

Turkish Meteorological Service Data Archiving System, accessing procedures and best practices



Mustafa Sert & Ersin Şimşek & Serhat Sensoy
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- History
- In-Situ Observation Network
- Remote Sensing Observations
- TSMS Telecommunication Network
- TSMS Archive Inventory
- TSMS Data Accessing Procedure
- Comparison between 19th Century Data (1866 – 1886) with Modern (1928 – 2010) Daily Data for Goztepe – Istanbul
- TUMAS : Turkish Meteorological Archiving System
- Data Flow
- Data Sources
- Data Archiving
- Data Inventory
- Data Flow, data archiving and data sources
- Hardware & Software
- Data Content

- 1841 First meteorological observations started in Istanbul
- 1873 Participated in the International Meteorological Congress (Vienna)
- 1875 First Observation Network established with 16 stations
- 1915 Upper air observations and weather forecasts started
- 1925 Establishment of Meteorological Institute
- 1937 Establishment of Turkish State Meteorological Service
- International Memberships
 - 1949 WMO
 - 1975 ECMWF
 - 1984 EUMETSAT
 - 1999 ECOMET
- 2000 Recognized as one of the 23 Regional Training Centre of WMO
- 2008 Became member of ALADIN Consortium

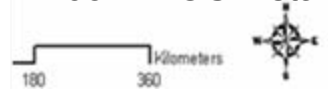
In-Situ Observation Network



-  KARAYOLLARI Road
-  PLANLANAN Planned
-  HSAF HSAF
-  AKOM DCC-Istanbul
-  MEYDAN Airport
-  151 AWOS AWOS
-  206AWOS AWOS(TEFER)
-  MEYDAN (OMGI VAR) Airport AWOS

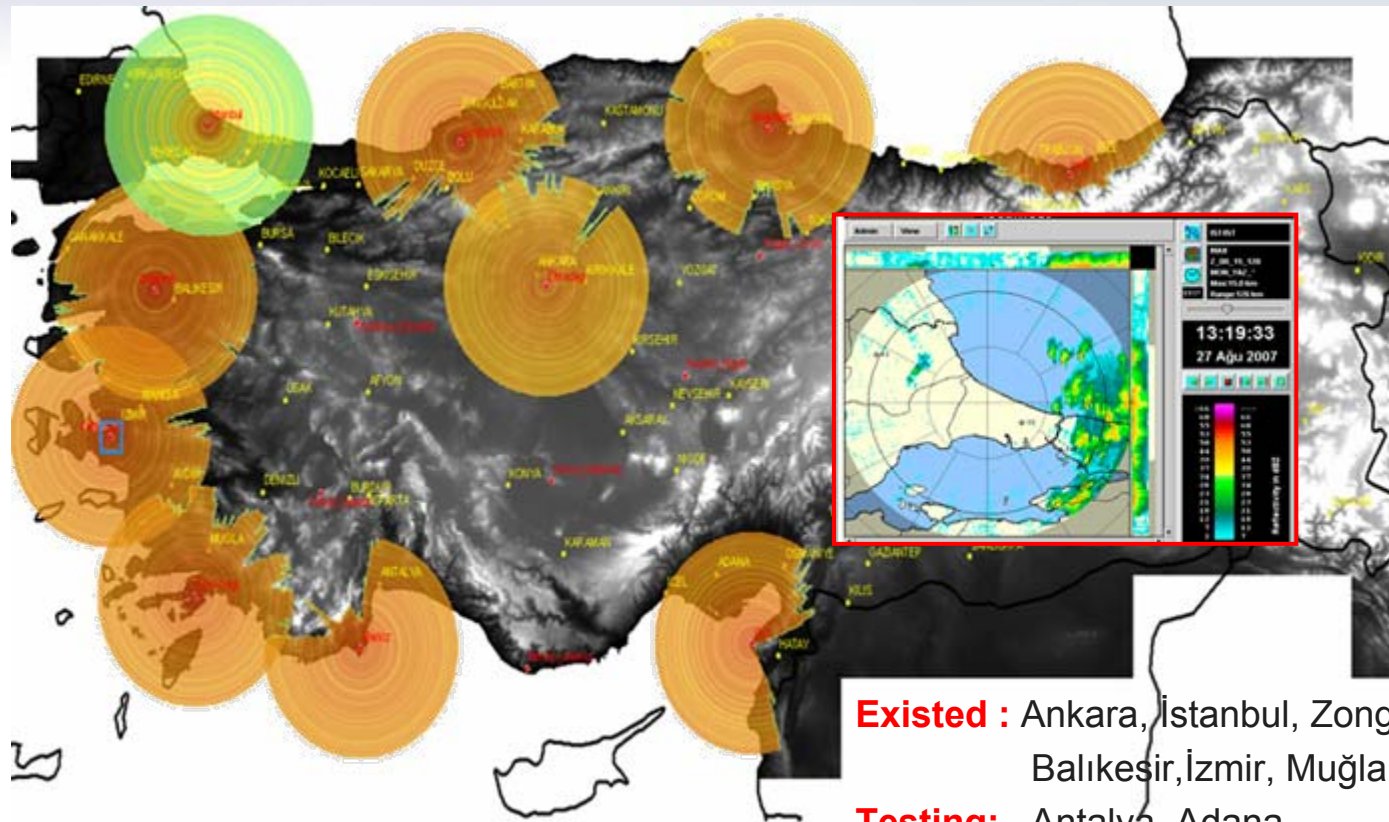
257 Climate, 132 Synoptic, 63 Airport (50 with AWOS),
40 Marine, 8 Ravinsonde

463 AWOS installed, 246 will be completed 2012



Remote Sensing Observations

C-Band Doppler Radars



- Geo-stationary (MSG)
- Polar (NOAA, METOP)



EUMETSAT
member since 1984

Existed : Ankara, İstanbul, Zonguldak,
Balıkesir, İzmir, Muğla,
Testing: Antalya, Adana
Samsun, Trabzon,

Also short range **X-band** radars
have been planned for 2012

- ❖ 110 VSAT Connection
- ❖ 5 Central Satellite Receiving System (2 EumetCast, 1 L-X Band, 2 L Band) and 4 Satellite Receiving System (EumetCast)
- ❖ 340 GPRS Connection
- ❖ 330 ADSL Connection
- ❖ 8 radio-link connection
- ❖ 150 Mb MetroEthernet Internet connection (Ankara - Centre)
- ❖ 10 Mb MetroEthernet Internet connection (İstanbul - Region)
- ❖ PSTN (Dial-up) connection
- ❖ Fax connection

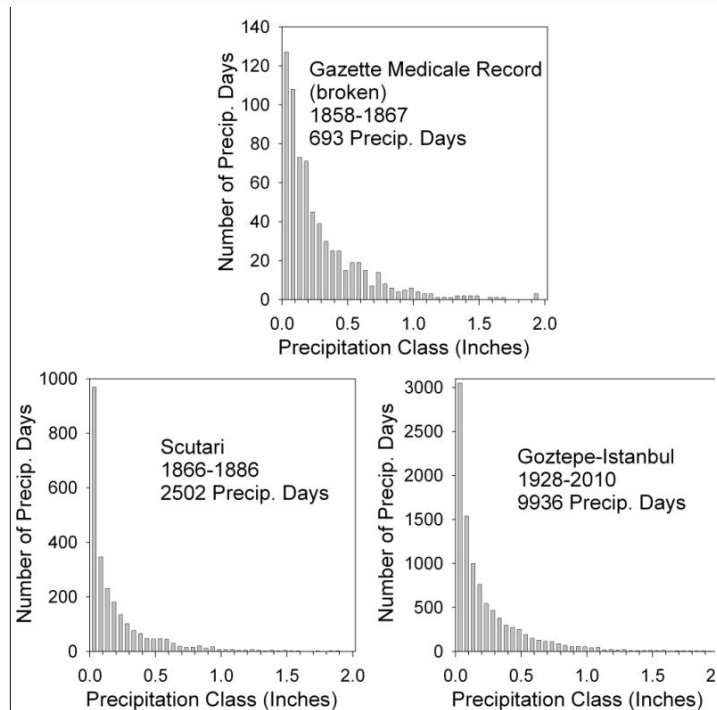
- Climatological data (1926-Today)
- Ravinsonde data (1971-Today).
- Synoptic data(1980-Today)
- AWOS data (2003 -Today)
- Aerodrome AWOS data (2003-Today)
- Metar data (2000-Today)
- Taf,Sigmet,Airmet data (2008-Today)
- Open Screen Observation Data (1999-Today)
- Sea Surface temperature data(Beginning– Today).
- Inversion analyse data (2006-Today)
- Ozon/UV Data (2006/1997-Today)
- Radar Data (2008 – Today)
- Satallite Data (2008 – Today)
- Model Data (2006 – Today)

TSMS Data Accessing Procedure

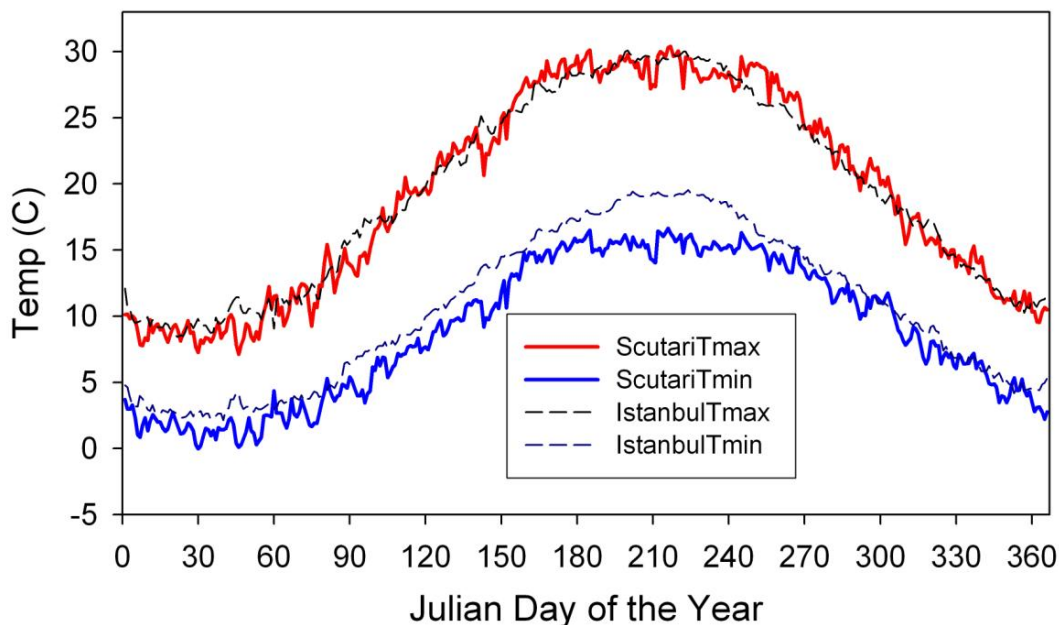
- **Turkish users:**
- Internal users can access data by describing their request by official application.
- Internal users are required to be members of TUMAS to retrieve data online.
- Universities and government organizations can access the data free of charge.
- For Individual users and private sector the access to data is a paid-service .

- **Non- Turkish users:**
- External users cannot be TUMAS members due to the fact that they do not have a valid Turkish ID.
- External users should make data request through written application to the TSMS
- The requests of foreign nationals are first considered in the External Relation Division
- Requests within the scope of ECOMET(*) is free of charge (universities, end-users), for private sector, the access to the data is a paid-service.

Comparison between 19th Century Data (1866 – 1886) with Modern (1928 – 2010) Daily Data for Goztepe - Istanbul



Comparison between late 19th Century Data (1866-1886) with Modern (1928-2010) Daily Temperature Averages for Goztepe-Istanbul



MEDARE METADATA

WMO MEDARE initiative

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Add New Station

Current Station Details

If already you have inserted

Station Code:*

Station Name:*

Latitude:*

Altitude:*

(in meters)

Country:*

Type of Station:

Responsible
Organisation:

Address:



220

IZMIR-GUZELYALI

38,39 N

e.g.: (49° 30'00"N) or (49.5000°)

28.6

TURKEY

synoptic

Turkish State Meteorologic

24. Sk. No.51 35290, Guzelyali, IZMIR

Longitude:*

27,08 E

e.g.: (3° 30'00"W) or (-3.5000°)

City/Town/Village:*

IZMIR

Opening Date:*

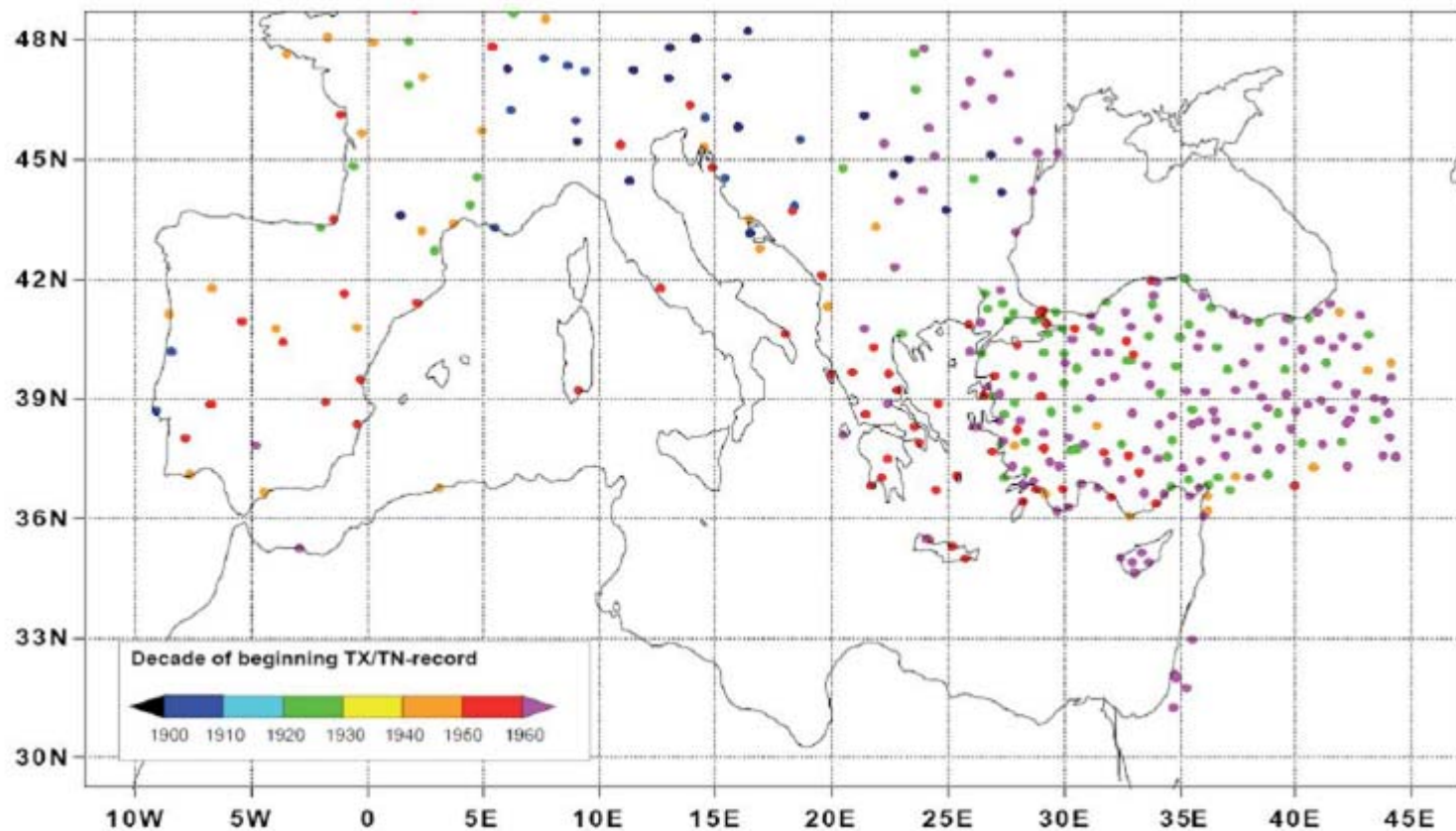
(Format: yyyy-mm-dd)

1938-01-01

Contact E-mail:

ssensoy@dmi.gov

Mediterranean Climatological Data Daily Obs. Tmax & Tmin Starting Year



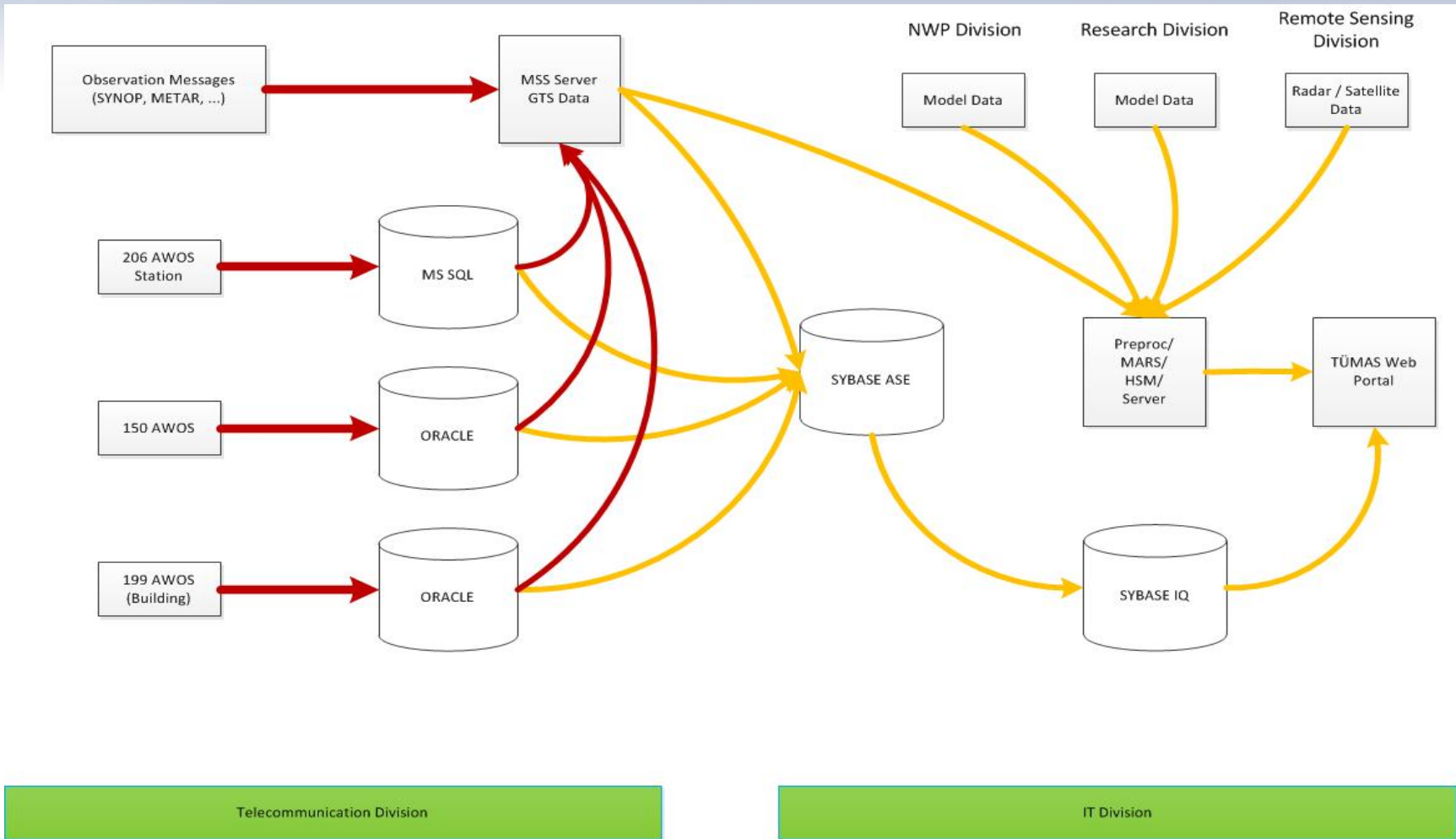
Courtesy of Elena Xoplaki

TUMAS : Turkish Meteorological Archiving System

Components;

1. Data acquisition, pre-processing
Contains Data acquisition mechanisms and some format conversions from data sources. BUFR packaging software is used for raw data.
2. Data archive on Databases and / or MARS
Contains data insert into databases (empress, sybase) and / or MARS. Some observations archive both db and MARS.
rdb server software is used to insert data from Empress db to MARS.
3. Data presentation via web Portal
Contains data presentation from web. It is a Web – based application developed by Java. Web portal can connect to Sybase DB and MARS (via WebMARS) and HSM system. Users can access data online via TUMAS.

Data Flow



AWOS : Automatic Weather Observation Station
TUMAS : Turkish Meteorological Data Archive System

Data Sources

- ❖ 132 Synoptic Stations
- ❖ 257 Climatological Stations (242 AWOS, 15 Manuel)
- ❖ 63 Aviation Stations (50 AWOS, 13 Manual)
- ❖ Total 463 AWOS Stations, + 246 installing (2012)
- ❖ 40 Sea Stations (installing, 2012)
- ❖ 8 Ravinsonde Stations
- ❖ 8 Meteorological Radars (+ 4 installing)
- ❖ Met. Satallite Systems (MSG, NOAA, HSAF, MPEF, SAFNWC)
- ❖ NWP Models (ECMWF, MM5, ALADIN)
- ❖ Reseach Models (WRF, DUST, RegCM, Precis)

Data Archiving

Our data archiving strategy is ;

- For small data, like observations: Database (Sybase db) and MARS (as bufr)
- For huge data, like radar, satellite and model: storage management software (TSM). But we archive some ECMWF Model Outputs as grib (Ecb, Ecd, Ece and MM5 Outputs on MARS).
All huge data archives on TSM.

Data Archiving

- We collect data in data center and disaster recovery center (Istanbul) for redundancy.
- Virtualization technology for some servers (database, dpp ?, mars ?) may be an effective solution. We're planning to use virtualization from relational database and after, dpp and mars server if possible.
- Enterprise tape library for huge data is still an optimal solution.

Data Archiving

We provide data as fast as possible from our archiving system to all internal and external users.

- To do this, we use Web Portal. (tumas.mgm.gov.tr)
- Web portal can access Sybase IQ datawarehouse (OLAP based Database) quickly, MARS and HSM System to retrieve the requested data.
- Data output format options for observations from database are xml, doc, xls,txt,pdf.
- Data output format for observations from MARS is bufr. We can convert BUFR data to ascii if requested. (using `metview - obs_filter`)

Data Inventory

Data Type	Archive Period	Archive - End	Media	Daily avg. Obs/Forecast/Data Count	Archived Daily Obs/Forecast/Data Amount	Sum of Archived Obs/Forecast/Data Amount	Data Format
Synoptic Obs.	1980	Today	Database	8800 row/day	--	151,5 GB	DB
	1990-01-01	Today	MARS	170,000 record	33 MB	181 GB	BUFR
Climate Obs.	1926-11-01	Today	Database	--	--	37,9 GB	DB
AWOS Obs. (Min.)	2003-03-14	Today	Database	355 station/day	--	-	DB
SHIP Obs.	1990-01-01	Today	MARS	21000	4.6 MB	28 GB	BUFR
METAR Obs.	2002-02-01	Today	MARS	56000	8.2 MB	31,5 GB	BUFR
	2000	Today	Database	1700 row/day	--	--	DB
TAF	2008-04-01	Today	Database	350 row/day	--	--	DB
SIGMET/AIRMET/ GAMET	2008-03-01	Today	Database	20 row/day	--	--	DB
Ravinsonde (TEMP) Obs.	1990-01-01	Today	MARS	1550 record	1.6 MB	25,69 GB	BUFR
	1970	Today	Database	45000 row/day	--	49,1 GB	DB
Inversion Analyse	2006-03-16	Today	Database	468 row/day	--	--	DB
Inversion Forecast	2008-01-01	Today	Database	2457 row/day	--	--	DB
Ozon (Ozonsonde)	1994-01-13	Today	Database	1700 row/mnth	--	--	DB



Data Inventory



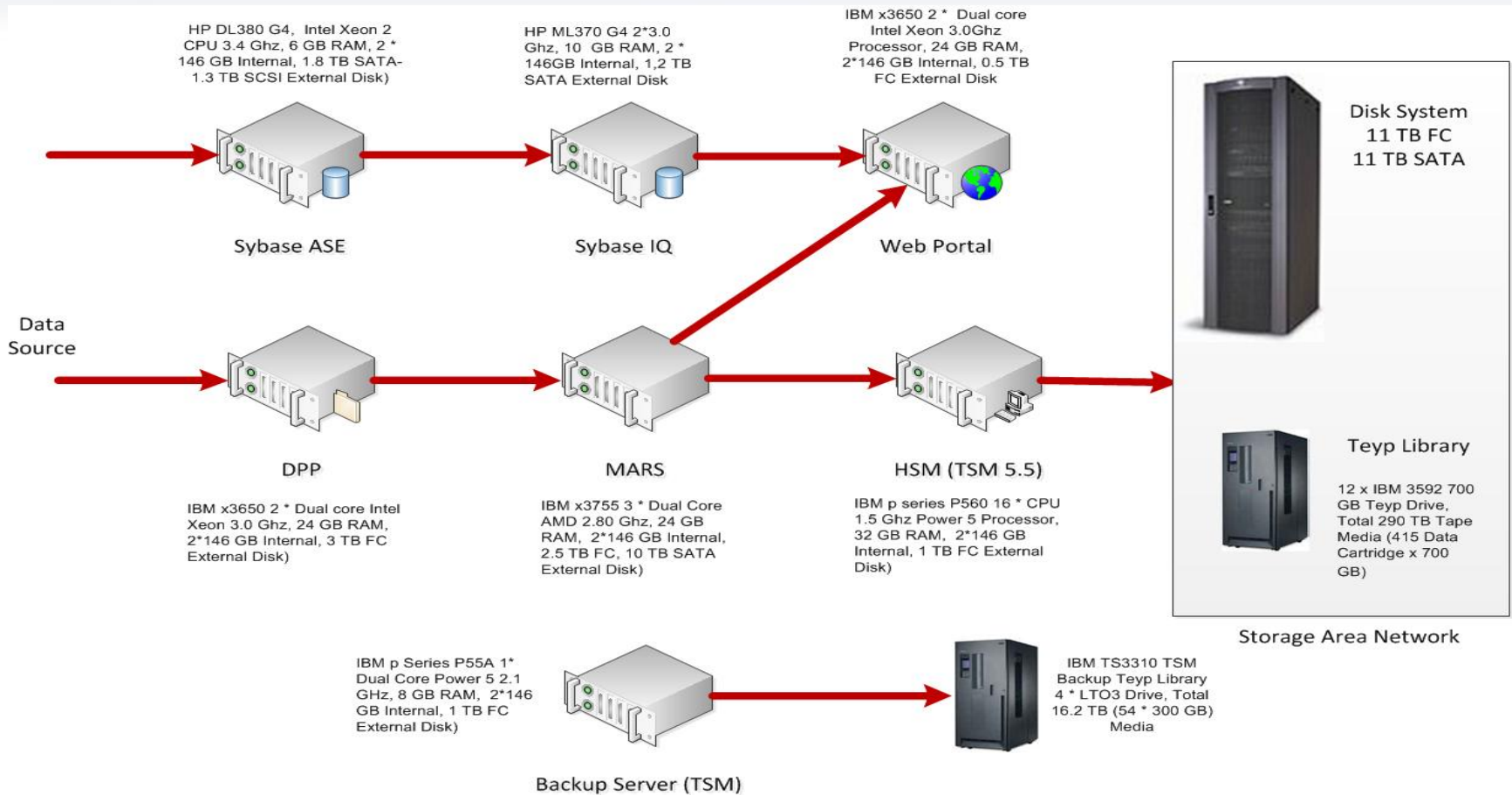
Data Type	Archive Period	Archive - End	Media	Daily avg. Obs/Forecast/Data Count	Archived Daily Obs/Forecast/Data Amount	Sum of Archived Obs/Forecast/Data Amount	Data Format
Ozon (Brewer)	2006-11-09	2009-12-31	Database	1 row/day	--	--	DB
UVA-UVB	1997-01-03	2010-07-12	Database	46000 row/day	--	--	DB
UVA-UVB (Brewer)	2006-11-09	2009-12-31	Database	8 row/day	--	--	DB
UvIndex (Brewer)	2006-11-09	2009-12-31	Database	8 row/day	--	--	DB
Prec.Water Analyse	1999-04-28	2010-10-17	Database	40 row/mnth	--	--	DB
Wind Energy Foracast Data	2010-10-12	Today	FileSystem	90 file	200 MB/day	7 GB	Ascii-Text
Aerodrome AWOS data	2003-02-01	Today	FileSystem	64 station/month	10 MB/month	69,1 GB	Ascii-Text
Radar (Ank-Ist-Blk-Zng)	2008-03-26	Today	MARS -TSM			5268 GB (MARS) 2936 GB (TSM)	Binary
Radar (Izm-Mgl)	2010-10-01	Today	TSM (Tape)	22000 (Total)	22 GB		
Radar (Ant - Hty)	2011-07-15	Today	TSM(Tape)				
Uydu - MSG	2008-06-07	Today	MARS TSM (Teyp)	13,000	8,2 GB	1484 GB (MARS) 6568 GB(TSM)	Binary
Uydu NOA	2008-06-07	Today	MARS TSM (Teyp)	2,200	1,8 GB	21,6 GB (MARS) 1509 GB (TSM)	Binary
Uydu SAF	2008-06-07	Today	MARS TSM (Teyp)	900	0,5 GB	36,5 GB (MARS) 794 GB (TSM)	Binary

Data Inventory

Data Type	Archieve Period	Archieve - End	Media	Daily avg. Obs/Forecast/Data Count	Archived Daily Obs/Forecast/Data Amount	Sum of Archieved Obs/Forecast/D ata Amount	Data Format
Model – METU3	2007-10-03	Today	TSM	2 File/day	23,4 MB/day	16,5 GB	ASCII
	2011-01-20	Today	TSM	1 File/day	431 MB/day	10,8 GB	NETCDF
Model – MM5-MD0	2007-11-26	Today	TSM-Tape	1 File/day	2,1 GB/day	2362 GB	CrayBin
Model – MM5-MD1	2006-03-09	Today	TSM-Tape	3 File/day		1592 GB	CrayBin
Model – MM5-MD2	2006-03-09	Today	TSM-Tape	3 File/day			CrayBin
Model – MM5-MD3	2007-11-01	Today	TSM-Tape	3 File/day			CrayBin
Model – MM5- MD4	2007-11-01	Today	TSM-Tape	3 File/day			CrayBin
Model – ALARO	2011-01-20	Today	TSM-Tape	72 File/day	2,88 GB/day		.fa
Model – ARPAGE	2011-01-20	Today	TSM-Tape	4 File/day	1,46 GB/day		NetCDF
Model – Image	2011-01-20	Today	TSM-Tape	1 Tar File/Day (18000 file)	2,64 GB/day		png
Model - Precis			TSM-Tape	1,077,730 file	-	6,77 TB	spec
Model – WRF	2009-12-17	2010-06-30	TSM-Tape	1	1,2 GB	450 GB	tar
Model – Dust (Dream8b)	2010-06-02	Today	TSM-Tape	1	520 MB	135 GB	tar.gz

Hardware

TÜMAS System





Hardware

MARS

MARS Server (MAIN)



IBM x3755
3 * Dual Core AMD 2.80 Ghz,
24 GB RAM,
2*146 GB Internal,
2.5 TB FC, 10 TB SATA External Disk

MARS2 Server



IBM x3755
2 * Dual Core AMD 2.3 Ghz,
16 GB RAM,
4*300 GB Internal Disk



Web Portal Server (+ WebMARS)

IBM x3650
2 * Dual core Intel Xeon 3.0Ghz Processor,
24 GB RAM,
2*146 GB Internal,
0.5 TB FC External Disk

Filesystem (MARS Server)	Size	Used	Avail	Use%	Mounted on
/dev/sda2	11G	3.9G	6.2G	39%	/
tmpfs	12G	68K	12G	1%	/dev/shm
/dev/sda1	107M	7.2M	94M	8%	/boot
/dev/sda4	123G	95G	29G	78%	/opt
/dev/mapper/mars1vg-arch0lv	1.1T	2.1G	1.1T	1%	/marsarch0
/dev/mapper/mars1vg-arch1lv	1.1T	2.4G	1.1T	1%	/marsarch1
/dev/mapper/mars1vg-arch2lv	1.1T	757G	364G	68%	/marsarch2
/dev/mapper/mars1vg-arch3lv	1.1T	735G	386G	66%	/marsarch3
/dev/mapper/mars1vg-arch4lv	1.1T	33M	1.1T	1%	/marsarch4
/dev/mapper/mars1vg-arch5lv	1.1T	772G	349G	69%	/marsarch5
/dev/mapper/mars1vg-arch6lv	1.1T	761G	360G	68%	/marsarch6
/dev/mapper/mars1vg-arch7lv	1.1T	33M	1.1T	1%	/marsarch7
/dev/mapper/mars1vg-arch8lv	1.1T	33M	1.1T	1%	/marsarch8
/dev/mapper/mars1vg-arch9lv	1.1T	33M	1.1T	1%	/marsarch9
/dev/mapper/mars4vg-marsbackupodlv	40G	143M	40G	1%	/marsbackupod
/dev/mapper/mars4vg-marsdbodlv	40G	1.4G	39G	4%	/marsdbod
/dev/mapper/mars4vg-logfileslv	10G	6.7G	3.4G	67%	/logfiles
/dev/mapper/mars4vg-marsmiscodlv	10G	563M	9.5G	6%	/marsmiscod
/dev/mapper/mars4vg-marstxnodlv	10G	68M	10G	1%	/marstxnod

MARS uses 2 x 1 TB cache, 4 x 1 TB prearc, 1 x 1 TB defrag disk, and 3 x 1 TB spare, total ; 11 TB capacity (SATA)

DATA ARCHIVES ON DISK, IF DISK REACHES TO WATERMARK VALUE, IT FLUSHES TO TAPE. SO, NEAR_TIME DATA IS GENERALLY ON DISK!

MARS2 SERVER WAITS COLD STAND-BY, IF A HARDWARE PROBLEM OCCURS TO MAIN MARS SERVER, IT MOUNTS THE MARS SERVER'S EXTERNAL DISKS AND OPERATES. ALL MARS SOFTWARE IS INSTALLED ON MARS2 SERVER.

Software

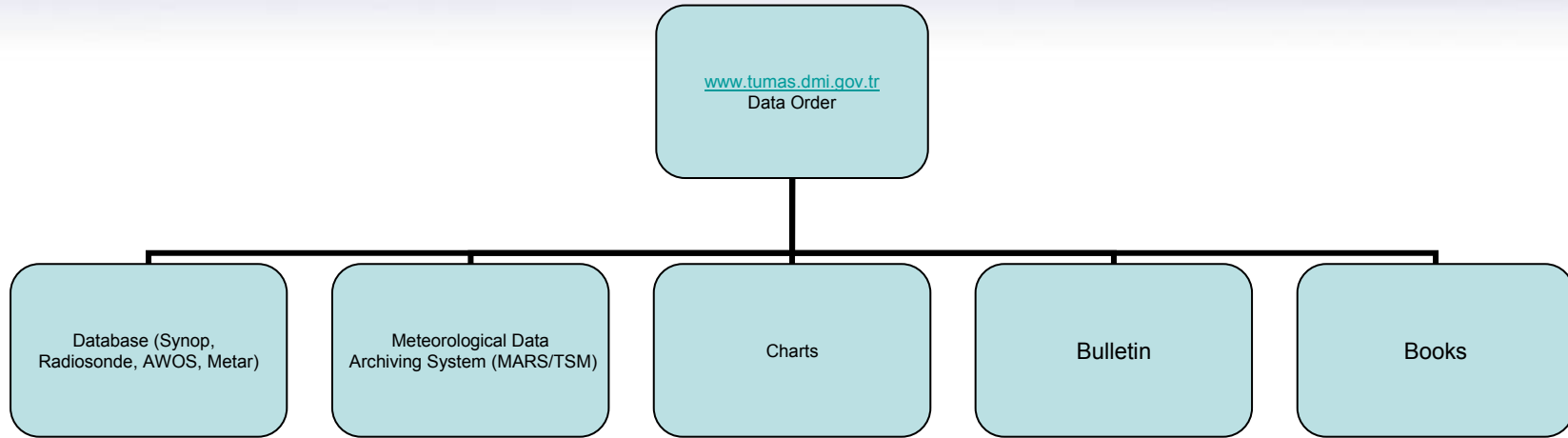
- o **Operating Systems** ; Suse Linux 9 / 10 ES, TSM Servers (AIX 5.4)
- o **Database** ; Sybase ASE 15.1, Sybase IQ 12.7, Empress DB 8.62 and mysql 4 (dpp server)
- o **Hierarchical Storage Management Software**; IBM Tivoli Storage Manager 5.5 (hsm server)
- o **Web Application Software**; IBM WebSphere Portal 6.1 (Web portal server)
- o **Specific Software** ; MARS (mars server, from ECMWF)
- o **Specific Software** ; Pre-processing software, rdb server software (dpp server, from ECMWF)
- o **Specific software** ; Raw Data Package/unpackage software (dpp server, webmars server)
- o **Specific Software** ; WebMARS, EmosLib, Metview/magics, GribAPI (dpp server, webmars server from ECMWF)

TUMAS Web Portal

- Web – based application developed by Java.
- Users can access data from TUMAS online.
- Internal / External users should be a TUMAS member to retrieve data.
- External users from non-governmental organizations are required to pay for data.
- Data size for database ~ 2 TB
- Data size for TSM (Tape Library) ~ 90 TB

Software

TUMAS Web Portal



The data presented in www.tumas.mgm.gov.tr can be grouped into 5 titles

Software

TUMAS Web Portal

TUMAS has been designed to meet the increasing demand of storing and presenting the meteorological data (observations, radar, satellite, NWP, etc.)

TUMAS is the main repository of meteorological data at Turkish State Meteorology Service (TSMS). It contains terabytes of data which are generated by TSMS.

TUMAS uses Sybase RDBMS and MARS software to achieve and retrieve data which are stored in different media (disk storage system,tape library). MARS software is installed in TUMAS and mainly works to archive/retrieve data from/to disks or tapes.



<http://www.tumas.mgm.gov.tr>

Teşekkürler
Thank you
Gracies

esimsek@mgm.gov.tr

**Turkish Meteorological Service
Division of Information Technologies
Information Technology Department
September – 2012**