

The LSO/KSO H α prominence catalogue – first results

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Abstract: We present the very first results on polar branches of the H α prominences for the current solar activity cycle based on the homogeneous H α prominence catalogue created at the Lomnický Peak Observatory in Slovakia (LSO) for the epoch 1967-2009 with incorporation of the new data acquired at the Kanzelhöhe Observatory for Solar and Environmental Research in Austria (KSO) for the epoch 2009-2011. The onset of the polar branches in the current solar activity cycle can be seen at the beginning of the year 2010 and at latitudes ~ 55 degrees similarly on both hemispheres. The northern polar branch is more pronounced reaching latitude of ~ 70 degrees in August 2011. The onset of the southern branch is less visible. These preliminary results need later confirmation by the new data added to the catalogue in future. Therefore our catalogue project will continue and the LSO/KSO H α prominence catalogue data set will be provided to the community not later then in year 2012.

Introduction

Time-latitude distribution of H α prominences (and filaments) can provide a possibility for investigation of global properties of large-scale magnetic fields on the solar surface. After Secchi's discovery (Secchi, 1872) of the polar zone of H α prominences migrating poleward this topic has attracted serious interest (e.g., Abetti, 1957, Waldmeier, 1973, Makarov and Sivaraman, 1985, Bumba et al., 1990, Dermendjiev et al., 1994, Minarovjech et al., 1998, Callebaut et al., 1998, Rušin, 2000, Minarovjech, 2007, Li, 2010). Understanding of the cycle-to-cycle variability and complexity of the multiple polar zones and their relation to the last evolutionary stages of individual magnetic cycles require continuous observations of H α prominences and creation of a homogeneous long-term H α catalogues of such data thereafter incorporating both the latest and the very first observations.

Our contribution presents the first results derived from extension of one of the most prominent H α prominence catalogues available - the Lomnický Peak Observatory (LSO) H α prominence catalogue 1967 – 2009 (Rušin et al., 1988, 1994) - onwards incorporating current observations taken at the Kanzelhöhe Observatory for Solar and Environmental Research (KSO) for the period 2009 – 2011. The contribution is focused on on time-latitude behaviour of the prominences during the onset of the current solar cycle addressing question on new polar branches migrating poleward.

LSO/KSO H α prominence catalogue

Since August 2009 regular observing procedure is introduced at the KSO to perform daily patrol observations of the solar prominences for the purpose of the LSO/KSO H α prominence catalogue. The observing procedure consists of 3 full-disk exposures (5ms, 20ms, 50ms) acquired using the 100/2000 refractor for full-disk patrol in the H α line (Otruba, 1999, 2002) with the Lyot filter (passband 0.07 nm) and the Pulnix TM-4200GE camera. Reduction for mean dark current and sky brightness with merging of 3 exposures and intensity normalisation to the disk center intensity is done by an IDL code together with a semi-automatic calculation of the prominence catalogue parameters: time, Carrington rotation, longitude, latitude, length along the limb (degrees), height (arcsec), area (degrees x arcsec), and brightness (subjective estimate 1-3). These data are merged with the original data of the LSO H α prominence catalogue for the epoch 1967 – 2009 (Rušin et al., 1988, 1994). At the LSO a 200/3000 coronagraph (Lexa, 1963) and interference filters (passband ~ 0.5 nm) were used to acquire 9 partly overlapping exposures along the limb with prominences by a photographic camera. Projection of the developed images was used for determination of the prominence parameters. Cross-calibration issues of merging these two data sources showed that no special homogenization is needed to create the common LSO/KSO catalogue data set (Rybák et al., 2011).

Results on new polar branches

A time-latitude distribution of the H α prominences (Fig.1) clearly depicts several polar branches of the H α prominences in all already completed solar cycles. In case of the current solar activity cycle we can see only the very first parts of the polar branches which tend to show migration to the poles. Nevertheless the first results on polar branches of the current solar activity cycle can be derived.

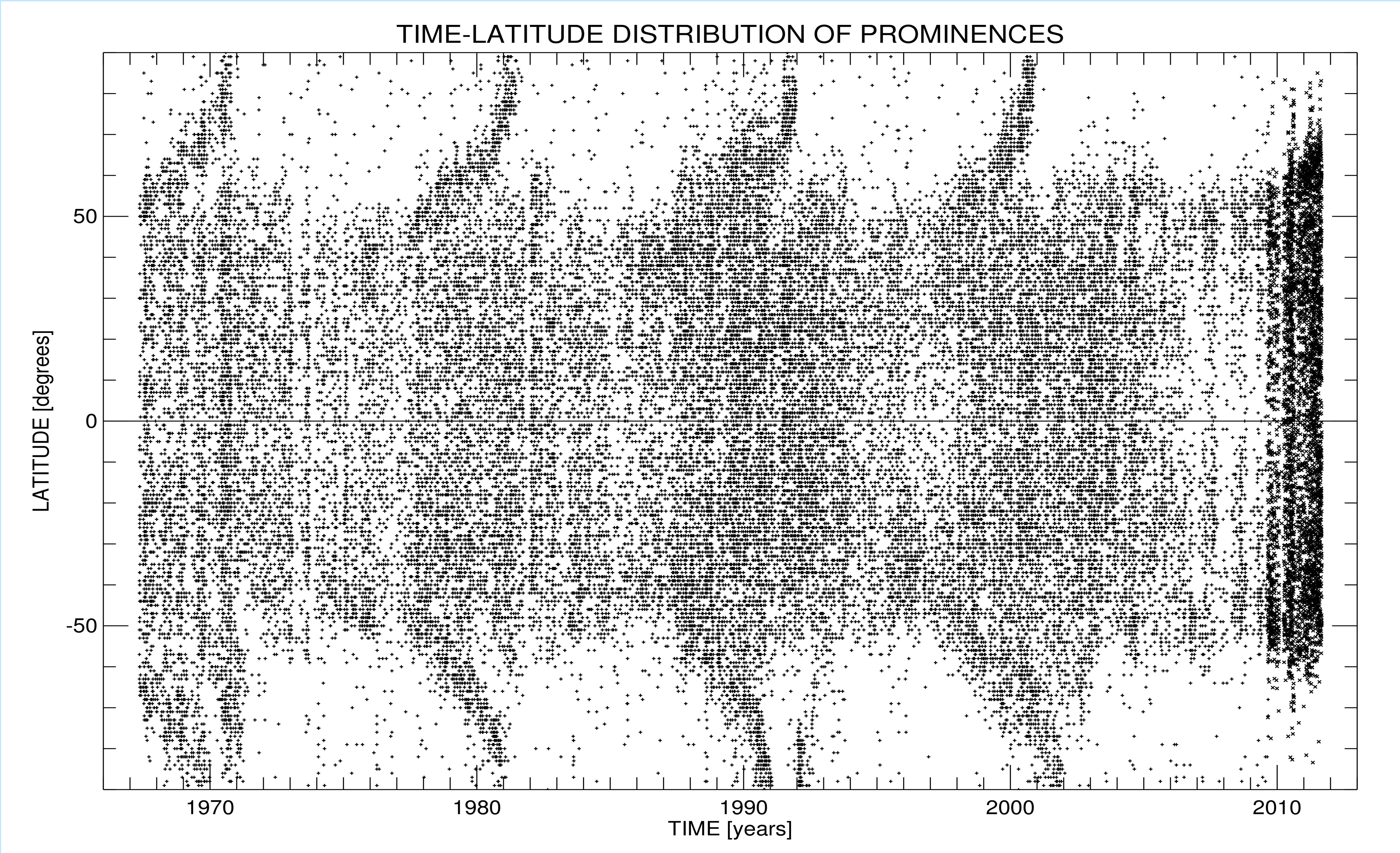


Fig. 1. Time-latitude distribution of the H α prominences for the period July 1967 – August 2011 derived from the current version of the LSO/KSO H α prominence catalogue. The LSO data are displayed by small “+” signs while for new KSO data small “x” signs is used. No correction for coverage of the time domain by observations is applied and so all determined prominences are shown. Days without observations influence density of data in this display of the time-latitude domain but not the general pattern of the polar branches of prominences migrating poleward.

Acknowledgments

Work was supported partly by the Slovak Grant Agency VEGA (projects 2/0064/09 and 2/0098/10). Additional support of the Slovak Research and Development Agency (SK-AT-0004-08) and Österreichische Austauschdienst (SK 17/2009 WTZ Slowakei 2009-10) was used for mobility of authors.

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Conclusions

The LSO/KSO H α prominence catalogue allows to conclude that the current solar activity cycle shows by now the very first parts of the polar branches of the H α prominences which migrate to the poles. Their onsets can be seen at the beginning of the year 2010 and at latitudes ~ 55 degrees similarly on both hemispheres. The northern polar branch is more pronounced reaching already latitude of 70 degrees in August 2011. The onset of the southern branch is less visible. Anticipating the currently seen asymmetry of branches we can expect that the northern polar branch will reach the pole earlier. An estimated time when the branch should reach the pole can be specified for the end of the year 2012 in case of a typical poleward speed expected for this branch. Such estimation can not be given for the southern solar polar branch nowadays. Of course, these - at the moment conditional results – will be confirmed or disapproved by data acquired in the next years.

Usage of the KSO special data acquisition procedure for the H α prominence patrol observations for the LSO/KSO catalogue has allowed to increase both number of observing days (factor of 2.3) as well as number of the observed prominences. Therefore we plan to continue with preparation of the catalogue in future continuing the data acquisition at the KSO and the data reduction and preparation of the catalogue data set at the LSO. Data of the LSO/KSO H α prominence catalogue should be publicly available not later then in the year 2012.