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Consecutive cold waves over Greece during winter time 2017

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Cold wave (CW) is a meteorological event associated with a rapid fall of temperature over large areas, mainly during winter time. CW is a rare phenomenon for Greece and other southern European countries against central Europe.

Over the last days of December 2016 and early January 2017, two consecutive cold waves affected Greece, causing considerable drop of temperature and heavy snowfalls. Specifically, the first CW intrusion started on December 28, 2016 and ended on December 31, 2016, with heavy snowfall taking place on December 29 and 30, mainly over eastern Greece. Problems were caused in transport and farms. The second one, which was more intense showing great consistence, started on January 6, 2017 and ended on January 12, 2017, with unusual long-lasting snow days for most parts of the country, even for coastal areas. In this case, problems in transport were huge, roads were closed for hours, power failures were frequent and whole areas were declared in a state of emergency. Furthermore, at least three fatalities were caused in Greece, while at least sixty fatalities were reported in central and eastern Europe in total.

The main goal of this study is to investigate the synoptic circulation patterns related to these CW events. Synoptic analysis was based on GFS reanalysis data at 500hPa, 850hPa isobaric levels and sea level pressure (SLP). Besides, the daily means and anomalies (with respect to 1981-2010 climatology) of specific meteorological parameters at the same isobaric levels are presented, based on the National Centers for Environmental Prediction-National Center for Atmospheric Research (NCEP-NCAR) reanalysis data sets. Additionally, analyses of 72h air mass backward trajectories at 500m, 1500m and 4000m (amsl) were performed by using the Hybrid Single-Particle Lagrangian Integrated Trajectory model (HYSPLIT), developed by NOAA's Air Resources Laboratory, in order to determine the origin of the air mases prevailing over Greece during CWs passes.

Our findings reveal that the synoptic pattern at 500hPa related to heavy snowfalls is a quasi-stationary long wave trough over northwest Europe. Thus, the dominant air flow (also confirmed by the back trajectories analysis) indicated an advection of polar or/and arctic air masses from Scandinavian countries (or northern) to Balkans which is in agreement with the well documented synoptic type, associated with the snow days in Athens, Greece. Besides, all the examined meteorological parameters exhibit intense anomalies at all isobaric levels.