The origin of solar cycle activities: the DynaMICS project

S. Turck-Chieze (1), A.S. Brun (1), R.A. Garcia (1), S. Mathur (1), S. Jimenez (2), P. Palle (2) and the DynaMICS team

(1) SAp / DAPNIA/ CEA CE Saclay, 91191 Gif sur Yvette, FRANCE, (2) IAC, Tenerife, Spain (cturck@cea.fr, fax +33169086577)

In order to better estimate the earth climatic variations at scales corresponding to decennia or centuries, it appears more and more important to understand the internal origin of the solar magnetic cyclic activities together with the evolution of the internal solar rotation profile. It is the only way to be able to predict how they will evolve in the future.

The seismic techniques are totally adapted to this knowledge and an enriched information will allow to interpret the solar global variations as irradiance, luminosity at different wavelengths, and will measure temporal global mode characteristics which must be linked to the total magnetic fluxes… Our main objectives are to predict the characteristics of the coming solar cycles and to determine if there is different origins for the longer solar cycles or if it is only a temporal evolution of the eleven cycle (22 years) which produces grand minima or maxima.

SDO is well adapted to progress on the convective zone with increased resolution in comparison with the SoHO mission, it will allow to improve the 11 year solar cycle predictions. In complementarity, we consider very important to get a general description of the dynamics of the solar radiative zone which contains the main part of the solar mass and to understand the interconnection between magnetic fields of the radiative zone and of the convective zones. Such information stays today poorly known even SoHO results on the solar radiative zone through acoustic and gravity modes are very promising to pursue this investigation.

In this review, we compile the main results and present the status of the GOLFNG prototype. Then we propose the development of a small space DynaMICS project (Turck-Chieze et al, ESA-SP588, Trends in Space Science and Cosmic Vision 2020, p193). We will discuss thanks to 3D simulations of different parts of the Sun how we hope to progress on this field and the need for a long and continuous space mission dedicated to gravity modes, irradiance, and evolution of the transition region between the solar photosphere and the chromosphere.