5.5. Notes on Possible Data Quality Issues and Limitations

The amount of missing ozone data varied by year and by site. Missing data are designated by 9999.000 in the ozone data files. Users of the dataset should confirm data availability for each site and year selected for use.

There are no over-water precipitation data and users must specify appropriate initial and boundary values for over-water portions of a modeling domain.

3.0 PROGNOSTIC MODEL OUTPUT FILES FOR USE WITH CALMET

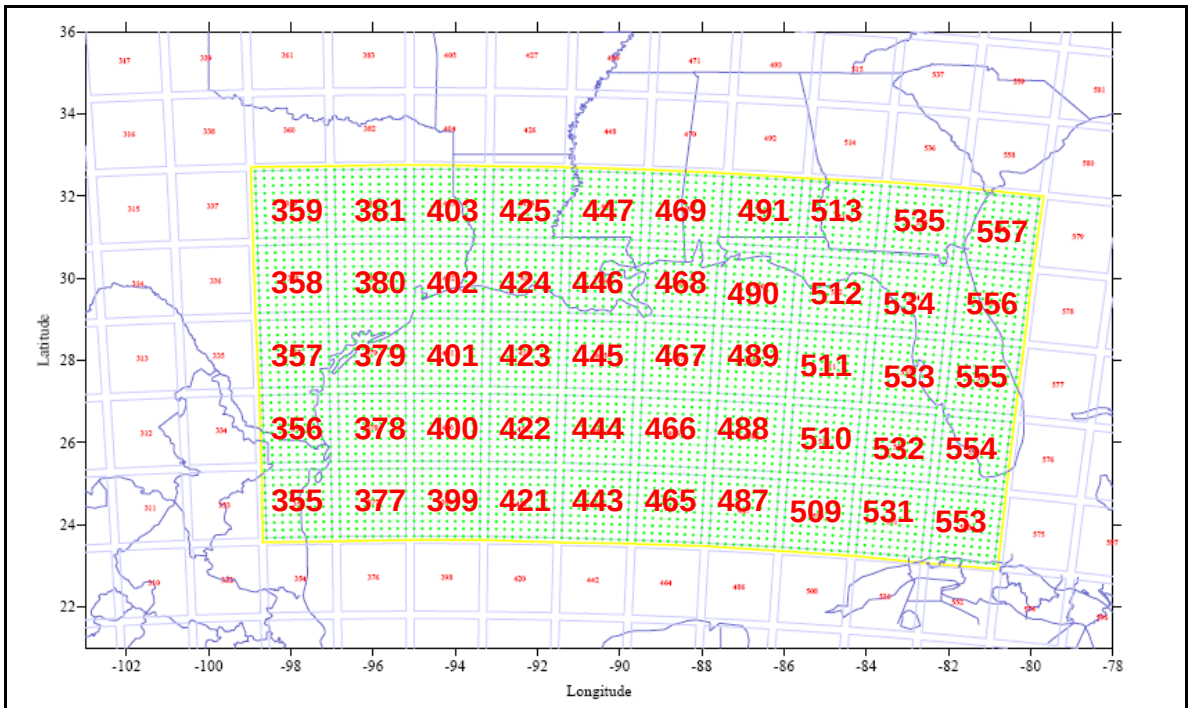
The CALMET model has the capability of using the output from a prognostic model as a first-guess field for the development of gridded wind, temperature and moisture fields. In a previous study, Earth Tech, Inc. (2006) processed output data from the Rapid Update Cycle (RUC) model (see web site at http://ruc.noaa.gov) for use by CALMET for 2003. Section D.3 of Volume 2 of this report describes the RUC data processing procedures, including the CALRUC program and the contents and formats of the required CALRUC input and output files. Thus, this study followed Earth Tech, Inc.'s approach and focused on preparing the RUC data files for 2000-2002 and 2004.

3.1. RUC DOMAIN AND DATA TILE DEFINITIONS

The RUC model is run for a domain that encompasses a large portion of North America. The output files are large and because of their size it can be difficult to work with RUC files for a full year or a multi-year period as is typical in CALMET/CALPUFF modeling. To reduce the size of the files for model applications for the GOM, subset output files covering the GOM region were extracted from the larger RUC output files. These were then further divided into "tiles," each tile covering a portion of the GOM region. The size and geographical locations of the tiles were established by Earth Tech, Inc. (2006). The GOM region is covered by 50 tiles and each tile includes 90 RUC grid points (for the RUC 20 km fields).

For the period 2000-2002 and 2004, the RUC outputs were available at 40 km resolution through mid April 2002 and then at 20 km resolution for the rest of 2002 and for 2004. In preparing the tiles, we interpolated the 40 km outputs to 20 km resolution, as needed, to achieve an effective 20-km resolution for all years.

The GOM domain for which RUC output fields are available is shown in Figure 6. The locations of the tiles are also shown in this figure. Note that Figure 6 is from Earth Tech, Inc. (2006).



Source: Earth Tech, Inc. (2006).

Figure 6. Locations of RUC Tiles for the GOM 5-Year Dataset.

The tile numbers shown in this figure are used in the file names.

3.2. MODEL OUTPUT PROCESSING PROCEDURES

We obtained the RUC output files in the gridded binary (GRIB) file format from the archive at Oak Ridge National Laboratory (www.ornl.gov). These included 40-km resolution GRIB files for 2000, 2001 and January through April 2002 and 20-km resolution files for April through December 2002 and 2004. The GRIB files specifically contain numerical forecast results combined with assimilated data from surface stations and buoys, radiosondes, wind profilers, radio acoustic sounding systems (RASS), commercial aircraft and a number of other routine and non-routine data sources. A complete description of variables included in the files can be found at http://ruc.noaa.gov/ruc20gribtable.html, for the 20-km files, and http://ruc.fsl.noaa.gov/ruc2.tpb.html for the 40-km files.

The processing procedures were slightly different for the 20- and 40-km resolution output files. For the 20-km files, we used the program CALRUC to extract the required information for CALMET from the GRIB files. This program was applied for April through December for 2002 and for the full year for 2004. The extracted information is written out to an ASCII file by the CALRUC program. Next, we used the RUCENCODE program to prepare the gridded information for each tile. The result is one binary file for each tile for each year that contains all of the parameters needed by CALMET. The binary files corresponding to the tiles can be decoded using the RUCDECODE program that is available from MMS.

The same procedures were applied to the 40-km files, with the exception that the outputs were interpolated to the 20 km grid as part of the RUCENCODE step.

Section D.3 of Volume 2 of the Earth Tech, Inc. report (Earth Tech, Inc., 2006) gives detailed examples of the RUC data processing procedures, including application of the CALRUC program and the contents and formats of the required CALRUC input and output files.

3.3. FILE NAMING CONVENTION

Each RUC tile file contains the RUC output for one tile for one year. The file names are:

Tilexxx_yyyy.pck

where xxx is the three-digit tile number from Figure 6 and yyyy is the four-digit year.

3.4. CONTENT AND FORMAT OF RUC-BASED METEOROLOGICAL INPUT FILES

The content and format of the prognostic-model-based meteorological input files is described in detail by Earth Tech, Inc. (2006). Specifically Section E.9 of Volume 2 of this report describes the contents of the prognostic model output (3D.DAT) files. The format is provided in Table E-23.

3.5. NOTES ON POSSIBLE INPUT FILE QUALITY ISSUES AND LIMITATIONS

In some cases, the RUC files were incomplete. Missing hourly values were filled in using persistence (i.e., using RUC values from the hour before), for a period of up to six hours. For longer periods, missing data were dealt with on a case-by-case basis, depending on the time of day and the amount of missing data. In a few cases, RUC output for an entire day was missing. For these cases, the RUC results for the day before were substituted. Note that hourly, gridded meteorological fields from CALMET combine the RUC fields with observed data, thus mitigating the effects of substitution.

As noted earlier, the horizontal grid resolution of the RUC outputs is not the same for the entire period. For 2000 through 16 April 2002 the resolution is 40 km. For the rest of 2002 and for 2004, the resolution is 20 km. In preparing the tiles, we interpolated the 40 km outputs to 20 km resolution, as needed, to achieve an effective 20-km resolution for all years.

4.0 OVER-LAND AND OVER-WATER METEOROLOGICAL DATASETS FOR USE WITH OCD5

The offshore and Coastal Dispersion model (Hanna et al., 1985; DiCristofaro and Hanna, 1989; Chang and Hahn, 1997) is a Gaussian dispersion model that was designed to simulate the effects of offshore emissions on onshore/coastal air quality. The meteorological inputs are used to characterize the over-water boundary layer including over-water transport and dispersion, as well as the transition to over-land dispersion conditions in connection with onshore flow.

In preparing the meteorological and ozone datasets for use with version 5 of the OCD modeling system (OCD5), we followed the guidelines on input preparation for OCD5 presented in the user's guide by Chang and Hahn (1997). The OCD5 input files were prepared for all years for the period 2000-2004. The OCD5 model requires meteorological input files for selected over-land (onshore) and over-water (offshore) locations. The offshore sites are paired with onshore sites for the purpose of filling in missing offshore data. These files were prepared using onshore surface and upper-air data from the NWS, mixing height estimates obtained from the National Climatic Data Center (NCDC), and offshore buoy data from the NDBC.

4.1. SURFACE, UPPER-AIR, AND BUOY SITE GROUPINGS

Onshore surface data include wind speed, wind direction, temperature, cloud cover, and ceiling height. Upper-air data are the twice-daily mixing heights. The surface and upper-air parameters were processed using the meteorological processor program PCRAMMET. In addition to reformatting the data and identifying missing data points, PCRAMMET also calculates various stability parameters for the onshore locations. The resulting onshore meteorological data file is referred to as the "lmet" file. Information from the lmet file is then used along with the buoy data to generate the "wmet" file. In this study, we used the program BUOY_WME to reformat the buoy data and then applied OCDPRO to fill in the missing required elements in the wmet files. The BUOY_WME reformatting program was developed and provided by MMS.

Working with MMS, we developed the following groupings (of buoy, onshore surface, and onshore upper-air sites) for preparation of the OCD5 meteorological input data files. Each grouping is intended to represent a section of the GOM region as indicated in parentheses.

- **OCD Group 1**: (southwestern portion of the Texas Gulf Coast)
  Buoy 42020
  Surface data: Corpus Christi
  Upper-air data: Corpus Christi
- **OCD Group 2:** (central portion of the Texas Gulf Coast)
  Buoy 42019
  Surface data: Corpus Christi
  Upper-air data: Corpus Christi
- **OCD Group 3a**: (northeastern portion of the Texas Gulf Coast)
  Buoy 42035
  Surface data: Port Arthur
  Upper-air data: Lake Charles

- **OCD Group 3b:** (western portion of the Louisiana Gulf Coast, specifically Cameron and Vermillion Parishes)
  Buoy 42035
  Surface data: Lake Charles
  Upper-air data: Lake Charles
- **OCD Group 3c:** (central portion of the Louisiana Gulf Coast)
  Buoy 42035
  Surface data: Patterson, LA
  Upper-air data: Lake Charles
- **OCD Group 4a:** (north of Pass a Loutre, Louisiana to Biloxi, Mississippi)
  Buoy 42007
  Surface data: New Orleans
  Upper-air data: Slidell
- **OCD Group 4b:** (east of Biloxi, Mississippi and Alabama)
  Buoy 42007
  Surface data: Mobile
  Upper-air data: Slidell
- **OCD Group 5a:** (east of around Morgan City to Pass a Loutre, Louisiana)
  Buoy 42040
  Surface data: Patterson, LA
  Upper-air data: Slidell
- **OCD Group 5b:** (Florida panhandle, west of Destin)
  Buoy 42040
  Surface data: Pensacola
  Upper-air data: Tallahassee
- **OCD Group 6a:** (Florida panhandle, Destin to Panama City)
  Buoy 42039
  Surface data: Panama City
  Upper-air data: Tallahassee
- **OCD Group 6b:** (Florida panhandle, east of Panama City)
  Buoy 42039
  Surface data: Tallahassee
  Upper-air data: Tallahassee
- **OCD Group 7a**: (Florida panhandle, east of Panama City and northern peninsular Florida)
  Buoy 42036
  Surface data: Tallahassee
  Upper-air data: Tallahassee

- **OCD Group 7b**: (central peninsular Florida)
  Buoy 42036
  Surface data: Tampa
  Upper-air data: Tampa

4.2. OVER-LAND DATA FILES

Over-land meteorological data are primarily used by OCD5 to estimate the temperature, stability, and turbulence characteristics of the atmosphere. In the OCD5 model, over-water observations of wind direction and wind speed are assumed to apply to both over-water and over-land areas. However, if on-site meteorological observations of these parameters over the water are not available, then hourly over-land values are used. The corresponding over-water data are contained in the wmet data files, which are discussed in Section 4.3.

4.2.1. Data Processing Procedures

Preparation of the over-land (lmet) data included several steps:

- Surface data for the sites listed above were obtained from NCDC, primarily from CDs. The surface data were extracted and converted to the SAMSON format. SAMSON stands for Solar and Meteorological Surface Observational Network and contains hourly solar radiation data along with selected meteorological elements.
- Twice-daily mixing height estimates for the upper-air sites were also obtained from NCDC. These were specifically prepared by NCDC for this project, using the standard Holzworth (1972) technique, in accordance with the guidelines for using PCRAMMET (EPA, 1999). Daily values of the nocturnal (minimum) and afternoon (maximum) mixing heights were provided in the format required by PCRAMMET. Files were re-formatted slightly because the field position of the afternoon mixing height in the files produced by NCDC is not the same as the position required by PCRAMMET.
- For each surface and upper-air site, missing data were identified and replaced with estimated values that were based on persistence (for less than 6 hours) or interpolation or substitution (by hand) for all other cases.
- PCRAMMET was then run for each surface/upper-air site pair. Standard PCRAMMET ASCII output files were generated.
- Quality assurance checks tailored to the lmet files were performed to ensure that all available data were incorporated into the lmet data files, that selected processed data values matched those in the raw data files, that no meaningful error messages were generated by PCRAMMET, and that the format of the lmet files is correct.

4.2.2. File Naming Convention

Each lmet file contains data for one surface/upper-air site pair for one year. The file names are:

lmet_group#_yyyy.dat

where group# is the OCD group number listed above (this indicates the surface/upper-air site pair) and yyyy is the four-digit year. In a few cases, the surface and upper-air sites are the same for different groups. In keeping with the group# naming convention, duplicate files were made and named according to the OCD group number.

4.2.3. Content and Format of LMET Datafiles

The content and format of the lmet meteorological data files is described in detail by Chang and Hahn (1997). Specifically Section 3.2.2 of this document describes the file and Table 3-13 of the document list the contents and the formats.

4.3. OVER-WATER DATA FILES

Over-water meteorological data are used by OCD5 to estimate the temperature and stability characteristics of the atmosphere over the water. In addition, over-water observations of wind direction and wind speed are used by the OCD model, as available. Buoy data can be much more sporadic than data from land-based stations, so there are several options for filling in missing data using persistence, over-land data, and/or default values.

4.3.1. Data Processing Procedures

Preparation of the over-water (wmet) data included several steps:

- Buoy data for the sites listed above (in Section 4.1) were obtained from NDBC, primarily via download from the web-based NCDC data archive. The web site address is http://www.ndbc.noaa.gov.
- The buoy data were reformatted using the program BUOY-WME, which was provided by MMS.
- The program OCDPRO (Chang and Hahn, 1997) was then applied using the reformatted buoy data and the lmet data for the corresponding surface/upper-air site pair. OCDPRO was iteratively applied to replace all missing data with estimated values. OCDPRO applies persistence for missing data for periods of less than 6 hours and replaces the missing values with default values for periods of greater than two days. The following default values were applied:

  Relative humidity 80%

  Air temperature .....Over-land air temperature

  Air minus water temperature .....0°C

  Mixing height.....500 m

For periods that are between 6 hours and two days, we manually edited the files and replaced the missing data using interpolation and/or day-to-day substitution, using the data and our meteorological judgment to guide us.

- Quality assurance checks tailored to the wmet files were performed to ensure that all available data were incorporated into the wmet data files, that selected processed data values matched those in the raw data files, that the data substitution was done in a consistent manner, that the lmet and wmet files were paired correctly for application of OCDPRO, and that the format of the wmet files is correct.

4.3.2. File Naming Convention

Each wmet file contains data for one buoy/surface/upper-air site group for one year. The file names are:

wmet_group#_yyyy.dat

where group# is the OCD group number listed above (this indicates the buoy/surface/upper-air site group) and yyyy is the four-digit year.

4.3.3. Content and Format of WMET Datafiles

The content and format of the wmet meteorological data files is described in detail by Chang and Hahn (1997). Specifically Section 3.2.3 of this document describes the file and Table 3-15 of the document list the contents and the formats.

4.4. NOTES ON POSSIBLE DATA QUALITY ISSUES AND LIMITATIONS

Most of the data quality issues for the OCD files pertain to missing data.

In a few cases, mixing heights were missing for either the morning or afternoon period or for the entire day (both periods). This is the result of missing upper-air sounding data. To fill in the missing data, we applied persistence and substituted the values from the same time period from the prior day. For all sites, fewer than approximately 10 percent of the mixing heights were missing. The occurrence of missing upper-air sounding data/mixing heights was roughly the same for all years.

Similarly, hourly surface meteorological data for the land-based monitoring sites were missing for some sites and periods used in preparing the OCD dataset. In this case we applied persistence on an hourly basis, for up to approximately 6 hours. For longer periods, we used interpolation and/or replacement with data from a prior day - based on the time of day and an analysis of the overall meteorological conditions and tendencies revealed in the available data. Persistence was applied automatically using a simple program. The interpolation/replacement was done by hand. A majority of the substitutions were for wind directions reported as variable and, for the most part, these were assigned the wind direction from the hour before. For the surface sites, the occurrence of missing data decreased slightly from 2000 to 2004. Patterson, LA and Panama City, FL had the greatest occurrence of missing data.

Buoy data were also missing for some sites and periods used in preparing the OCD dataset. As discussed earlier in this section we used the OCDPRO tool to fill in the missing buoy data. One key assumption in the buoy files is the use of default values for several of the parameters including over-water mixing heights.

Finally, the user of this dataset should note that the buoy, surface, and upper-air sites were grouped based on location and each group is intended to represent over-water and over-land conditions for a certain portion of the GOM and the coastal area. The representativeness of the sites may vary by region and by year.

The OCD files have not been used for any OCD modeling, so the integrity of the files has not been fully tested. Application of the OCD5 model may be version and platform dependent and minor formatting and other issues may arise in using these files, especially in response to changes in model or the computer system on which it is run.

5.0 SUMMARY OF QA/QC PROCEDURES FOR DATA COLLECTION AND PROCESSING

In preparing these datasets, we assumed that the meteorological and air quality data used for this study had already received some level of data validation. Consequently, our QA/QC procedures focused on data handling and processing procedures, observance of data flags, and ensuring the accuracy, completeness, and consistency of the processed datasets.

To ensure the reliability of the meteorological and air quality data as well as the extraction, processing and reformatting steps, we conducted the following quality assurance checks:

- All programs/codes used to process and reformat the data were reviewed and checked before each application.
- All data flags were reviewed and used appropriately to guide the data processing (e.g., to exclude erroneous or questionable data).
- The site locations and IDs were checked and confirmed.
- The units for all data elements were checked and confirmed.
- The temporal resolution for each data type was checked and confirmed.
- The range of time over which the data are available and the date/time stamp for each data element was reviewed.
- For each type of data file prepared, multiple random dates and times were selected and the values of the processed/reformatted data elements were spot-checked against the original data files.
- This same check was also done for the derived quantities, such as mixing heights.
- The values of the each parameter for each site were sorted according to magnitude, to check that all values are within an acceptable range.
- The data files for each site and year were checked for completeness.
- Finally, the format, content and name of each file was verified.

6.0 REFERENCES

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The Department of the Interior Mission

As the Nation's principal conservation agency, the Department of the Interior has responsibility for most of our nationally owned public lands and natural resources. This includes fostering sound use of our land and water resources; protecting our fish, wildlife, and biological diversity; preserving the environmental and cultural values of our national parks and historical places; and providing for the enjoyment of life through outdoor recreation. The Department assesses our energy and mineral resources and works to ensure that their development is in the best interests of all our people by encouraging stewardship and citizen participation in their care. The Department also has a major responsibility for American Indian reservation communities and for people who live in island territories under U.S. administration.

The Minerals Management Service Mission

As a bureau of the Department of the Interior, the Minerals Management Service's (MMS) primary responsibilities are to manage the mineral resources located on the Nation's Outer Continental Shelf (OCS), collect revenue from the Federal OCS and onshore Federal and Indian lands, and distribute those revenues.

Moreover, in working to meet its responsibilities, the **Offshore Minerals Management Program** administers the OCS competitive leasing program and oversees the safe and environmentally sound exploration and production of our Nation's offshore natural gas, oil and other mineral resources. The MMS **Minerals Revenue Management** meets its responsibilities by ensuring the efficient, timely and accurate collection and disbursement of revenue from mineral leasing and production due to Indian tribes and allottees, States and the U.S. Treasury.

The MMS strives to fulfill its responsibilities through the general guiding principles of: (1) being responsive to the public's concerns and interests by maintaining a dialogue with all potentially affected parties and (2) carrying out its programs with an emphasis on working to enhance the quality of life for all Americans by lending MMS assistance and expertise to economic development and environmental protection.