

# EXTREME WINTER TIME IN THE MOUNTAIN REGIONS OF BULGARIA

T. Andreeva, M.Martinov  
National Institute of Meteorology and Hydrology (NIMH)  
Department for Weather Forecasts  
Blvd. Tzarigradsko shousse, 66, Sofia, 1784, Bulgaria  
E-mail: [teodosia.andreeva@meteo.bg](mailto:teodosia.andreeva@meteo.bg)

## 1. INTRODUCTION

In this paper the attention was paid to the atmosphere circulation during the winter time of 2001/02 over Atlantic Ocean and Europe. Notable temperature extremes during December of 2001 and February of 2002 are registered in the mountains of Bulgaria, but mean temperature of the winter 2001/02 was closer to average. Mild winter (T. Andreeva et al., 2003) leads to higher avalanche risk. An avalanche occurs because of a weakness in the snow pack or the amount of snow that covers the ground.

## 2. THE NORTH ATLANTIC OSCILLATION (NAO)

NAO is the dominant mode (Hurrell, J.W., 1995; David B. Stephenson et al., 2000) of winter climate variability in the North Atlantic region ranging from central North America to Europe and much into Northern Asia (Fig.1). The NAO is a large scale seesaw in atmospheric mass between the subtropical high and the polar low. The corresponding index varies from year to year, but also exhibits a tendency to remain in one phase for intervals lasting several years.

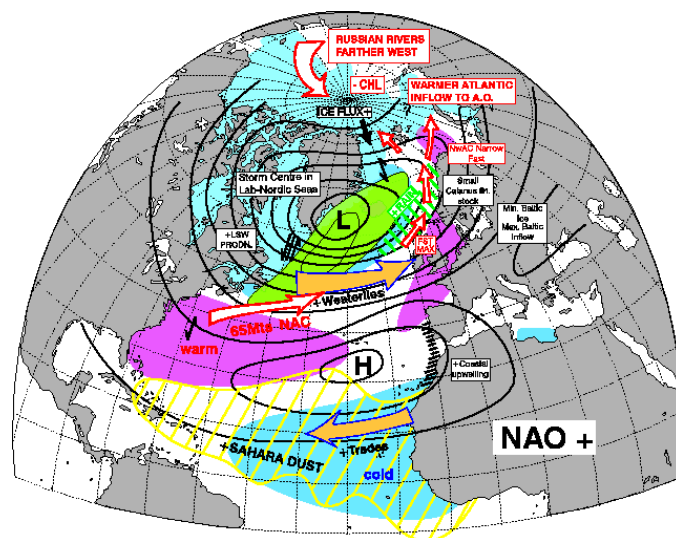
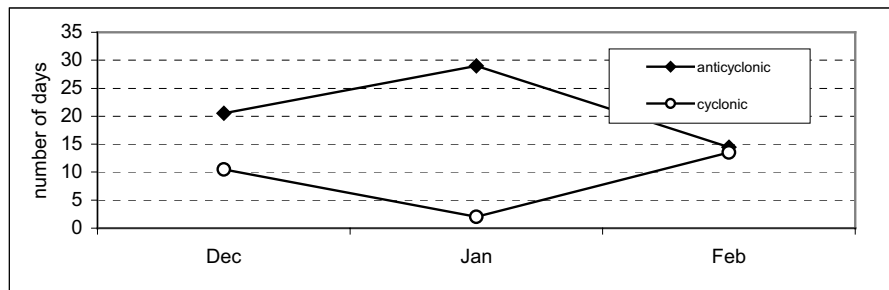


Figure 1. North Atlantic Oscillation by David B. Stephenson

### 3. PRESSURE PATTERNS AND TEMPERATURES

The data of daily surface pressure fields over Balkan Peninsula received at 00:00 UTC covering the period from 1.12.2001 to 28.02.2002 was used. The anticyclonic baric relief predominates-the average of 71% in all days of the period is with anticyclonic relief: the cyclonic baric relief is 29% in the rest of the days (Fig. 2).

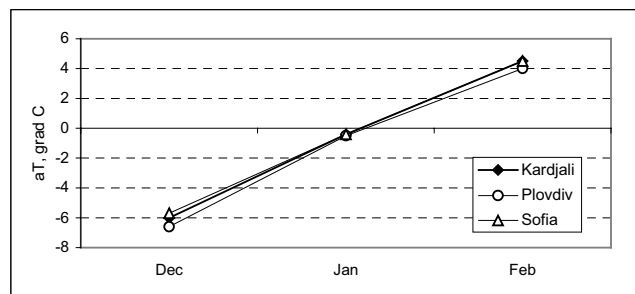
There was a marked difference in values between December and January. High pressure during January was not balanced by some low values as depressions passed close to or over the territory of Bulgaria. The circulation was meridional during first month of the winter 2001/02 and December was very cold. Mean temperature was below normal everywhere and particularly in the mountains where the anomaly was minus 5.7°C.



**Figure 2.** Seasonal course of cyclonic and anticyclonic baric relief during the winter 2001/02

During February there was zonal circulation and the month was warmest and dry.

In January two typical circulation forms can be differentiated: meridional and zonal. The anticyclone with a center 1040 hPa occupies almost all Europe and the adjacent regions from the Atlantic Ocean over the North Sea. Bulgaria is situated between high pressure to the west and low pressure over Black Sea. It gave mostly snow cover generally for the country. It's got cold everywhere (Fig. 3).



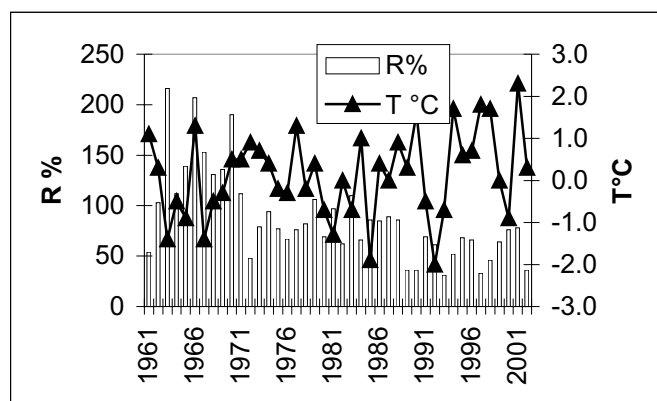
**Figure 3.** Monthly trend of air temperature anomaly for winter 2001/02 in West-South part of Bulgaria

Global temperatures were above average during 2002 throughout most land areas (Climate of 2002 Annual Review by NOAA). The warmer than average temperatures (for a 1961–1990 base period) were widespread across much of the United States as well as most of Europe and Asia. Temperatures in these regions were 1–4°C (1.8–7.2°F) above the 1961–1990 average.

#### 4. CLIMATIC VARIABILITY OF WINTER TEMPERATURE AND PRECIPITATION

During the winter 2001/02 the NAO index (Osborn et al., 1999) was positive with value 0,79 on the relationship between winter precipitations.

Rainfall totals for the winter were below normal everywhere (Fig. 4) despite a wet December. The heaviest snowfalls of the season at most stations were measured during December. Percentage of normal values for the 3-month period were over 20 % lower than normal at most stations and it was the driest for 6 or 7 years in places. In contrast, it was the wet December, there are a little higher than normal generally. In the wall country for the winter period precipitation anomalies were generally low than the estimated norm.



**Figure 4.** Deviations of winter temperature and precipitation for station on the peak Cherni vrah (2286 m) from mountain Vitosha in Southwest Bulgaria

The precipitation anomalies are lower and equal than the estimated norm in 73% of the period 1961–2002 by the territory of Bulgaria.

The precipitation below norm is observed usually during the periods with positive anomalies of air temperature.

There is the tendency for positive anomalies of air temperature to increase during winter.

#### REFERENCES

- Hurrell, J.W., 1995: Decadal trends in the North Atlantic Oscillation and relationships to regional temperature and precipitation. *Science*, **269**, 676-679.
- Osborn, T.J, Briffa, K.R, Tett, S.F.B, Jones, P.D and Trigo, R.M., 1999: Evaluation of the North Atlantic Oscillation as simulated by a coupled climate model., *Clim. Dyn.*, **15**, 685–702.
- David, B., Stephenson, V. Pavan, R. Bojariu, 2000: Is the North Atlantic Oscillation a random walk? *International Journal of Climatology*, **20**, 1–18.
- Andreeva, T., M. Martinov, S. Momcheva, 2003: Mild Winters and the Precipitation in the Mountain Regions in Bulgaria. International Conference on Alpine Meteorology and MAP-Meeting. Brig, Swiss, 19–23 May, Volume A.