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Stratigraphic dating of a 80 m deep firn core drilled in coastal East Antarctic ice sheet (Eastern Wilkes Land)

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The Antarctic ice sheet and ocean play a key role in climate dynamics. Causes and control factors of the current climate change are not yet fully understood; for these reasons, increasing attention has been recently paid to natural climate variability over the last millennium, as compared to anthropogenic climate forcing occurred during the last century.
This work is focused on Northern Victoria Land and Eastern Wilkes Land (East Antarctica) sector, where GV7 site (70° 41' 17.1" S; 158° 51' 48.9" E; 1950 m a.s.l.) is located. GV7 is situated on north-south transect following the ice divide extending from the Oates Coast to Talos Dome.
The GV7 drilling was accomplished through a bilateral Italy - South Korea collaboration, during the 2013/2014 Antarctic summer field. Snow pit samples, shallow firn cores and a 250 m deep ice core were collected.
This site was investigated during the 2001/2002 ITASE traverse, where a mean snow accumulation rate of 241 mm we/yr were found over the past 50 years. Besides, this site is characterized by an ice thickness of about 1700 m, which could allow to obtain a very well time resolved and preserved records for the last 1-2kyr.
In this work we present the stratigraphic dating of the most superficial 80m of the 250 m firn core, firn core dating is the first step for a correct interpretation of climatic and environmental changes.
The firn core sections were firstly decontaminated, subsampled at 5 cm resolution and analysed using a ion chromatography system allowing the simultaneous detection of main and trace ions.
Among the analysed ions nssSO42- (sulphates not coming from sea spray), MSA (methanesulfonic acid) and NO_3 were chosen as chemical markers for dating as they have the same seasonal cycle with summer maxima. In order to be able to compare these three parameters on a mathematical basis the concentration are normalized by dividing each value with those of the nearest summer maxima. In this way each profile ranges from 0 to 1. The three markers normalized concentrations profiles were summed point to point to obtain a new profile. This multi-parametric approach for the dating is more robust than using the individual marker profile because a peak found in the latter profile is due to the three parameters values, thus, validating its existence as real summer peak. The sum of normalized values profile gave maximum values sufficiently defined with greater sampling frequency and less temporal dephasing of the measured parameters. Stratigraphic dating was validate by using the volcanic eruptions, well visible in the nssSO4 profile as concentration peak lasting more than one year, as historically known as tie point.
The GV7 (B) firn core dating showed clear snow layers from 2008 to 1775 and six clear volcanic events: Pinatubo (Philippines 1991), Agung (Indonesia, 1963), Krakatoa (Indonesia, 1883), Cosiguina (Nicaragua 1835), Tambora (Indonesia, 1815) and Unknown (1809).
The accumulation rate for the 2008-1775 time period was 191 mm we/yr, slightly lower than 242 mm we/yr found for recent period (2013-2008) from snow pit analysis.