Mapping and Monitoring of Snow Cover and its Changes over a 10 Years period for the White Mountains of Crete, Greece

Marily Xigaki

GeoScopio, Applied Geological & Environmental Researches and Studies & GIS, S. Zografaki 5, 73100, Chania Crete, Contact: info@geoscopio.gr

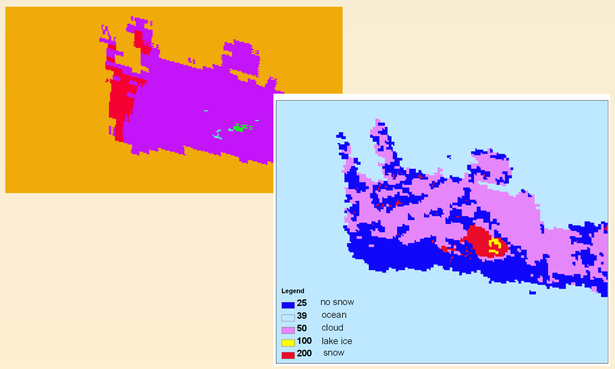
1. INTRODUCTION:

The study of snow coverage and how it varies due to climate change in a specific area for a certain period, provides extremely important results. Information on the snow cover and of its changes is essential for both global scale in evaluating future climate change scenarios and catchment scale for water resource management. To this direction, remote sensing has a significant contribution as it offers rapidly, cost-effectively and in frequent time intervals spectral information in a wide range of spatial scales that can be used in snow analysis.

3. DATA:

MODIS/Terra Snow Cover Daily L3 Global 500m Grid (MOD10A1) were used for the monitoring and analysis of snow cover. MODIS products contain snow cover, snow albedo, fractional snow cover and Quality Assessment (QA) data in compressed Hierarchical Data Format-Earth Observing System (HDF-EOS) and GEOTIFF format along with corresponding metadata. MOD10A1 consists of 1200 km by 1200 km tiles of 500 m resolution data gridded in sinusoidal map projection. For the study, were used daily data from October to end of May for all years from 2000 to 2010.

Figure 1-2: MODIS products, MODIS/Terra Snow Cover Daily L3 Global 500m Grid (MOD10A1)



2. STUDY SITE:

The "White Mountains" is the main mountain of Chania Prefecture, found in the west part in Crete Island. This is the most mountainous and arid region of Crete with shallow, poor, rocky and with steep slopes soils. White Mountains are the main water trap of the prefecture because of the limestones that are consisted by. The amount of precipitation received on the higher parts of the mountain is more than 2000 mm per year. The snow melting sometimes delays until mid-June due to the low temperatures prevailing in the mountains.

Figure 3: Chania Prefecture, Greece

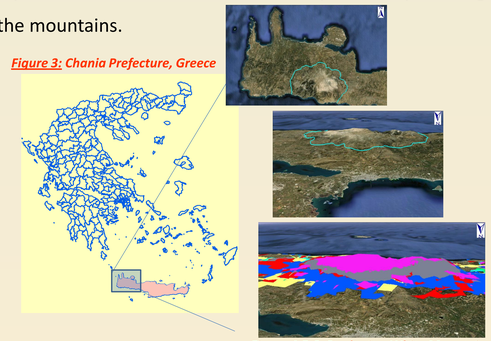
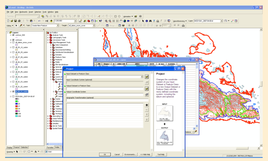


Figure 4,5,6: Study site, White Mountains

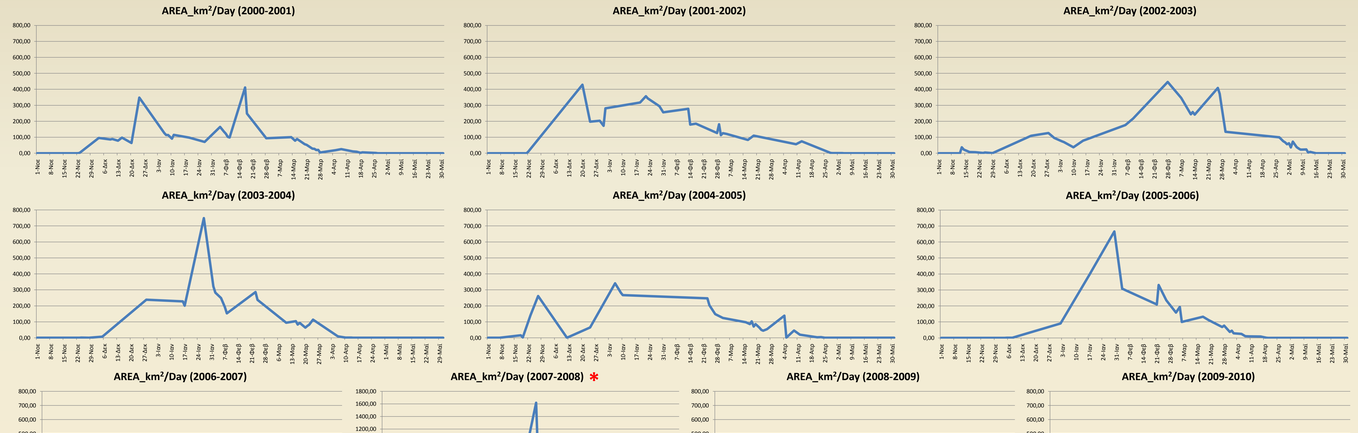
4. METHOD & CONDITIONS:

For the process and analysis of the MODIS MOD10A1 products, Geographical Information Systems (GIS applications) were used. The Geotiffs were converted from raster to vectors, the data of the snow cover for the study area were selected and exported from all files to one and processed. A data base was developed in order to facilitate the data analysis, with all data, unique ids, dates and area calculations. It was taken into consideration that MODIS data have never been validated in this area. Furthermore images with clouds were processed differentially.

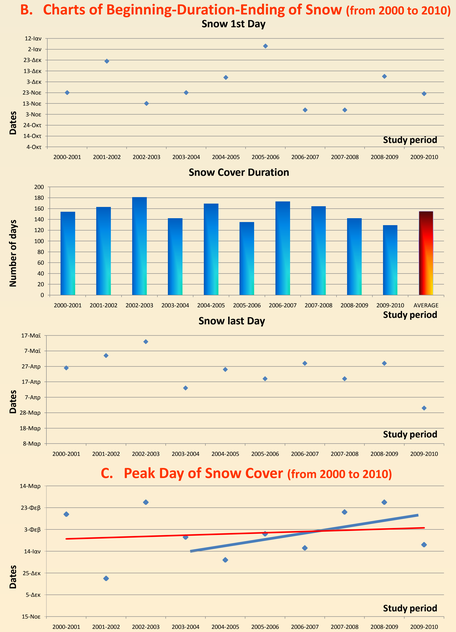


5. RESULTS:

A. Charts of the Period of Snow Covered Area (from 2000 to 2010)

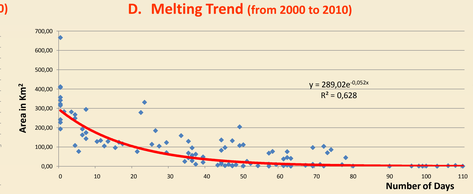


B. Charts of Beginning-Duration-Ending of Snow (from 2000 to 2010)

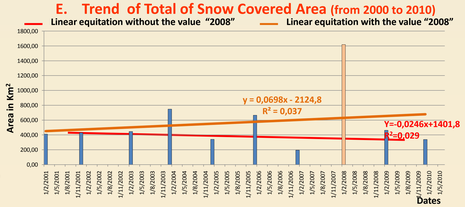


C. Peak Day of Snow Cover (from 2000 to 2010)

D. Melting Trend (from 2000 to 2010)



E. Trend of Total of Snow Covered Area (from 2000 to 2010)



6. CONCLUSIONS

Although the study period is not very long, however interesting conclusions are arising. There is a periodicity in the appearance of snow year by year from early November till the middle of December (**B charts**) and as well as a periodicity in the duration of the snow cover from 130 to 180 days. An interesting part is that there is appeared a "removal" of the peak day of snowing, year by year since 2003 (**chart C**). More data would give a more clear picture if the "seasons are moving". There was calculated a linear equitation for the snow melting (**chart D**) which is very important in hydrology and geology.

Furthermore (**chart E**) the analysis is showing that the covered area and so the volume of snow is decreasing year by year except some peaks like in 2008 (the red line without the value in 2008). The peak in 2008 shows that this year was an exception and it can be characterized as extreme weather period. The analysis showed that the volume of water that comes from the melted "snow", consider as "snow" the cover of the peak snow day as the snow of the year, is 25-27*10^6 m^3 (~1,5% of the water resources of Chania).

7. REFERENCES: Hall, Dorothy K., George A. Riggs, and Vincent V. Salomonson. 2006, updated daily. *MODIS/Terra Snow Cover Daily L3 Global 500m Grid V005*, from Oct to Jun from 2000 to 2010. Boulder, Colorado USA: National Snow and Ice Data Center. Digital media.