Current status of observation network and climate data in Armenia

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Second WMO/MEDARE International Workshop
10-12 May 2010, Nicosia, Cyprus

OUTLINE

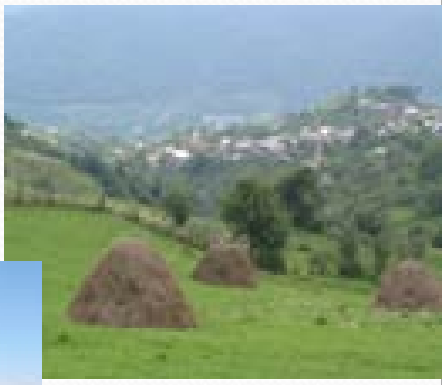
- **Armenia in brief**
- **Meteorological observation network**
- **Climate data and metadata**
- **Other sources of climate information**

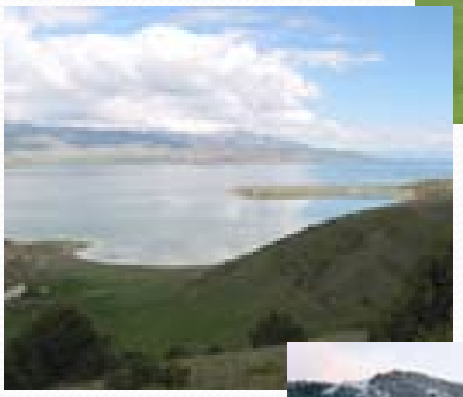
ARMENIA IN BRIEF

- *Armenia* is situated in the north-eastern part of Armenian plateau
- The area of about 30 000 sq.km
- Length up 360 km from the north-west to the south-east
- Width up 200 km in the widest part.
- Bordering Georgia to the North, Azerbaijan to the east and south-west, Turkey to the west and Iran to the south.
- Relief is basically mountainous and consists of numerous high mountain ridges (about 47 % of the territory), intermountain hollows, extinct volcanic mountains, plateau and plains.

ARMENIA IN BRIEF

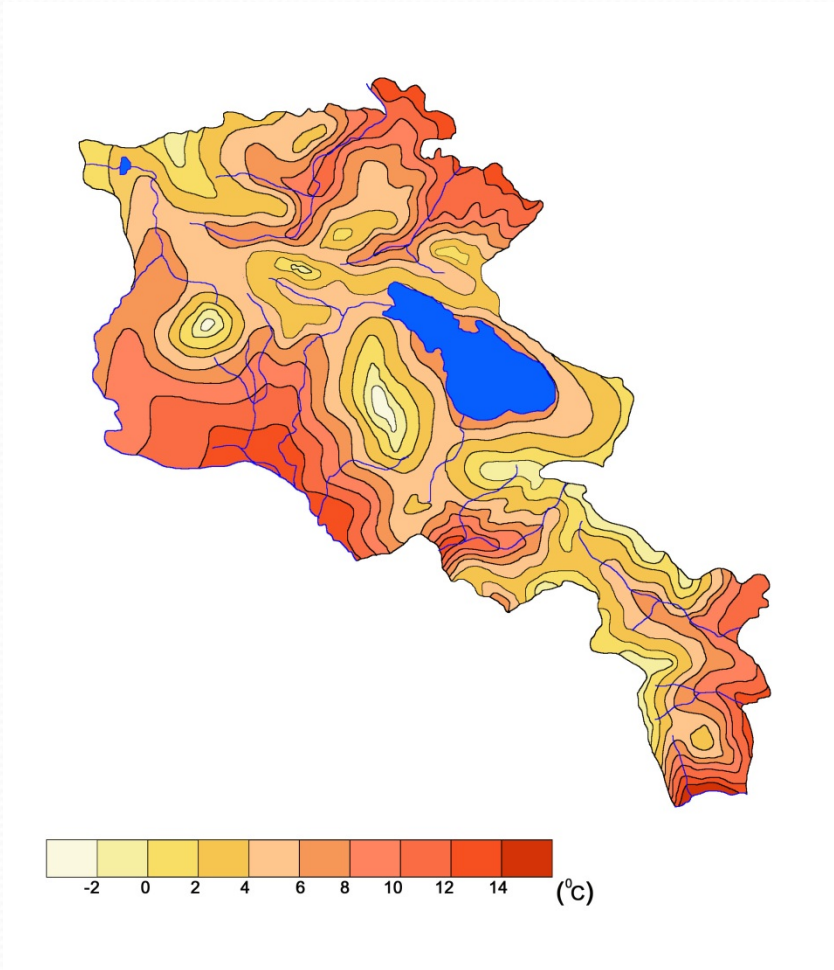
- **The lowest altitude is about 370m a.s.l., the highest point is 4095m (M. Aragats)**
- **The average altitude across the country is 1850m**
- **Geographical location of Armenia, complex mountain relief have conditioned the diversity of natural conditions across the country.**
- **There are ten climatic zones from dry subtropical to rigorous high mountainous and from everlasting snowcaps and glaciers to warm humid subtropical forests and humid semi-desert steppes.**





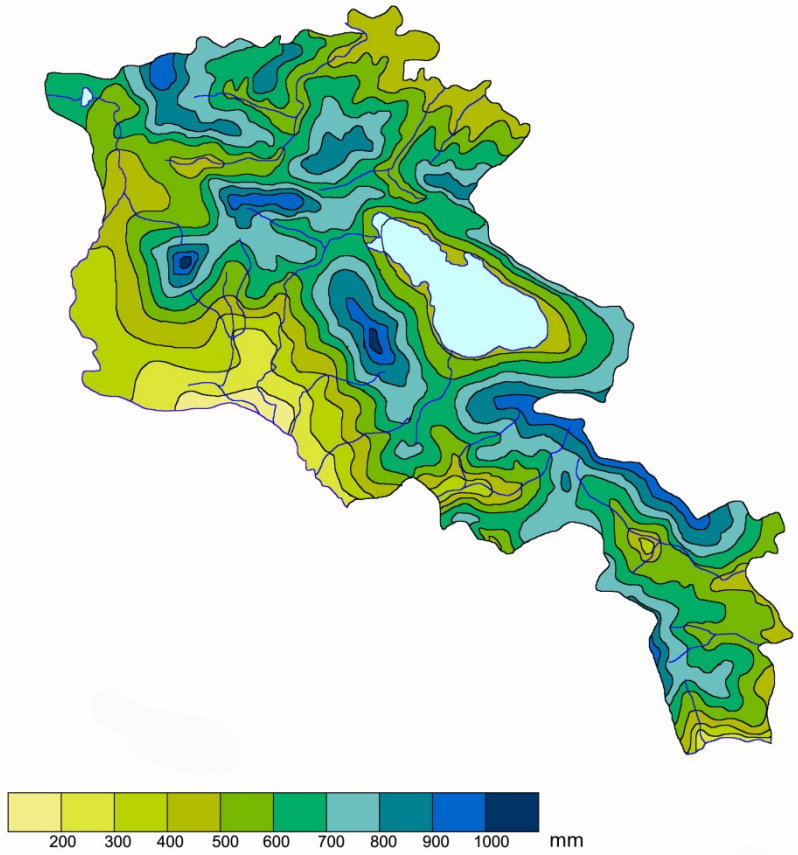
Climate of Armenia
Temperature

- Climate of Armenia is continental with hot summers and cold winters
- Annual mean air temperature over Armenia is **5.5^{0}C**
- In June-August average temperature varies from 10^{0}C in high mountain regions to +24…+26^{0}C in lowlands
- In January the average air temperature depending on the altitude and peculiarity of the relief fluctuates from –13^{0}C to +1^{0}C.
- The absolute maximum and minimum temperatures in Armenia are **+43^{0}C** and **–42^{0}C** accordingly



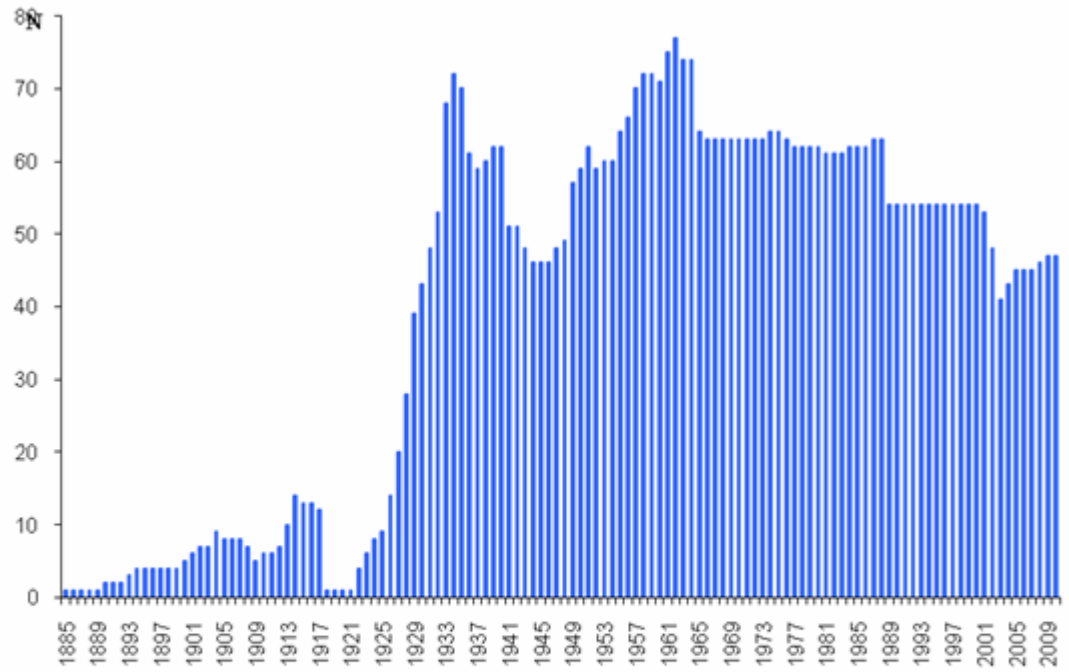
PRECIPITATION PATTERN

- Armenia climate is arid, with the annual total precipitation **592mm**.
- In lowlands the total annual precipitation is about **200-250** mm, while in the mountains and highlands it reaches **1000-1100 mm.**
- The rainiest periods are April-May and October-November, when about 40 % of annual precipitation is being observed, the driest months are July and August with only 10 % of annual rainfall.

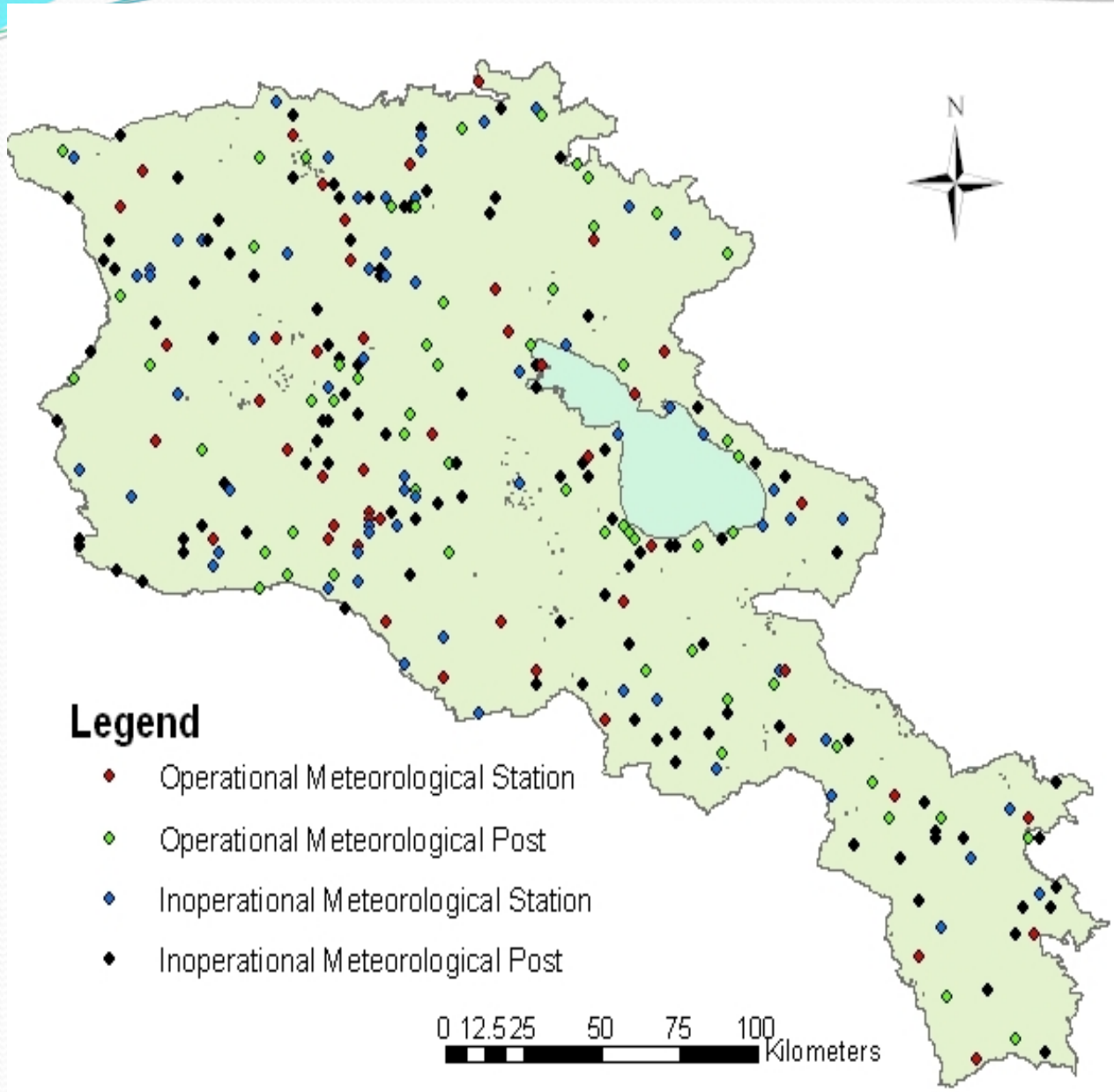


Armstatehydromet: Evolution of observation network

- First observations started in **1843** in Gyumri and in **1844** in Yerevan
- Highest number of stations **77** was in 1972
- Until 1935 two times per day observations
- Until 1965 - 4 times
- From 1966 - 8 times



Evolution of meteorological network in Armenia during 1885-2010



Inventory of network

288 observation sites, including

80 meteorological stations,

about 180 rain gauge sites,

ever operated

Current network

Consists of 47 meteorological stations 8 obs. per day

5 stations have time series for more than 100 years

Those are unique in the region due to their location and duration.

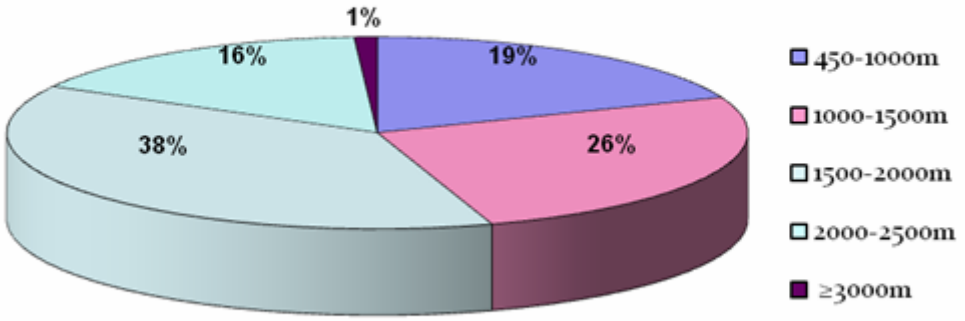
12 stations are high-mountainous and located at the elevation over 2000 m above sea level, out of them 6 are remote and hard-to-reach stations.

Aragats high-mountain (3229 m a.s.l.) established in 1929,

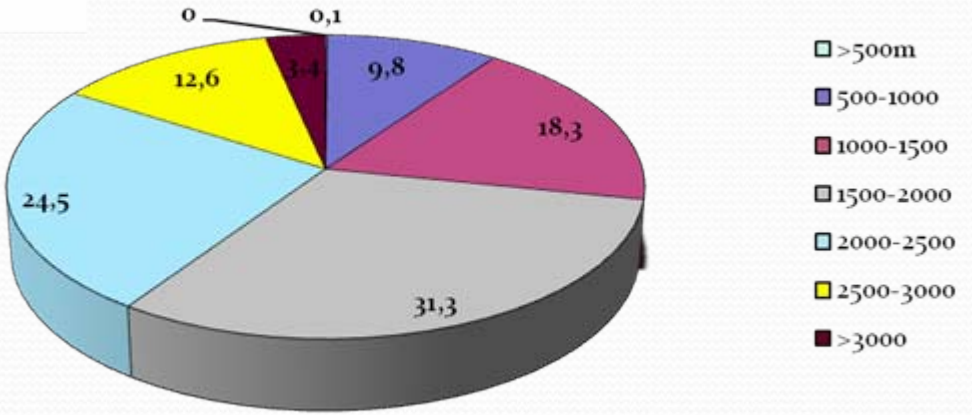
It is the only station in the region, operating in the altitude more 3000m

Aragats h/m included in the GSN.

The distribution of meteorological stations (%) by their elevation above sea level in Armenia



Distribution of the area (%) according to the elevation a.s.l



Data storage: archive

Paper copies

Meteorological annual books for stations and posts are stored in the data fund from 1885 to 1992;

Agrometeorological books starting from 1949

Hydrological yearbooks starting from 1926

Metadata preserved in station books only

All the paper copies are endangered; urgent actions are to be taken to rescue the big amount of valuable historical data.

Data storage: digital

Database:

- ***CLICOM*** *system with DBMS DataEase is used*
- *In the database synoptic, daily data of meteorological parameters for 80 stations starting from 1881 to present are stored. The gap* ***1992-1997***
- *About 30% of data have more than 60 years time series, 10%- more than 80 years, 5 station have time series of 100 years*
- *It is planned to upgrade the CDBM by* ***CLIWARE****, since the CLICOM system is obsolete and doesn't meet the requirements of our database*

Monthly data

20 stations with homogenized monthly time series selected from current network
Have not been replaced

< 50 years - 4 stations

50-60 years – 5 stations

60-70 years – 3 stations

> 80 years – 8 stations

Gyumri	48
Ijevan	49
Sisian	49
Gavar	50
Yerevan	55
Hankavan	55
Vorotan pass	56
Aparan	59
Vanadzor	59
Jermuk	61
Ararat	75
Urtsadzor	77
Goris	80
Stepanavan	80
Aragats, h.m.	**81**
Fantan	81
Kadjaran	82
Martuni	83
Masrik	84
Hrazdan	85

Homogeneity of data

- Reasons for inhomogeneity:

  change of location, change of instruments, new observers, change of surrounding area, change of frequency of observations

Location, instruments, frequency of observations – data homogenized applying respective transition coefficients

Metadata

Preserved in form of station books, containing all information about station, geographical location, surrounding area, instruments, results of inspection on condition of instruments, change of observer, replacement of instrument etc.

All the information is not digitized, we have only paper copies, which are to be rescued.

Other sources of climate information

Institute of ancient manuscripts Matenadaran

is an ancient manuscript repository located in Yerevan, Armenia. It holds one of the world's richest repositories of medieval manuscripts and books which span a broad range subjects, including history, philosophy, medicine, literature, science, art history and cosmography

is in possession of nearly 17,000 manuscripts and 30,000 other documents

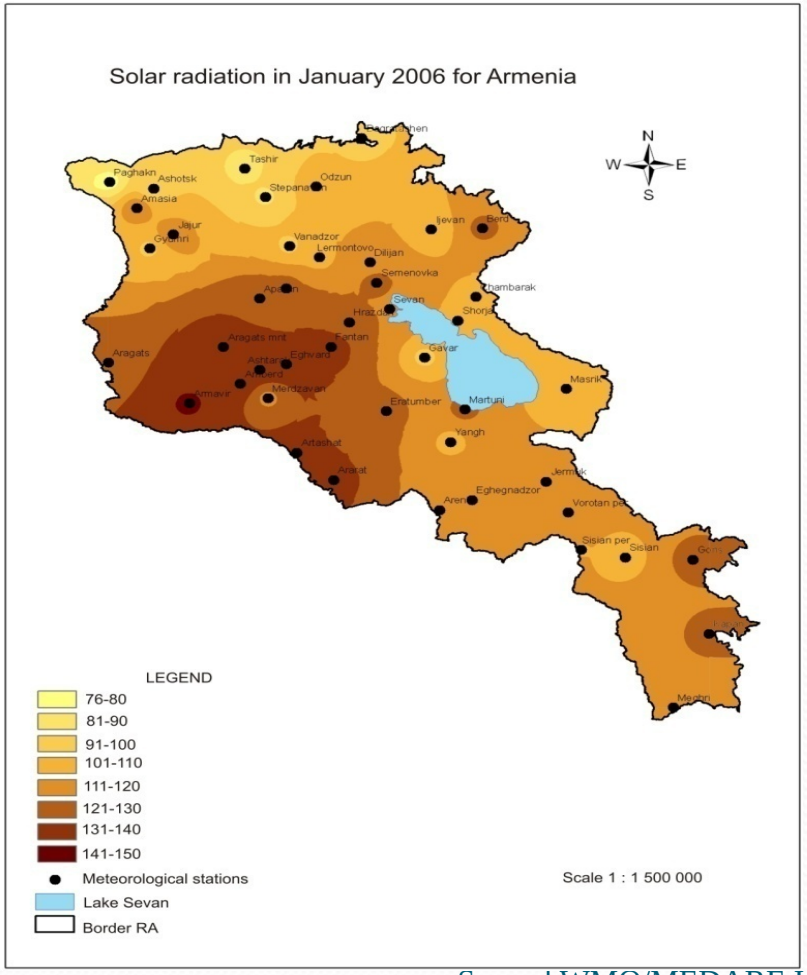
Needs funding to study the manuscripts jointly with institute

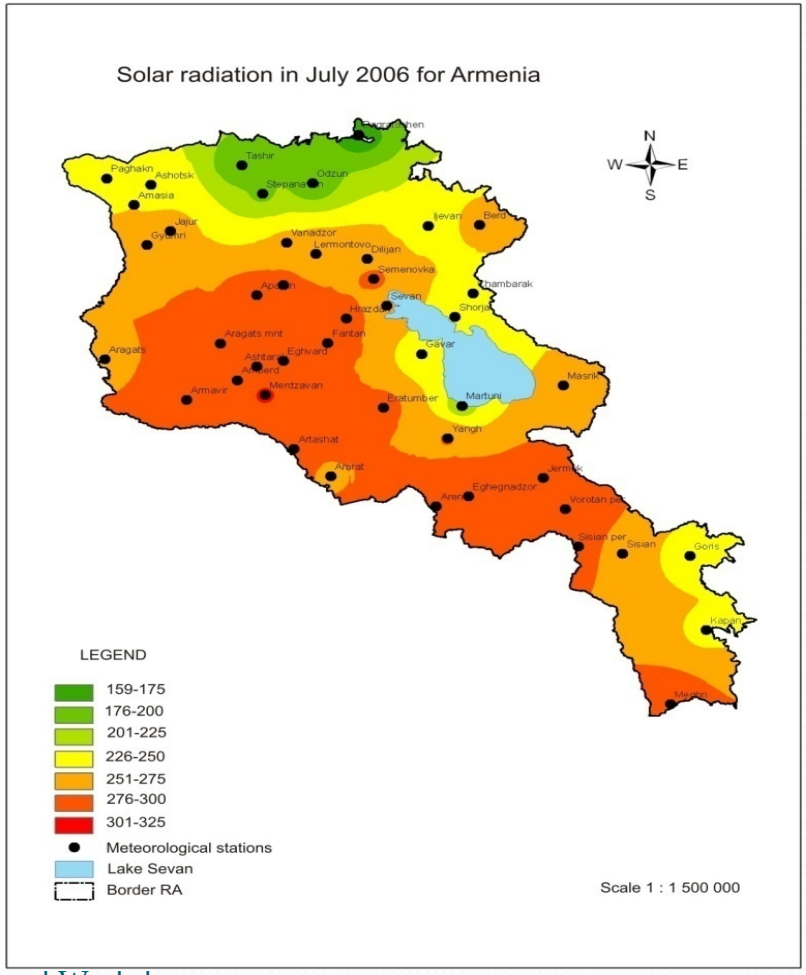
Satellite derived products

Satellite Application Facility on Climate Monitoring (CM-SAF) DWD provides high quality, reliable data sets with high spatial resolution

- inter-comparison of satellite data with observed values for solar radiation and albedo,
- validation of CM-SAF products
- development and application of merging technique with surface data

Solar radiation monthly maps





Thank You