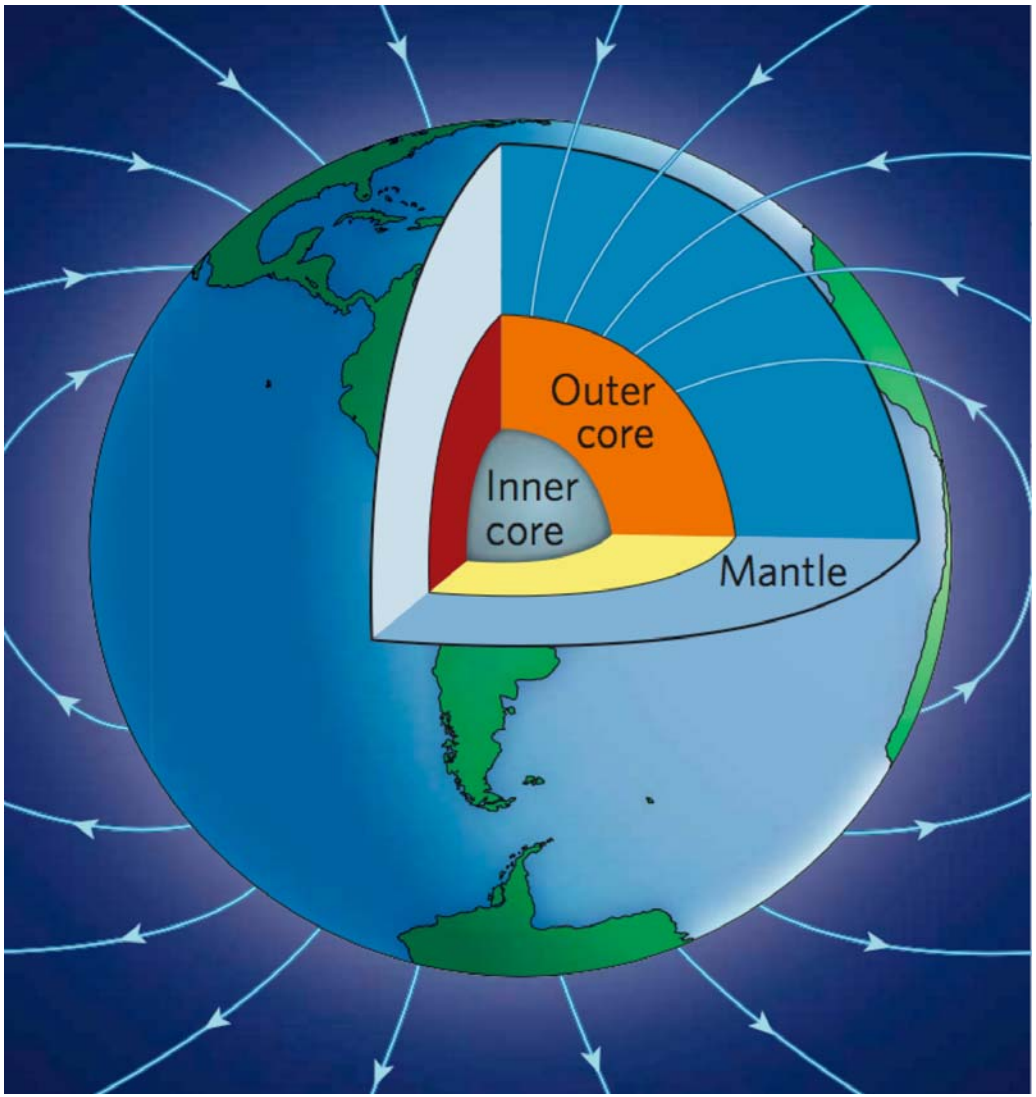
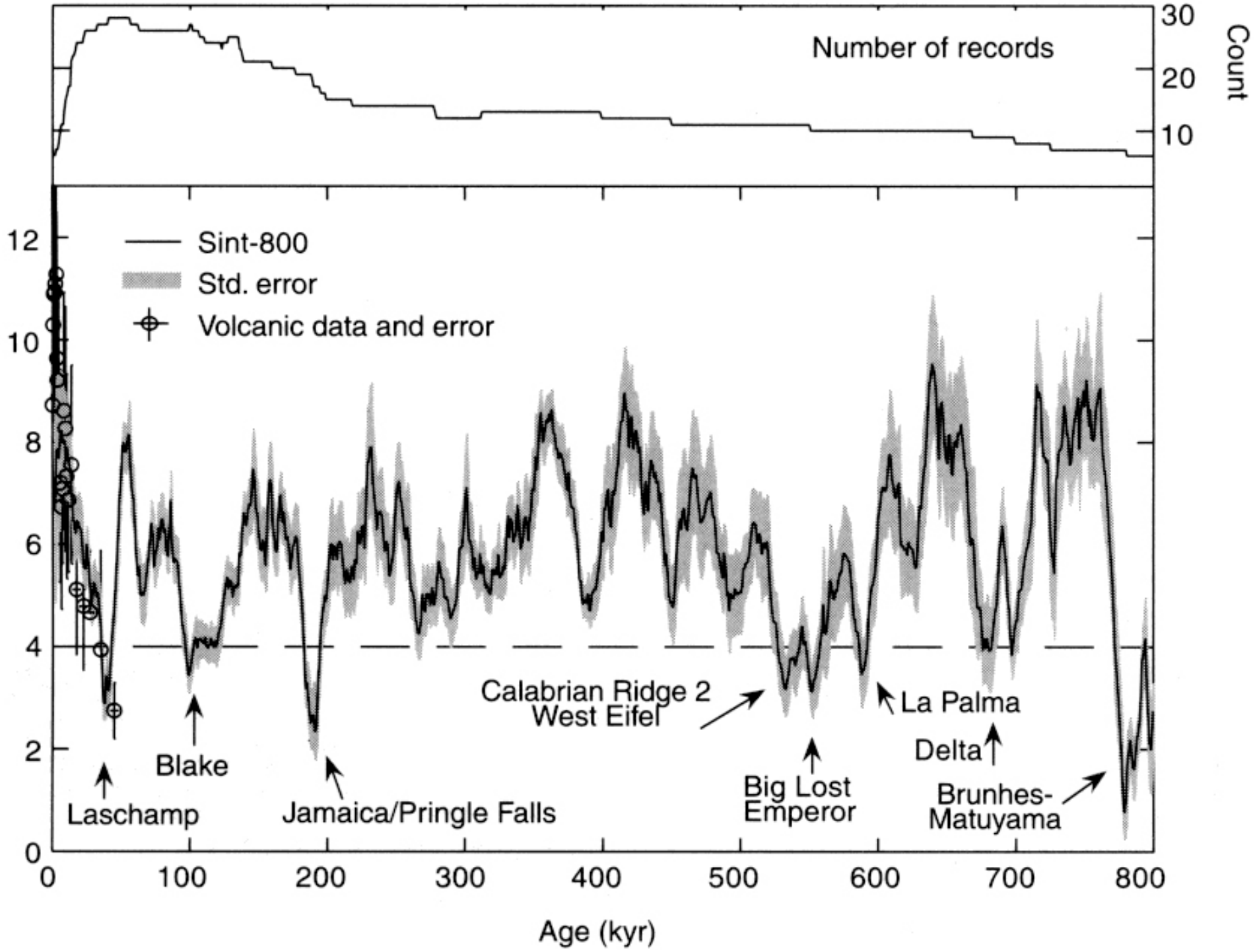
Geomagnetic Reversals



David Gubbins
School of Earth & Environment
University of Leeds UK

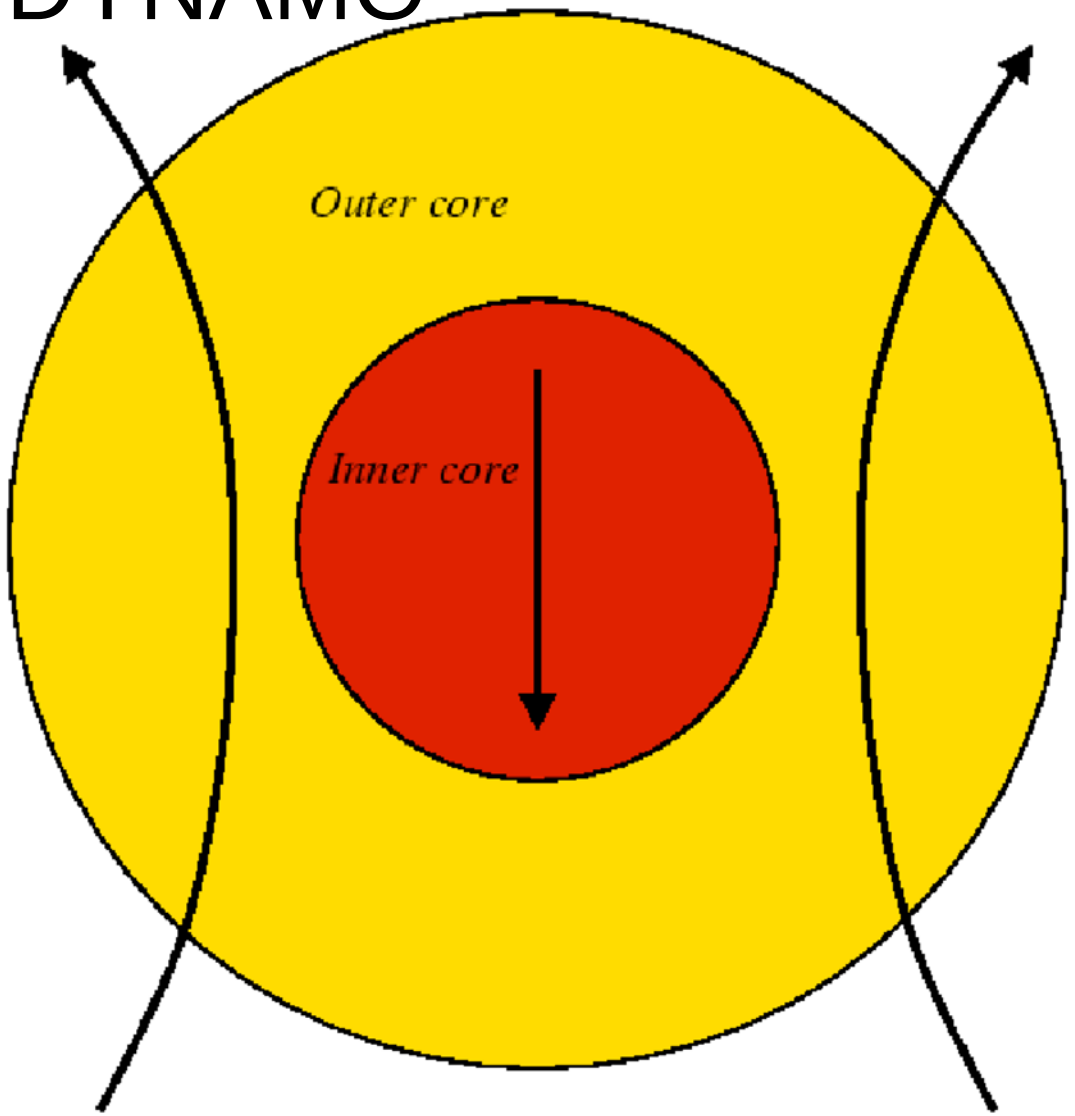
KITP Dynamo Theory Workshop May 2008.


Number of records
Count
30
20
10
Sint-800
Std. error
Volcanic data and error
12
10
8
6
4
2
0
Laschamp
Blake
Jamaica/Pringle Falls
Calabrian Ridge 2
West Eifel
Big Lost
Emperor
La Palma
Delta
Brunhes-
Matuyama
0
100
200
300
400
500
600
700
800
Age (kyr)

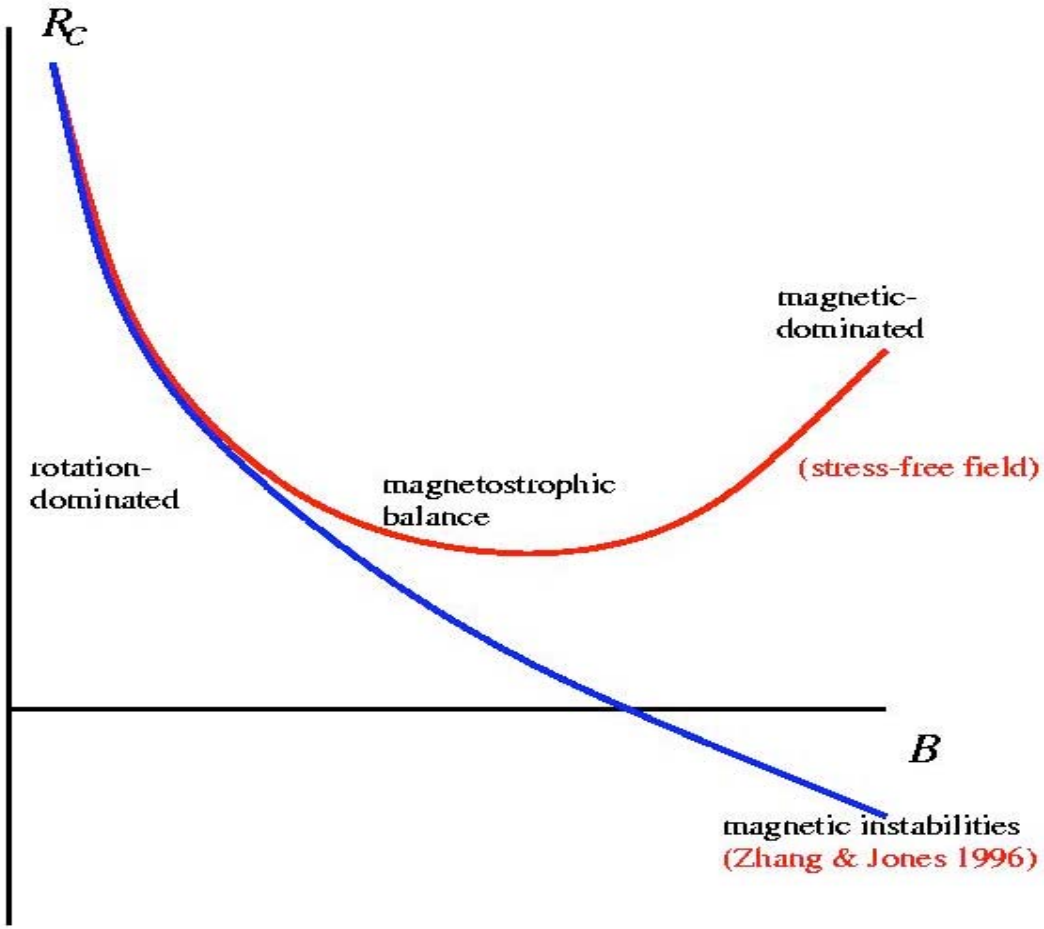
STABILISING THE GEODYNAMO

Time scale to change B in outer core: 500 yr

Time scale in inner core (diffusion) 5 kyr

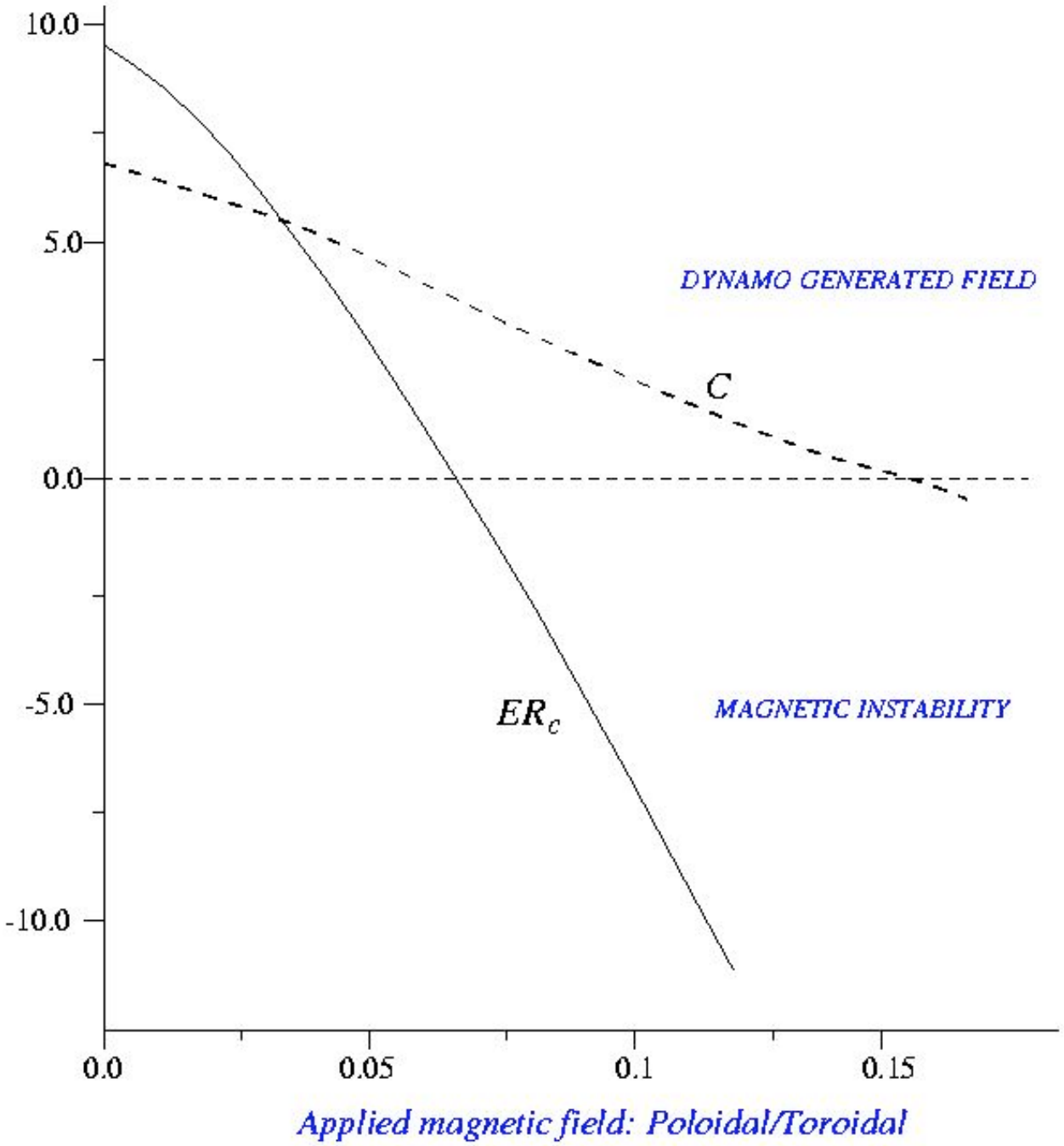


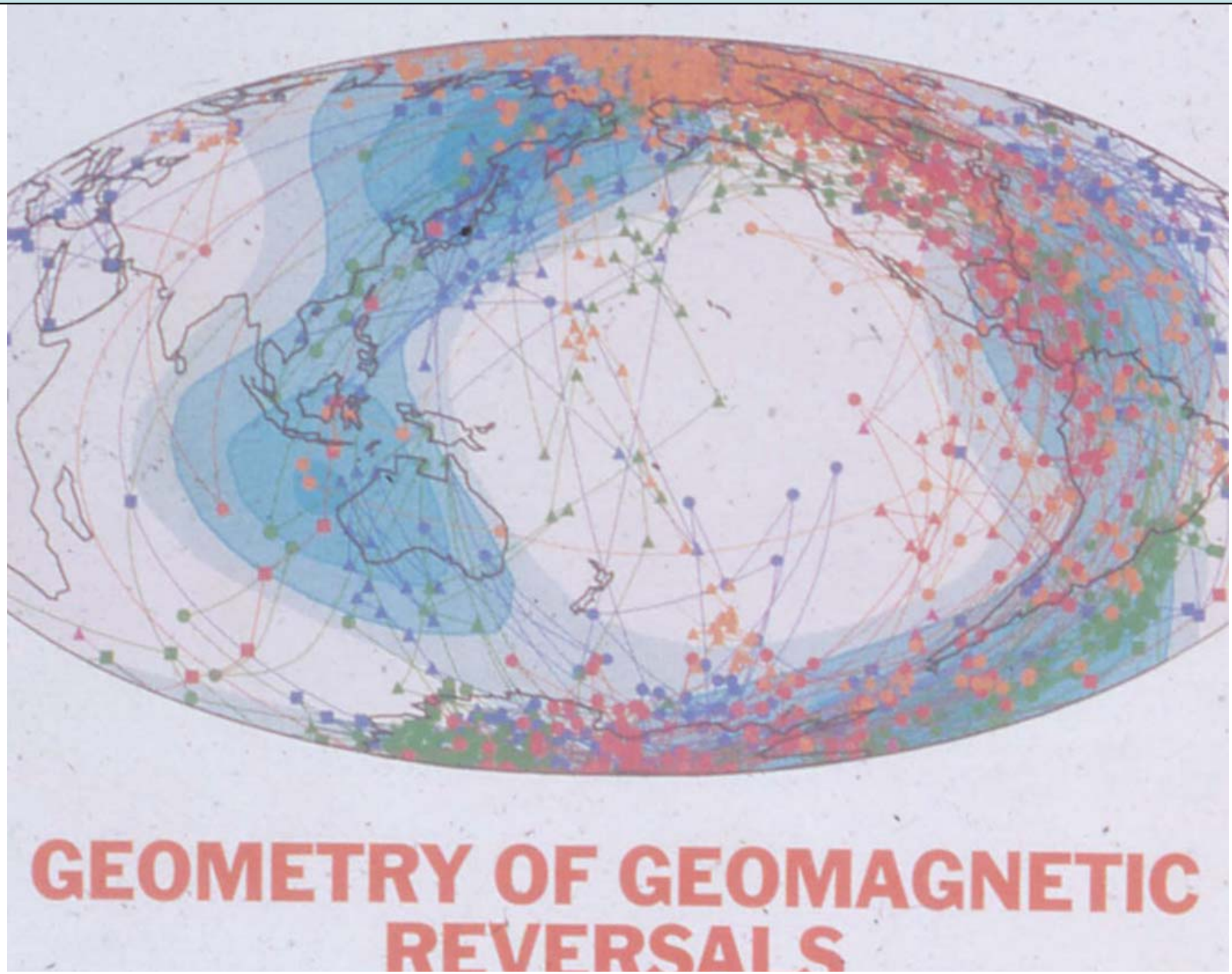
NON-MAGNETIC CONVECTION IS HARDER TO DRIVE

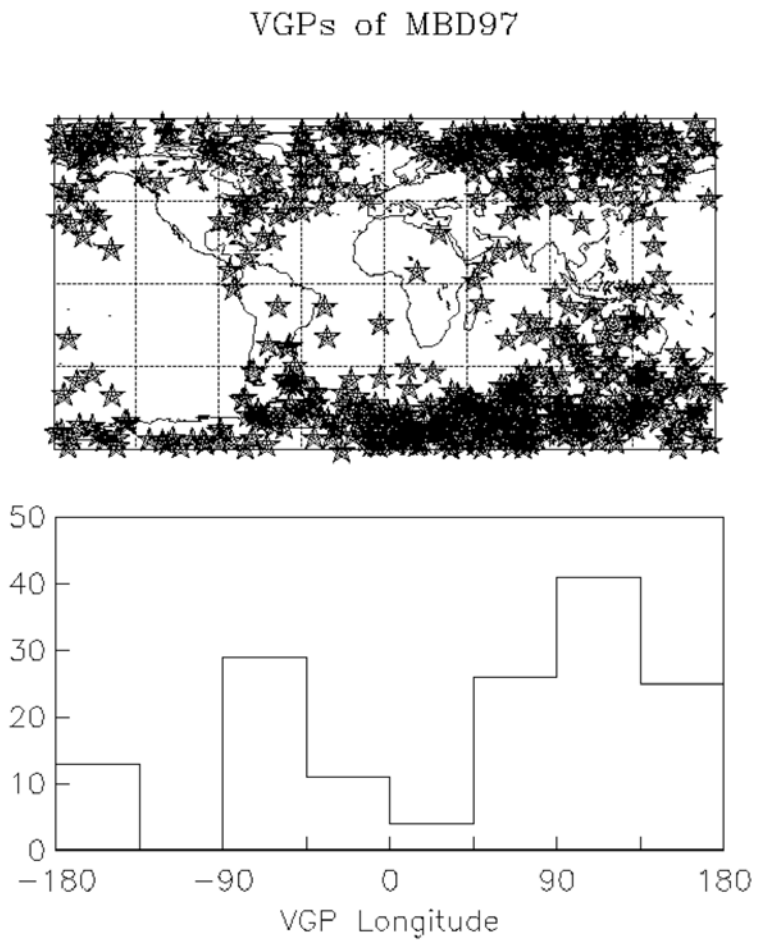


- $Ra(B)$ does not have a minimum except for force-free fields
- $Ra = 0$ may be a stable limit for a strong-field dynamo

[Zhang & Jones 1996]

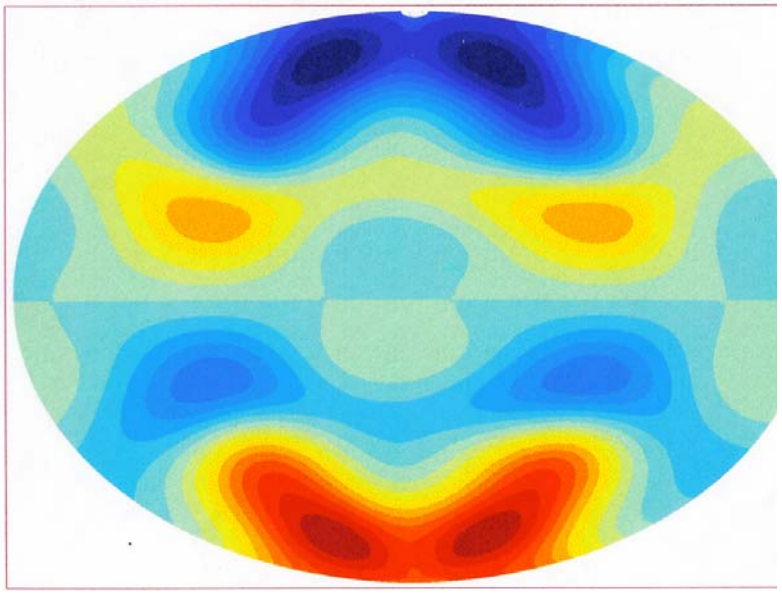

10.0
5.0
0.0
-5.0
-10.0
0.0
0.05
0.1
0.15
DYNAMO GENERATED FIELD
C
ER_c
MAGNETIC INSTABILITY
Applied magnetic field: Poloidal/Toroidal


GEOMETRY OF GEOMAGNETIC
REVERSALS

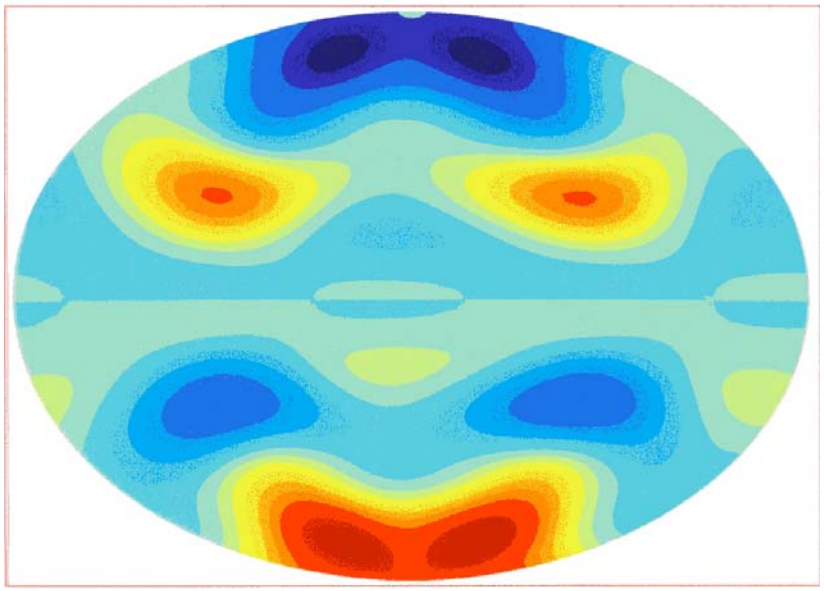


Matuyama-Brunhes, after Love & Mazau (1997)

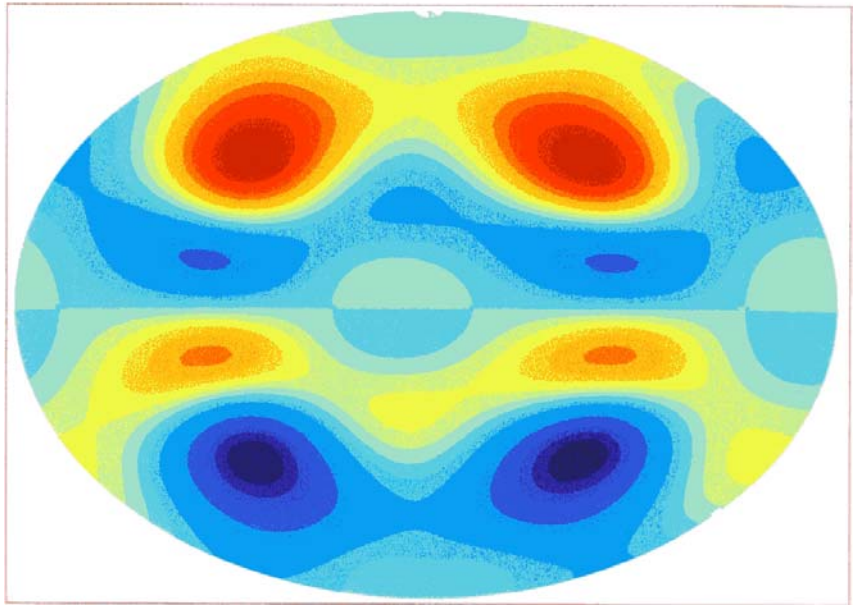
Gubbins & Sarson (1994). Radial field, time =0.



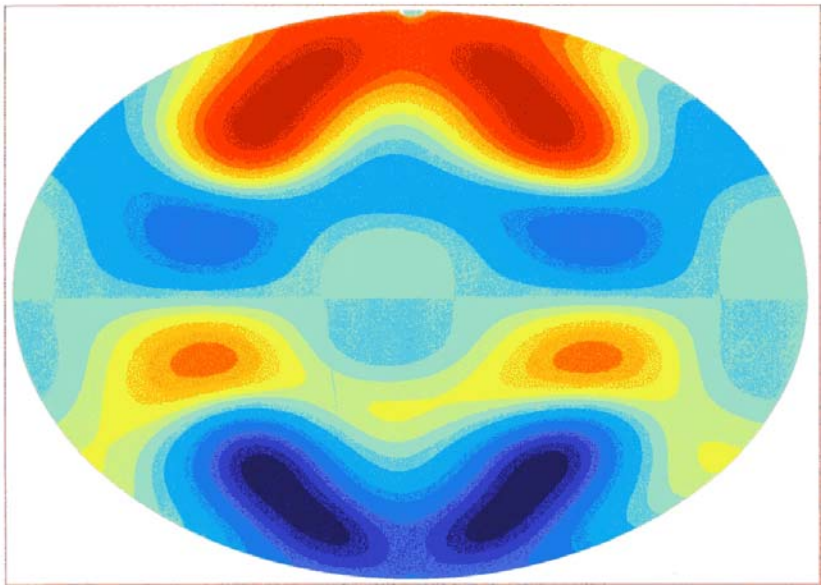
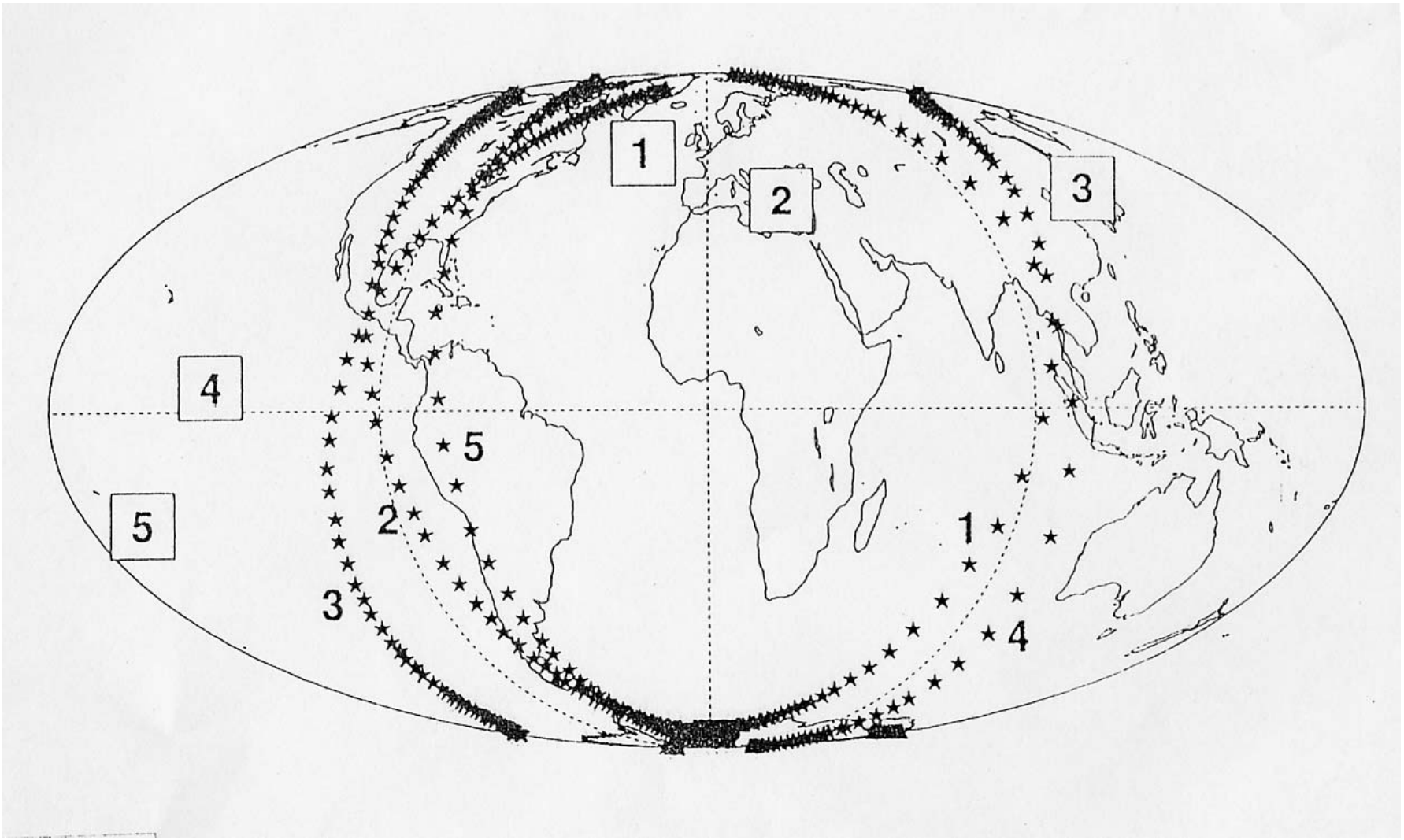
Gubbins & Sarson (1994). Radial field, time = 1/4 cycle.



Gubbins & Sarson (1994). Radial field, time = 1/2 cycle.



Gubbins & Sarson (1994). Radial field, time = 3/4 cycle.



VGP PATHS