The Abdus Salam
International Centre for Theoretical Physics

United Nations
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Two-Layer Exchange Flows

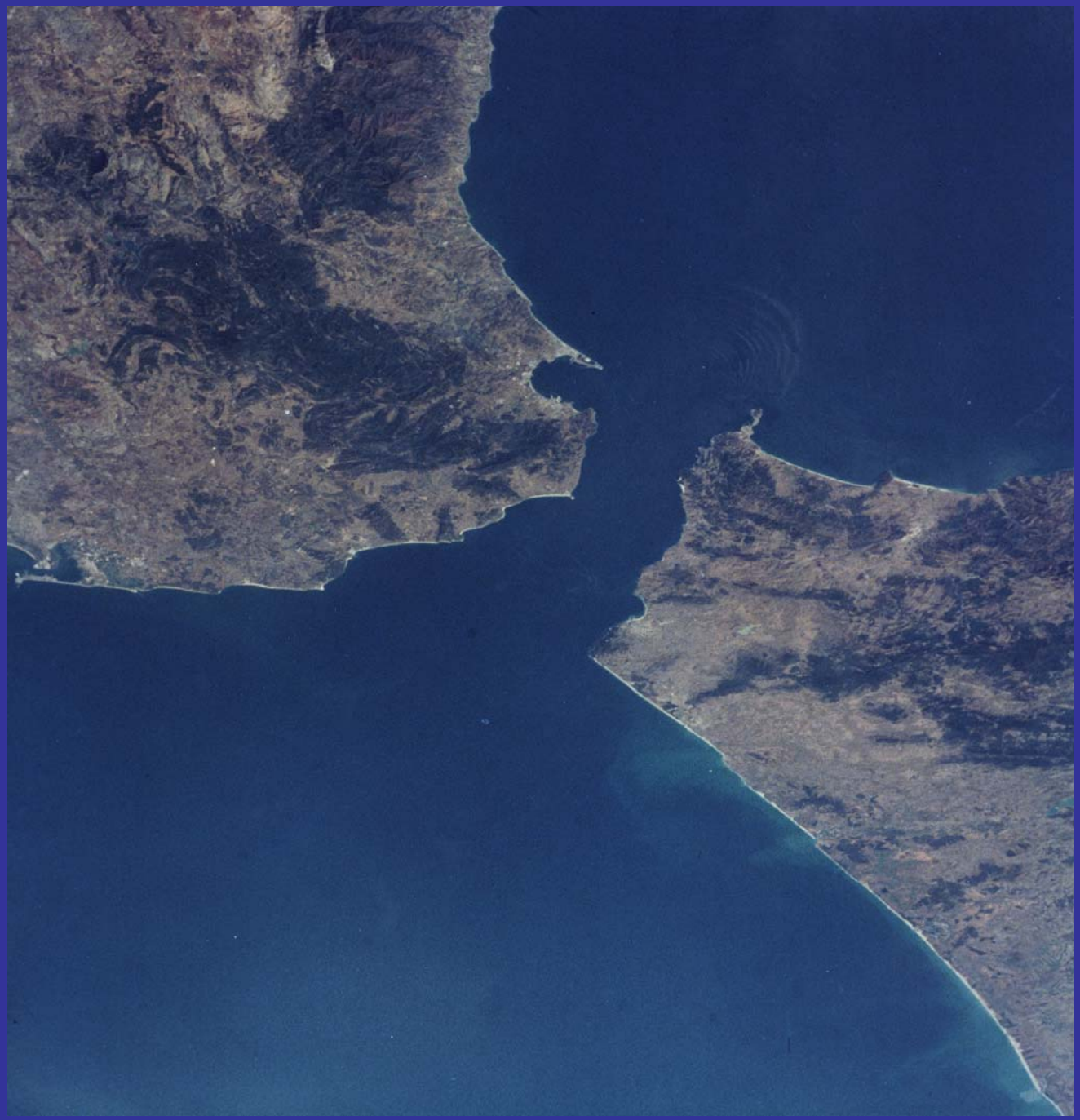
H. Bryden

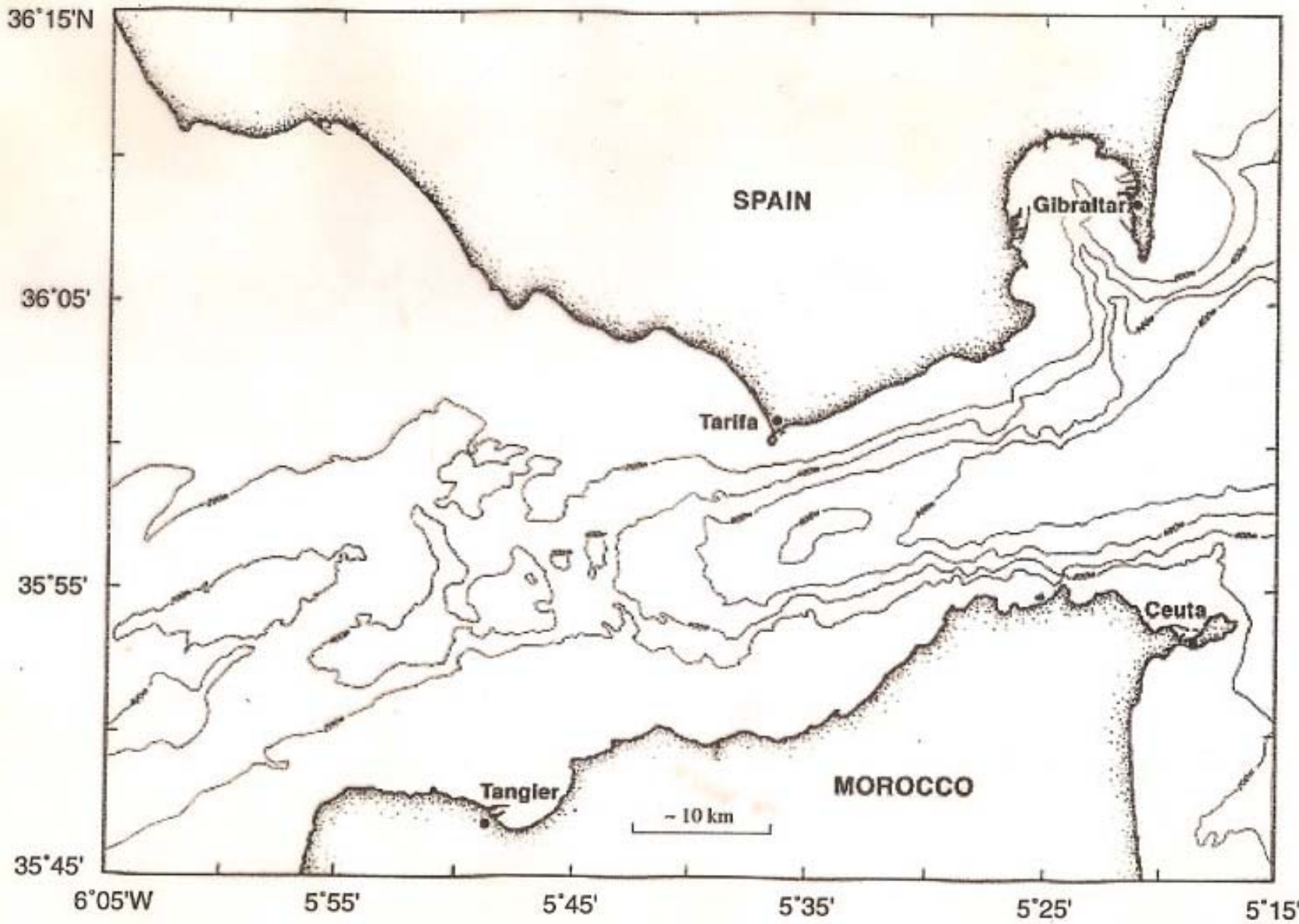
National Oceanography Centre
Southampton, UK

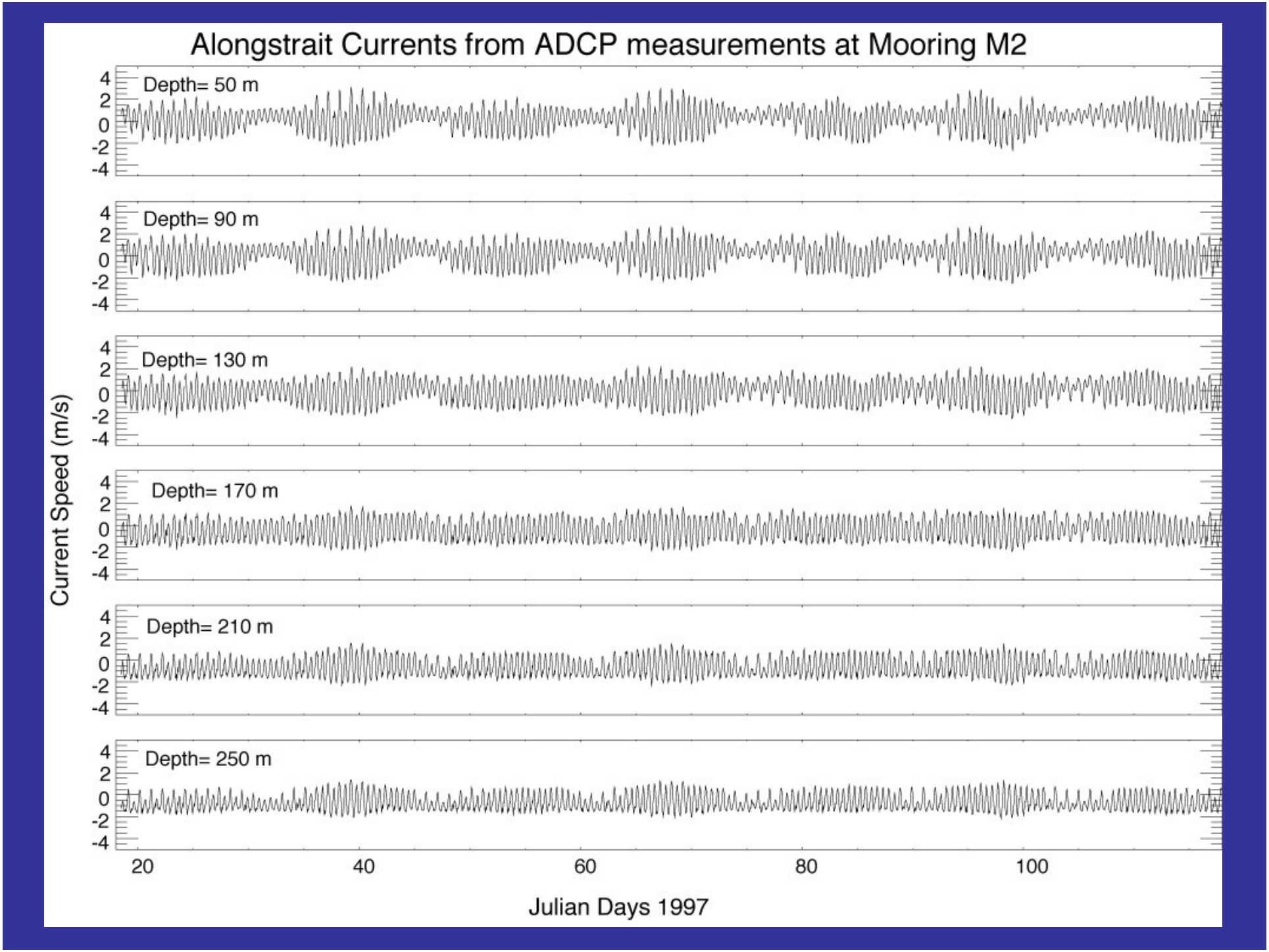
Two-Layer Exchange Flows

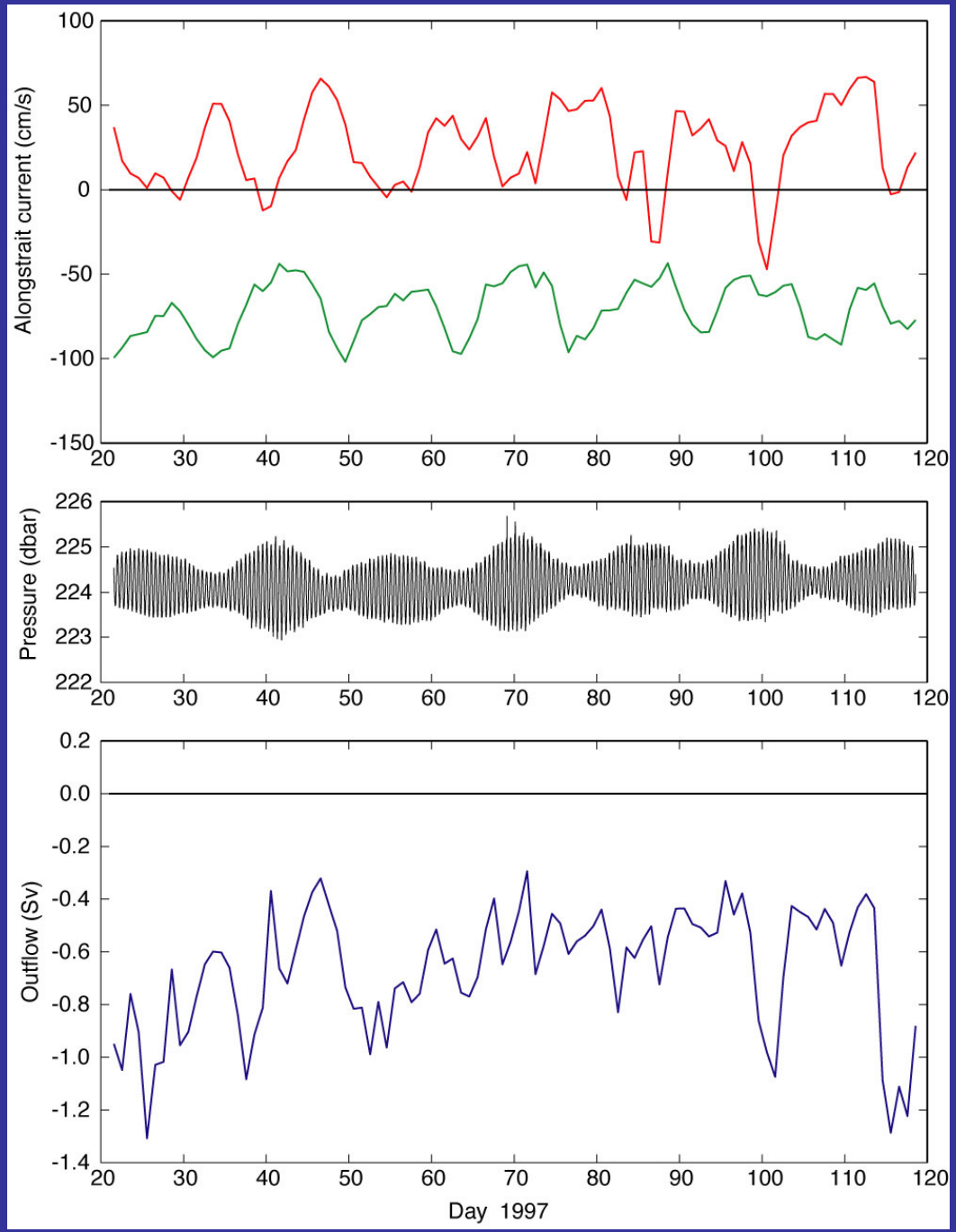
Lecture for ICTP Advanced School on Oceanography
International Centre for Theoretical Physics
Trieste, Italy April-May 2007

Prof. Harry L. Bryden




36°15'N
36°05'
35°55'
35°45'
6°05'W
5°55'
5°45'
5°35'
5°25'
5°15'
SPAIN
Gibraltar
Tarifa
Ceuta
MOROCCO
Tangier
~ 10 km


Alongstrait Currents from ADCP measurements at Mooring M2
Depth= 50 m
Depth= 90 m
Depth= 130 m
Depth= 170 m
Depth= 210 m
Depth= 250 m
4
2
0
-2
-4
Current Speed (m/s)
20
40
60
80
100
Julian Days 1997


Alongstrait current (cm/s)
100
50
0
-50
-100
-150
Pressure (dbar)
226
225
224
223
222
Outflow (Sv)
0.2
0.0
-0.2
-0.4
-0.6
-0.8
-1.0
-1.2
-1.4
20
30
40
50
60
70
80
90
100
110
120
Day 1997

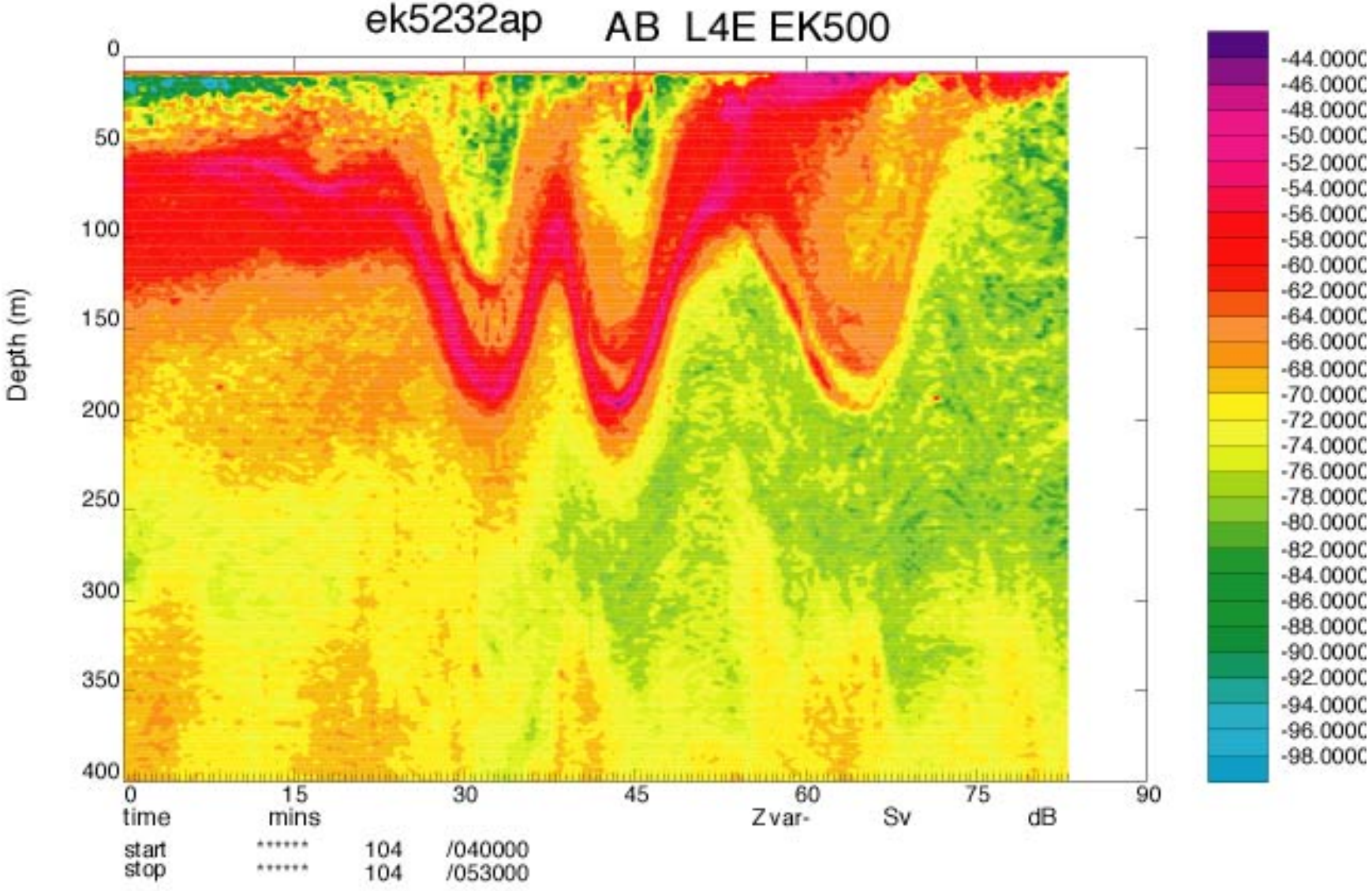
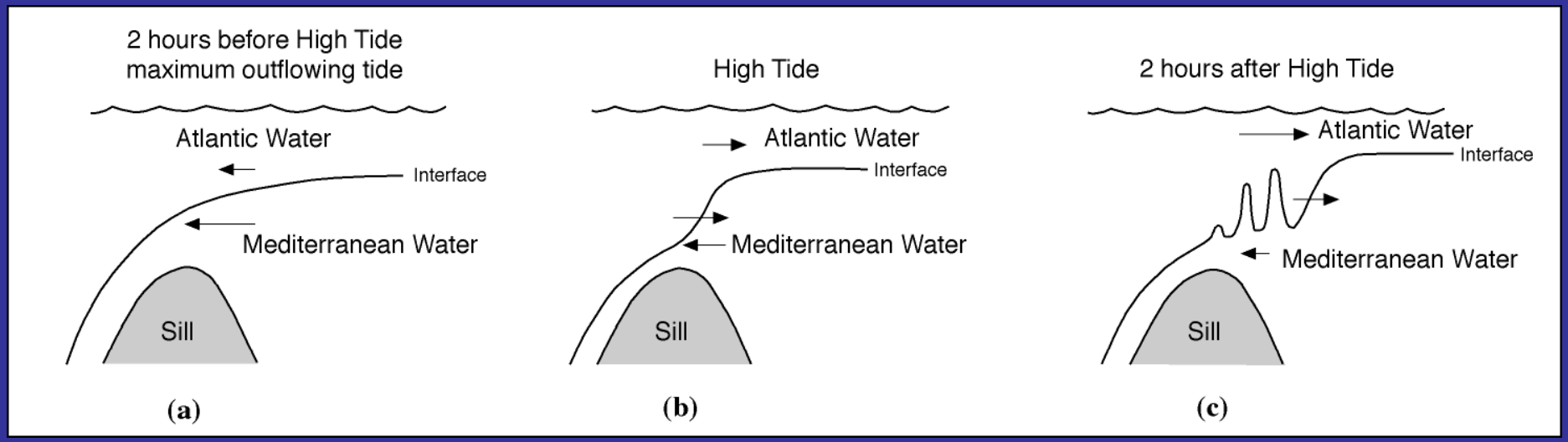
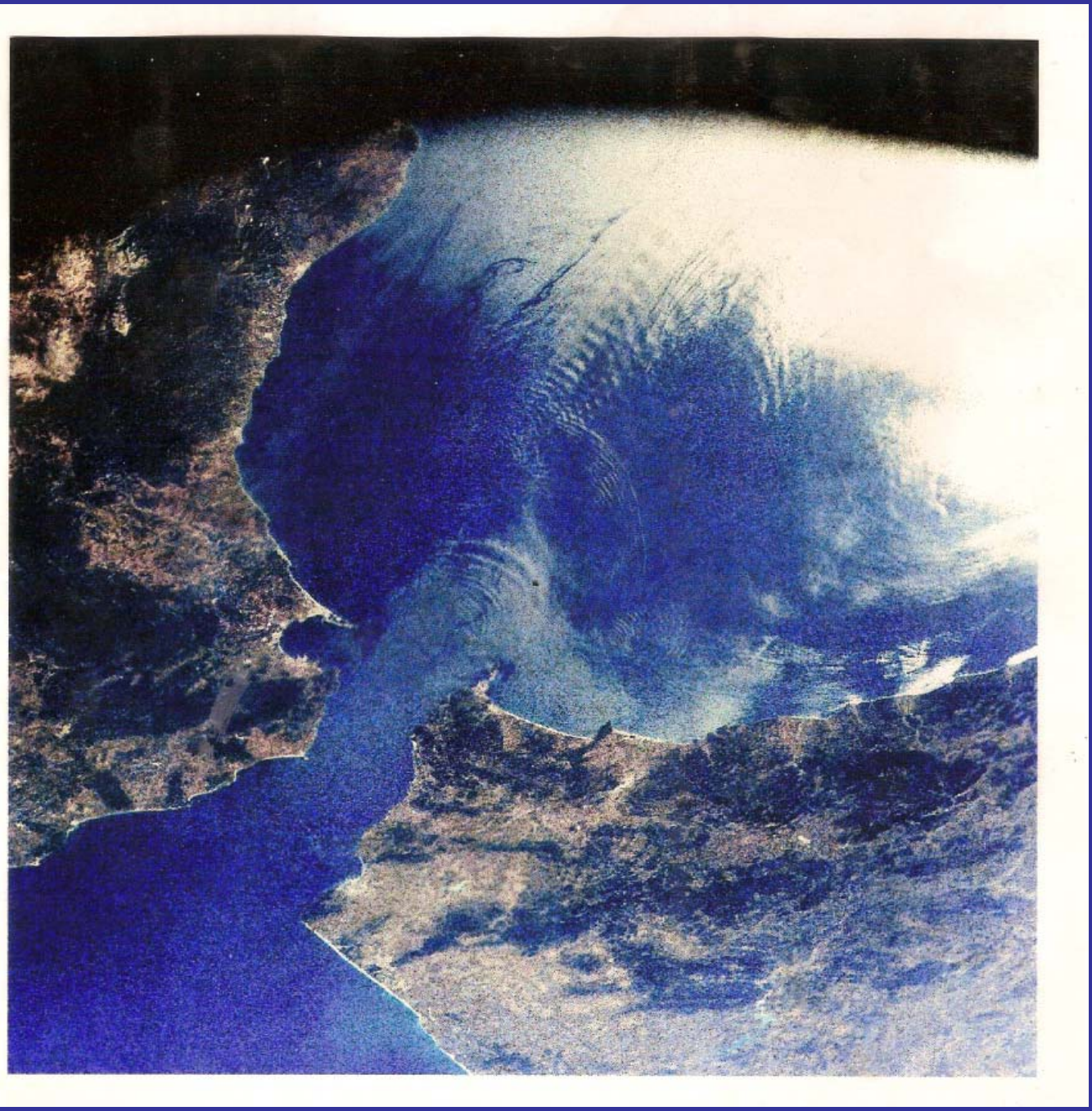


Figure 2. Backscatter intensity (dB) for 38 KHz EK500 underway sampling in the Strait of Gibraltar at L4E on 14 April between 0400 and 0530.


2 hours before High Tide
maximum outflowing tide
Atlantic Water
Interface
Mediterranean Water
Sill
(a)
High Tide
Atlantic Water
Interface
Mediterranean Water
Sill
(b)
2 hours after High Tide
Atlantic Water
Interface
Mediterranean Water
Sill
(c)



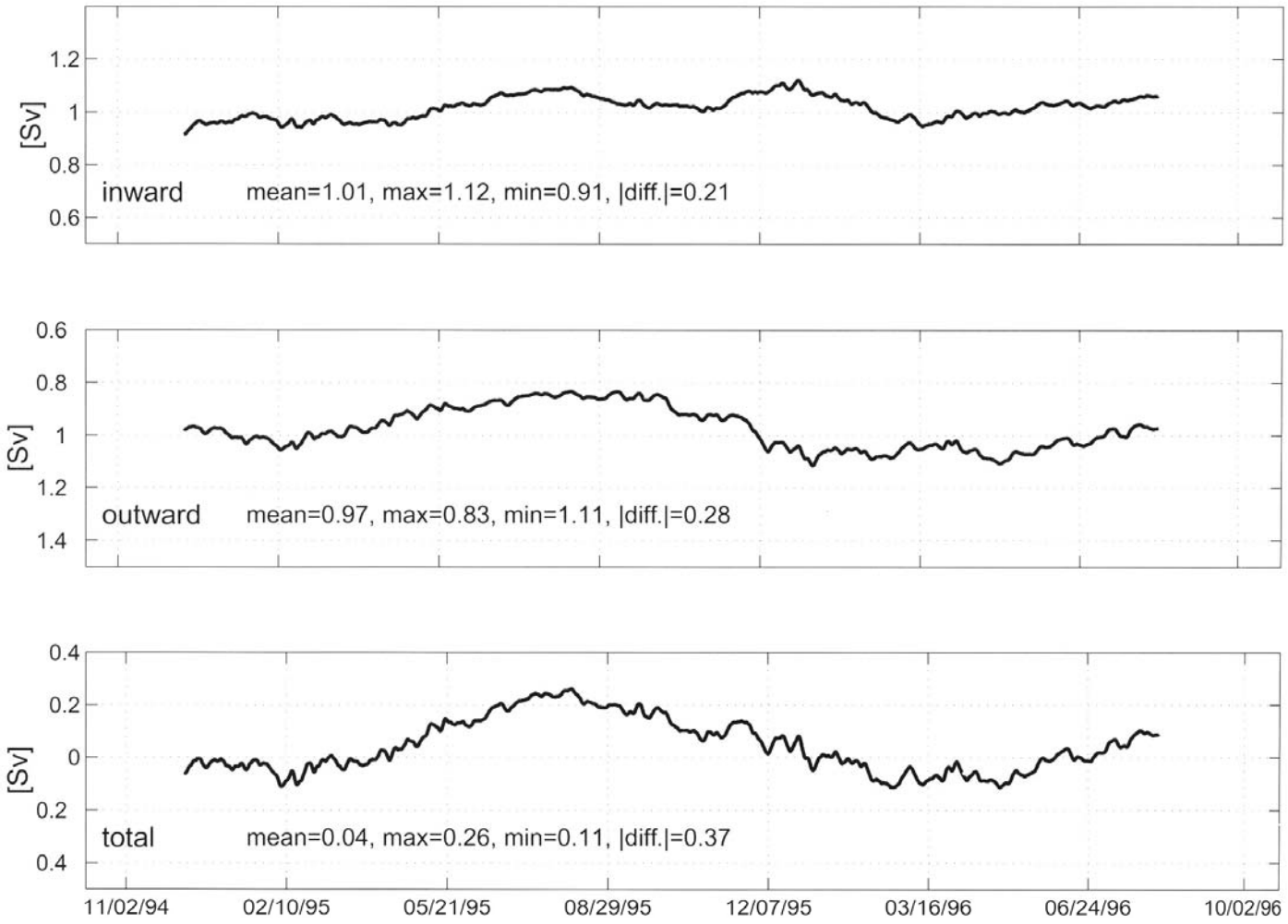


Fig. 5.7.4 Low-passed (periods larger than three months) transport estimates in the Strait of Gibraltar. The transport calculations are done from hourly time series of currents measured at the mid-point of Gibraltar's main sill with a vertical resolution of 10 m, time series of the depth of the 37‰ isoline separating Atlantic and Mediterranean Waters and information of the cross-strait current structure based on shipboard current observations across the sill during two complete semidiurnal tidal cycles at springs and neaps. The inflow (upper), outflow (middle) and total (bottom) transports are indicated in Sverdrups ($1\ Sv = 10^6\ m^3\ s^{-1}$). The mean, maximum, minimum and range of each plot are also indicated. The time axis of the lower plot is common to all three panels.