Characteristics of a long-lived CIR and analytical modelling of the corresponding depression in the GCR flux

M. Dumbovic[1], B. Vrsnak[1], B. Heber[2]
M. Temmer[3], P. Kuhl[2], A. Kirin[4]

*1-**Hvar Observatory**, Faculty of Geodesy, University of Zagreb, Croatia*
2-Christian-Albrechts University in Kiel, Germany
3-Institute of Physics, University of Graz, Austria
4-Karlovac University of Applied Sciences

Introduction: motivation

WHAT?

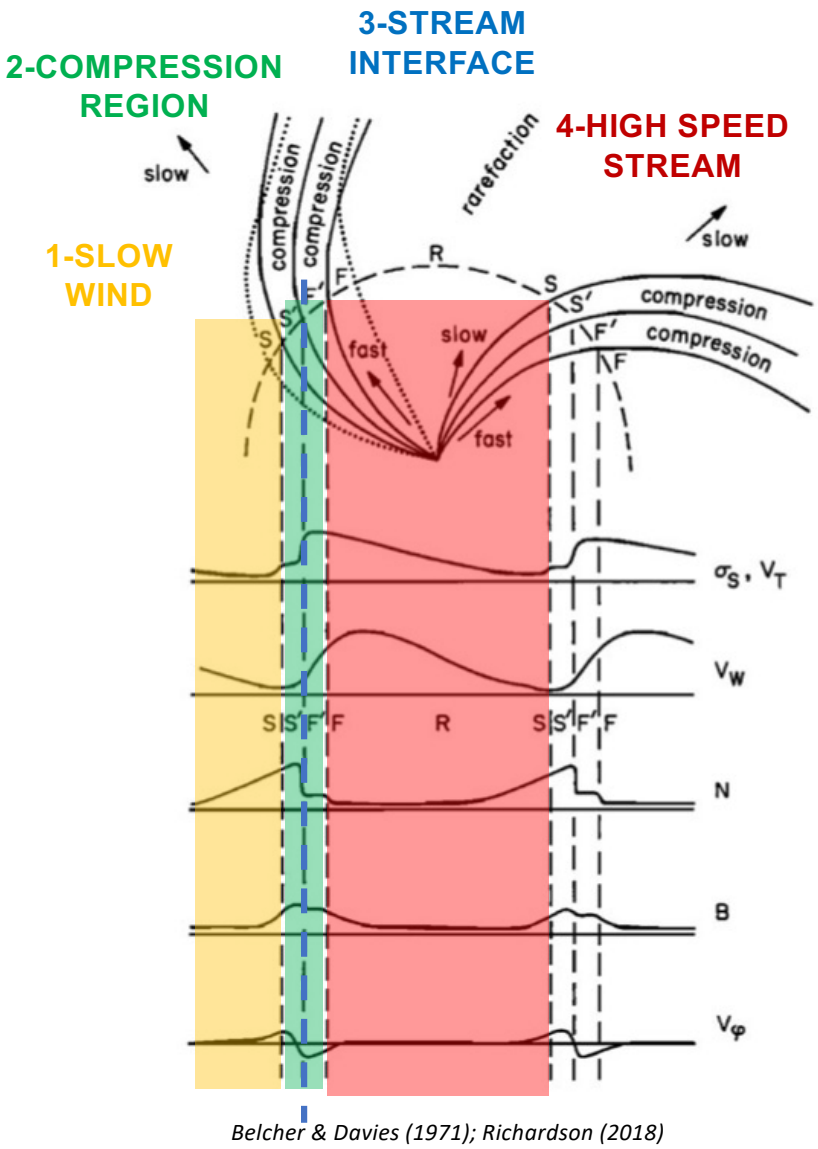
Obtain a generic CIR profile based on measurements that basically reproduces the famous sketch by Belcher & Davies (1971).

WHY?

to check deviations from the generic profile in individual CIR examples (see e.g. how CIR-ICME interactions look like compared to generic CIR profile)

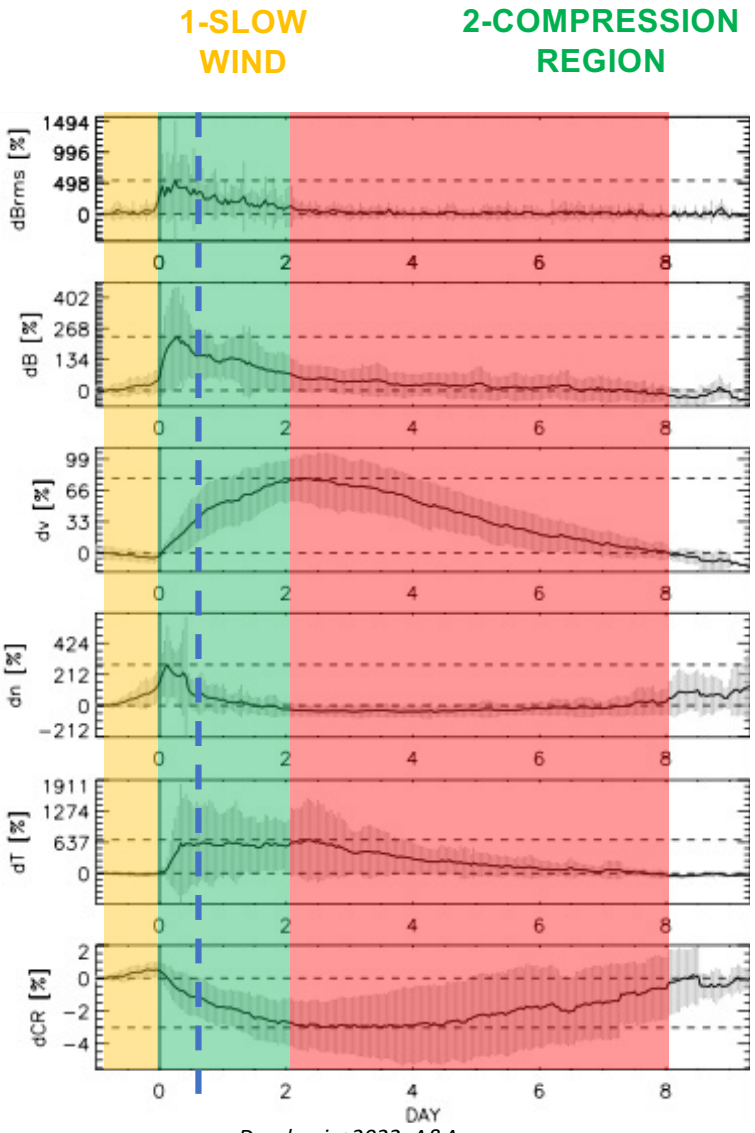
HOW?

We find a very long-lived CIR which recurs in 27 consecutive carrington rotations 2057-2083 in the time period from June 2007 - May 2009 and perform superposed epoch analysis

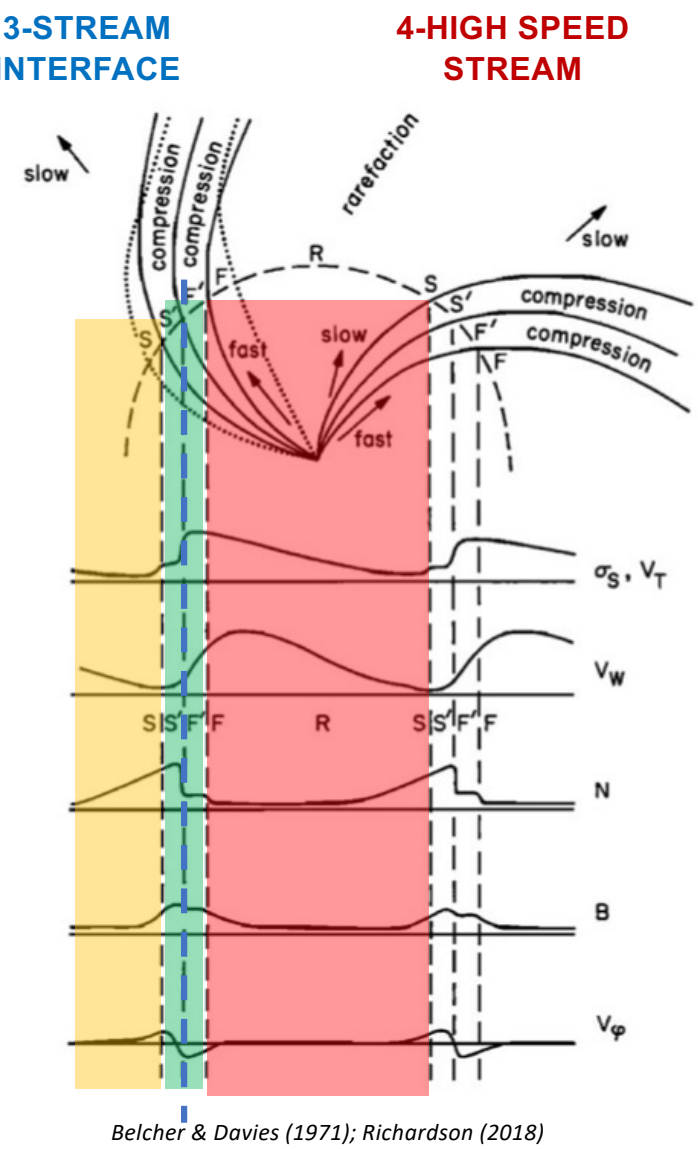


Belcher & Davies (1971); Richardson (2018)

Superposed epoch analysis and generic CIR profile



Dumbovic+2022, A&A



Belcher & Davies (1971); Richardson (2018)

Modelling CIR-associated recurrent Forbush decrease

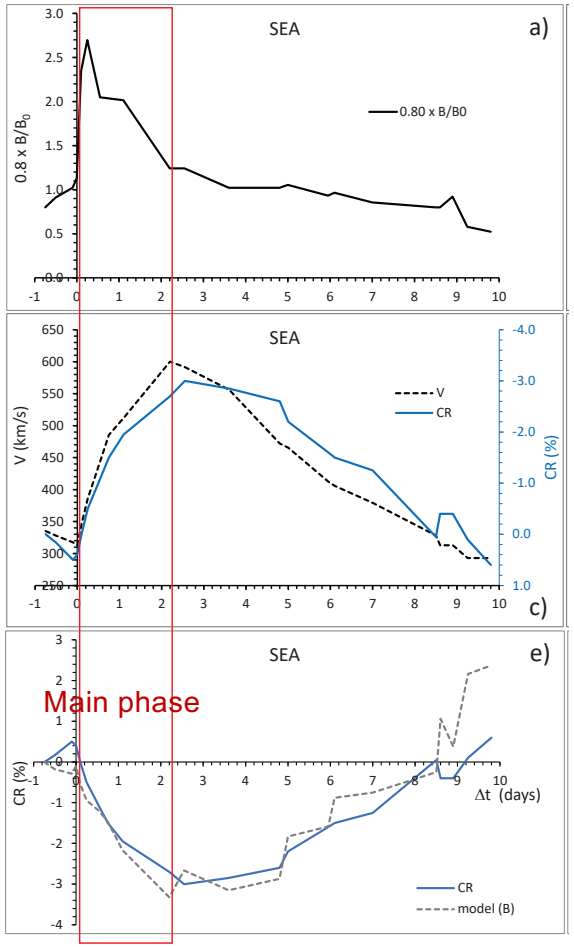
We adopt a corotating frame where parallel diffusion and solar wind flow are co-aligned and anti-parallel and reduce the transport equation to the **stationary convection-diffusion equation** (similar to approach of Wibberenz+1998 for GMIRs):

$$CR\ [\%] = -kvB$$

Modelling CIR-associated recurrent Forbush decrease

We adopt a corotating frame where parallel diffusion and solar wind flow are co-aligned and anti-parallel and reduce the transport equation to the **stationary convection-diffusion equation** (similar to approach of Wibberenz+1998 for GMIRs):

$$CR\ [\%] = -kvB$$



Vrsnak+2022, A&A

B normalized with respect to the pre-event values, and multiplied by the free-parameter k

solar-wind flow speed, v_r (black-dashed line) and the inverted graph of the cosmic-ray count-rate, CR (blue line)

observed CR (blue line) compared to the model results (gray-dashed line).

OPEN QUESTIONS:
-physics of free parameter k?
-applicability to real (not generic) events?