Appendix 1

The computational method used in this paper is adapted from Crouch and Starfield [1983]. We use a version of the boundary element technique that employs constant relative displacement boundary elements.

The technique consists of introducing a series of dislocation elements into an infinite (2- dimensional) elastic medium of appropriate properties. The number, location and amplitude of slip on the elements is then adjusted such that stresses and displacements at boundaries and fault interfaces reasonably approximate those in the real problem being examined.

The problem can be expressed as the solution of the following equations:

$$
\begin{aligned}
b_s^i - \beta_s^i &= \sum_{j=1}^{N} C_{ss}^{ij} D_s^j + \sum_{j=1}^{N} C_{sn}^{ij} D_n^j \\
b_n^i - \beta_n^i &= \sum_{j=1}^{N} C_{ns}^{ij} D_s^j + \sum_{j=1}^{N} C_{nn}^{ij} D_n^j
\end{aligned}
\qquad 1)
$$

where $i = 1$ to N. The b_x^i are displacements ($b_x^i = u_x^i$) of or stresses ($b_x^i = \sigma_x^i$) on the appropriate side of the ith boundary element. For normal components $x = n$ and for shear $x = s$. The D_x^j are normal ($x = n$) or shear($x = s$) displacements between ith faces of the jth boundary element, and the C_{xy}^{ij} are the influence coefficients between the ith and jth elements. Subscripts indicate normal components (x or $y = n$) and shear (x or $y = s$) components.

The β_x^i correspond to pre-stresses at the ith element. In this paper they correspond to stresses due to all elements ($k = 1$ to M) where the normal and tangential displacements (B_n^k and B_s^k) between the faces have been fixed.

$$\beta_s^i = \sum_{k=1}^{M} C_{ss}^{ik} B_s^k + \sum_{k=1}^{M} C_{sn}^{ik} B_n^k$$
$$\beta_n^i = \sum_{k=1}^{M} C_{ns}^{ik} B_s^k + \sum_{k=1}^{M} C_{nn}^{ik} B_n^k \quad 2)$$

In some cases an element is needed in which one relative slip component is known and the other is sought subject to some requirement (e.g. a fault in which opening or closure is set to zero and slip occurs to ensure zero stress between the fault surfaces). In this case the line and column corresponding to the component of known slip is subtracted from equation 1 and an appropriate line added to equation 2.

Influence coefficients relate stress at the *i*th element to displacement between the faces of the *j*th element. In equation 1 they must be chosen appropriately according to whether the corresponding b_x^i refers to a displacement or a stress. They are derived from the solutions for a dislocation in an elastic medium. In equation 2 where the β_x^i fall in lines that calculate displacements in equation 1 (i.e.$b_x^i = u_x^i$) the $C_{xy}^{ij} = 0$.

When the β's have been calculated from all the fixed elements (faults or other structures where normal and/or tangential relative displacement is known), the appropriate displacements or stresses are specified for the other elements and the influence coefficients are calculated. There are the 2N equations minus the number of rows and columns deleted and these can be solved for the same number of unknown values of *D*. Once the *D*'s are known, it is straightforward to calculate stresses strains or displacements anywhere in the medium as the sum of the effects of the slips (*D*'s and *B*s) on all the elements.

In the modelling in this paper, elements are specified by spatial coordinates whose relation to geographical co-ordinates can be found from the appropriate figures. Elements with fixed slip (i.e.$b_x^i = u_x^i$) on one side of the element are used to describe distant plate boundaries and it is this displacement rather than the displacement between the element faces that is provided in the tables. By the convention of the program these displacements must be on the left side of the element determined by the order in which the end coordinates are specified. Some faults or structures have both normal and tangential relative slips fixed and in other cases one or both of these are left free slipping ($\sigma_z^i = 0$). Calculated displacement values are identified in the tables by being enclosed by brackets.

Tables

TABLE 1: FAULTS USED IN DOLIANA BASIN MODELLING (see Figure 6)

The Doliana Basin is modelled by an elastic plate. Plate thickness is arbitary since we are concerned with identifying regions of uplift and subsidence and not with assessing absolute amplitudes (See Bilham and King [1989] for a discussion). The identified active structures are modelled by boundary elements with specified or calculated displacements in the horizontal plane only (see Figure 3g). Thus uplift and subsidence predicted is only that which is a result of motion on structures that have not been explicitly included (i.e. secondary structures). The relation between the grid coordinates, geographical coordinates and the features being modelled can be found in Figure 6. Some boundary elements, such as those that apply the distant displacement boundary conditions or that extend major structures to prevent termination strains cannot be shown at the scale of the figure but their location can be recovered using information in the table.
In the table the first two boundary elements represent plate motion and the 'along' (boundary parallel) and 'normal' motions are the distant plate displacements (equal and opposite displacements for the two plates. See conventions if this seems confusing). The remaining elements represent faults and the slips are relative slip between the fault faces. The relative motion between Ionia and Europe is later estimated to be 16 mm/yr (see Table 6) which corresponds to a total amlitude applied between 'Boundary west' and 'Boundary east' of 0.175 units. Thus multplying displacements in the table by 100 gives aproximate rates in millimetres per year.

Coordinates of boundary elements and slip components:

Fault name	Letter on Figure 6a	-----Grid coordinates------ X1	Y1	X2	Y2	-components- along	normal	N° of Segments
Boundary west		+695	+560	+1150	+1536	+0.045	-0.075	1
Boundary east		+1310	+1480	+855	+504	+0.045	-0.075	1
Doliana west	A	+981	+998	+1001	+999	[-0.171]	0.000	1
Doliana east	B	+1001	+999	+1058	+1002	[<-0.002]	0.000	3
Kasidiares N s/s	C	+1001	+999	+1017	+1034	-0.075	0.000	1
Kasidiares S s/s	D	+1017	+1034	+1026	+1053	-0.083	0.000	1
Kasidiares d/s	E	+1001	+999	+1026	+1053	0.000	+0.150	1
Soulopoulou	F	+1026	+1053	+1029	+1053	[-0.173]	0.000	1
Kourenton s/s	G	+1029	+1053	+1250	+1527	-0.090	0.000	1
Kourenton d/s	H	+1029	+1053	+1250	+1527	0.000	+0.150	1
Chrysodouli ext.	I	+770	+545	+981	+998	-0.090	+0.150	1

Conventions:
Left lateral and normal dip-slip components are negative; right lateral and thrust are positive. For the boundary elements the sense of motion refers to looking accross the boundary into the region being deformed which is the left-hand side of the line drawn between the element ends. Bracketed figures are calculated by the program; unbracketed are input.

Fault orientations and the orientation and rate of the associated slip:

(The vector rate is given as a fraction of the applied plate rate.)

Fault name		Fault angle to grid N	Qty along	Qty normal	Vector angle	Vector rate
Doliana west	A	-87.1	-0.171	0.000	272.9	0.977
Doliana east	B	-87.0	-0.002	0.000	273.0	0.001
Kasidiares N s/s	C	-24.6	-0.075	0.000	335.4	0.428
Kasidiares S s/s	D	-25.3	-0.083	0.000	334.7	0.474
Kasidiares d/s	E	-24.8	0.000	0.150	245.2	0.857
Soulopoulou	F	-90.0	-0.173	0.000	270.0	0.989
Kourenton	G&H	-25.0	-0.090	0.150	276.0	1.000
Chrysodouli	I	-25.0	-0.090	0.150	276.0	1.000

TABLE 2

FAULTS USED IN EPIRUS-WIDE MODELLING (see figures 4 and 11)

The Epirus is modelled by an elastic plate. Plate thickness is arbitary since we are concerned with identifying regions of uplift and subsidence and not with assessing absolute amplitudes (See Bilham and King [1989] for a discussion). The identified active structures are modelled by boundary elements with specified or calculated displacements in the horizontal plane only (see Figure 3g). Thus uplift and subsidence predicted is only that which is a result of motion on structures that have not been explicitly included (i.e. secondary structures). The relation between the grid coordinates, geographical coordinates and the features being modelled can be found in Figure 9. Some boundary elements, such as those that apply the distant displacement boundary conditions or that extend major structures to prevent termination strains cannot be shown at the scale of the figure but their location can be recovered using information in the table.
In the table the first two boundary elements represent plate motion and the 'along' (boundary parallel) and 'normal' motions are the distant plate displacements (the eastern plate is fixed). The remaining elements represent faults and the slips are relative slip between the fault faces. The relative motion between Ionia and Europe is later estimated to be 16 mm/yr (see Table 6) which corresponds to a total amplitude applied between 'Boundary west' and 'Boundary east' of 0.2 units. Thus multplying displacements in the table by 80 gives aproximate rates in millimetres per year.

Fault name	Letter on Figure 9	-----Grid coordinates----- X1	Y1	X2	Y2	-components- along	normal	N^{o} of Segments
Boundary west		-20.00	-15.00	+29.00	+68.00	+0.122	-0.158	1
Boundary east		+51.00	+58.00	+2.00	-25.00	0.000	0.000	1
Doliana	A	+9.50	+16.35	+13.55	+16.80	[-0.072]	0.000	3
						[-0.014]	0.000	
						[-0.010]	0.000	
Episkopou	B	+13.55	+16.80	+15.60	+14.85	+0.025	+0.015	1
Kasidiares NE	C	+11.20	+16.55	+12.35	+19.00	-0.020	0.000	1
Kasidiares SE	D	+12.35	+19.00	+12.90	+20.40	-0.040	0.000	1
Kasidiares W	E	+10.90	+16.50	+12.65	+20.30	0.000	+0.040	1
Soulopoulou	F	+12.90	+20.40	+13.50	+21.00	[-0.051	+0.040]	1
Kourenton E	G	+13.50	+21.00	+15.10	+23.90	-0.060	0.000	1
Kourenton W	H	+13.20	+21.00	+14.40	+23.75	0.000	+0.040	1
Chrysodouli	I	-0.15	+1.45	+9.50	+16.35	-0.055	+0.070	1
Mitsikeli	J	+13.55	+16.80	+18.70	+21.50	-0.030	+0.010	1
Psina	K	+14.40	+23.75	+15.50	+24.00	[-0.027	+0.047]	2
						[-0.067	-0.015]	
Tomaros E	L	+15.50	+24.00	+17.00	+25.60	-0.060	0.000	1
Tomaros W	M	+15.00	+24.40	+16.20	+26.50	0.000	+0.060	1
Tomaros S	N	+16.20	+26.50	+17.00	+25.60	0.000	+0.060	1
Ag. Kyriaki E	O	+12.70	+25.50	+16.20	+26.50	-0.060	0.000	1
Ag. Kyriaki W	P	+10.10	+26.25	+12.70	+25.50	[-0.006]	0.000	2
						[-0.050]	0.000	
Derviziana N	Q	+16.20	+26.50	+16.60	+27.30	-0.050	+0.120	1
Derviziana S	R	+16.60	+27.30	+16.30	+28.30	0.000	+0.100	1
Pente Dendra ext.	S	+16.30	+28.30	+23.96	+50.00	-0.056	+0.121	1
Paramythia N ext.	T	-0.15	+1.45	+11.70	+25.80	-0.066	+0.075	1
Paramythia South 1	U	+11.70	+25.80	+12.25	+26.65	-0.010	+0.035	1

Paramythia South 2	V	+12.25	+26.65	+13.20	+29.50	-0.020	+0.040	1
Souli	W	+13.70	+28.20	+14.55	+30.10	-0.020	+0.020	1
Tourli	X	+13.35	+29.90	+13.50	+31.00	-0.010	+0.020	1
Thesprotika North	Y	+15.70	+28.45	+14.85	+30.75	0.000	+0.050	1
Thesprotika S ext.	Z	+14.85	+30.75	+20.74	+50.00	-0.027	+0.061	1

Conventions:
Left lateral and normal dip-slip components are negative; right lateral and thrust are positive. For the boundary elements the sense of motion refers to looking accross the boundary into the region being deformed which is the left-hand side of the line drawn between the element ends. Bracketed figures are calculated by the program; unbracketed are input. Where an element is shown to have more than one segment it is split into the indicated number of separate boundary elements on a straight line between the assigned coordinates. The values of slip calculated for the elements are provided with the uppermost corresponding to the (X1,Y1) end and the lowermost to the (X2,Y2) end.

TABLE 3
FAULT SLIP VECTORS USED IN EPIRUS-WIDE MODELLING

Fault orientations and the orientation and rate of associated slip:

Fault name		Fault angle to grid N	Qty along	Qty normal	Vector angle	Vector rate
Boundary west		-30.6	+0.122	-0.158	277.1	0.200
Doliana	A1	-84.0	[-0.072]	0.000	276.0	0.072
	A2		[-0.014]	0.000	276.0	0.014
	A3		[-0.010]	0.000	276.0	0.010
Episkopou	B	+46.0	+0.025	0.015	257.0	0.029
Kasidiares NE	C	-25.0	-0.020	0.000	335.0	0.020
Kasidiares SE	D	-21.0	-0.040	0.000	339.0	0.040
Kasidiares W	E	-25.0	0.000	0.040	245.0	0.040
Soulopoulou	F	-45.0	[-0.051	+0.040]	276.9	0.065
Kourenton E	G	-29.0	-0.060	0.000	331.0	0.060
Kourenton W	H	-24.0	0.000	0.040	246.0	0.040
Chrysodouli	I	-33.0	-0.055	0.070	275.2	0.089
Mitsikeli	J	-48.0	-0.030	0.010	293.6	0.032
Psina	K1	-77.0	[-0.027	+0.047]	222.9	0.054
	K2		[-0.067	-0.015]	295.6	0.069
Tomaros E	L	-43.0	-0.060	0.000	317.0	0.060
Tomaros W	M	-30.0	0.000	0.060	240.0	0.060
Tomaros S	N	+42.0	0.000	0.060	318.0	0.060
Ag. Kyriaki E	O	-74.0	-0.060	0.000	286.0	0.060
Ag. Kyriaki W	P1	+74.0	[-0.006]	0.000	256.0	0.006
	P2		[-0.050]	0.000	256.0	0.050
Derviziana N	Q	-27.0	-0.050	0.120	265.6	0.130
Derviziana S	R	+17.0	0.000	0.100	287.0	0.100
Pente Dendra extn	S	-19.0	-0.056	0.121	275.8	0.133
Paramythia N extn	T	-26.0	-0.066	0.075	285.3	0.100
Paramythia S1	U	-33.0	-0.010	0.035	252.9	0.036
Paramythia S2	V	-18.0	-0.020	0.040	278.6	0.045
Souli	W	-24.0	-0.020	0.020	291.0	0.028
Tourli	X	-8.0	-0.010	0.020	288.6	0.022
Thesprotika N	Y	+20.0	0.000	0.050	290.0	0.050
Thesprotika S extn	Z	-17.0	-0.027	0.061	276.9	0.067

Conventions:
Vector angle is expressed in degrees relative to grid north. Left lateral and normal dip-slip components are negative; right lateral and thrust are positive. For the boundary elements the sense of motion refers to looking accross the boundary into the region being studied. Rates are expressed in displacement per unit time. Multiplying the figures listed by 80 gives the approximate rates for Epirus in mm/yr. Bracketed figures are calculated by the program; unbracketed are input.

TABLE 4

VECTORS SUMMED FOR TRANSECTS ACROSS EPIRUS (using data from Table 3)

#	Transect	Summed Vector Angle	Summed Vector rate
1	Paramythia NX [T] - Chrysodouli [I] - Episkopou [B]	277.5	0.215
2	Paramythia NX [T] - Kasidiares [C,E] - Mitsikeli [J]	283.3	0.175
3	Paramythia NX [T] - Kasidiares [C,E] - Doliana [A2]	280.6	0.158
4	Paramythia NX [T] - Kasidiares [D,E] - Doliana [A3]	287.0	0.164
5	Paramythia NX [T] - Kourenton [G,H]	291.3	0.174
6	Paramythia S1 [U] - Ag. Kyriaki [O] - Tomaros [L,M]	276.1	0.186
7	Paramythia S2 [V] - Ag. Kyriaki [O] - Mitsikeli [K2,J]	288.5	0.205
8	Paramythia S2 [V] - Derviziana N [Q]	270.0	0.174
9	Paramythia S2 [V] - Souli [W] - Pente Dendra [S]	278.5	0.205
10	Tourli [X] - Thesprotika N [Y] - Pente Dendra [S]	280.6	0.204
11	Thesprotika SX [Z] - Pente Dendra SX [S]	276.2	0.200

Conventions:
Vector angle is expressed relative to grid North. Rates are expressed in displacement per unit time: for order of magnitude, multiplying the figures listed by approximately 80 would give mm/yr.

TABLE 5
POLES OF ROTATION AND THEIR ANGULAR VELOCITY

Pole	Latitude	Longitude	Power (rad/yr)
Iblean/African	40° 40'	16° 20'	3.3 10^{-8}
Aegean/African	38° 40'	16° 00'	9.8 10^{-8}
Ionian/African	44° 50'	25° 20'	3.0 10^{-8}
Ionian/European	44° 30'	21° 20'	2.83 10^{-8}
Ionian/Aegean	40° 12'	18° 12'	13.0 10^{-8}
Aegean/European	39° 00'	17° 15'	10.2 10^{-8}

TABLE 6
SOME RELATIVE RATES OF MOTION (derived from Figure 15)

Relative motion	Location	Rate (mm/yr)
Iblean/African	Malta/Sicily escarpment - south end	18
Ionian/African	Malta/Sicily escarpment - south end	36
Aegean/African	Strabo south end	93
Aegean/Ionian	Strabo south end	115
Aegean/Ionian	Gulf of Arta - Preveza	31
Ionian/European	Gulf of Arta - Preveza	16
Aegean/European	Gulf of Arta - Preveza	26

TABLE 7

FAULTS USED IN THE MODELLING OF THE GULF OF ARTA (see Figures 17,18 and 19)

The Gulf of Arta is modelled by an elastic plate. Plate thickness is arbitary since we are concerned with identifying regions of uplift and subsidence and not with assessing absolute amplitudes (See Bilham and King [1989] for a discussion). The identified active structures are modelled by boundary elements with specified or calculated displacements in the horizontal plane only (see Figure 3g). Thus uplift and subsidence predicted is only that which is a result of motion on structures that have not been explicitly included (i.e. secondary structures). The relation between the grid coordinates, geographical coordinates and the features being modelled can be found in Figure 17. Some boundary elements that extend major structures to prevent termination strains cannot be shown at the scale of the figure but their location can be recovered using information in the table.
In the table the elements represent faults and the slips are relative slip between the fault faces. The relative motions on the last five elements are those for Prevesa taken from Table 6) Levkas North and West both carry the Aegean/Ionian motion. The Souli/Thesprotika and Pente Dendra structures equally share the Ionian/European motion and the Aetolia structure carries all of the Aegean/European motion. Multplying displacements in the table by 100 gives rates in millimetres per year.

Fault name	Letter on	-----Grid	coordinates-----			-components-		N^{o} of
	Figure 20	X1	Y1	X2	Y2	along	normal	Segments
Loutraki	A	18.85	38.20	21.60	40.15	[+0.075	-0.076]	3
						[+0.227	-0.139]	
						[+0.175	-0.151]	
Thyrion	B	17.90	40.80	20.10	39.10	[+0.035	-0.006]	3
						[+0.027	+0.017]	
						[+0.021	+0.059]	
Serekas	C	17.90	40.80	19.15	44.20	[+0.019	+0.029]	3
						[+0.014	+0.013]	
						[+0.008	+0.003]	
Zalongon	D	13.85	33.15	15.45	32.70	[+0.103]	0.000	1
Stavros	E	15.45	32.70	16.40	32.45	[+0.033]	0.000	1
Ziros	F	16.40	32.45	17.45	31.10	[+0.052]	0.000	1
Arta	G	19.60	32.40	22.70	36.30	[-0.052	-0.069]	3
						[-0.060	-0.100]	
						[-0.055	-0.094]	
Amvracia	H	21.60	40.15	24.00	43.80	[+0.092	-0.219]	3
						[+0.088	-0.266]	
						[+0.063	-0.252]	
Amphilochia	J	22.70	36.30	24.00	43.80	[-0.088	-0.012]	3
						[-0.115	+0.075]	
						[-0.168	+0.155]	
Preveza	K	13.85	33.15	15.80	37.70	[+0.035	+0.131]	3
						[+0.065	+0.153]	
						[+0.094	+0.187]	
Levkas North	L	14.40	39.40	15.80	37.70	+0.310	0.000	1
Levkas West	M	14.40	39.40	0.00	68.80	+0.300	+0.075	1
Souli/Thesprotika	N	5.83	3.00	15.45	32.70	-0.031	+0.074	1
Pente Dendra	P	8.23	3.00	17.45	31.10	-0.031	+0.074	1
Aetolia	Q	24.00	43.80	35.29	70.00	-0.217	-0.136	1

Conventions:
Vector angle is expressed in degrees relative to grid north. Left lateral and normal dip-slip components are negative; right lateral and thrust are positive. Where an element is shown to have more than one segment it is split into the indicated number of separate boundary elements on a straight line between the assigned coordinates. The values of slip calculated for the elements are provided with the uppermost corresponding to the (X1,Y1) end and the lowermost to the (X2,Y2) end. Bracketed figures are calculated by the program; unbracketed are input.

TABLE 8
FAULT VECTORS USED IN THE GULF OF ARTA MODELLING

Fault orientations and the orientation and rate of the associated slip

Fault name		Fault angle to grid N	Qty along	Qty normal	Vector angle	Vector rate
Loutraki	A1	-54.7	[0.075	-0.076]	79.9	0.107
Loutraki	A2	-54.7	[0.227	-0.139]	93.8	0.266
Loutraki	A3	-54.7	[0.175	-0.151]	84.5	0.231
Thyrion	B1	+52.3	[0.035	-0.006]	222.6	0.036
Thyrion	B2	+52.3	[0.027	0.017]	264.5	0.032
Thyrion	B3	+52.3	[0.021	0.059]	302.7	0.063
Serekas	C1	-20.2	[0.019	0.029]	216.6	0.035
Serekas	C2	-20.2	[0.014	0.013]	202.7	0.019
Serekas	C3	-20.2	[0.008	0.003]	180.4	0.009
Zalongon	D	+74.3	[0.103	0.000]	74.3	0.103
Stavros	E	+75.3	[0.033	0.000]	75.3	0.033
Ziros	F	+37.9	[0.052	0.000]	37.9	0.052
Arta	G1	-38.5	[-0.052	-0.069]	14.5	0.086
Arta	G2	-38.5	[-0.060	-0.100]	20.5	0.117
Arta	G3	-38.5	[-0.055	-0.094]	21.2	0.109
Amvracia	H1	-33.3	[0.092	-0.219]	79.5	0.238
Amvracia	H2	-33.3	[0.088	-0.266]	75.0	0.280
Amvracia	H3	-33.3	[0.063	-0.252]	70.7	0.260
Amphilochia	J1	-9.8	[-0.088	-0.012]	358.0	0.089
Amphilochia	J2	-9.8	[-0.155	0.075]	324.4	0.172
Amphilochia	J3	-9.8	[-0.168	0.155]	307.5	0.229
Preveza	K1	-23.2	[0.035	0.131]	231.8	0.136
Preveza	K2	-23.2	[0.065	0.153]	223.8	0.166
Preveza	K3	-23.2	[0.094	0.187]	220.1	0.209
Levkas North	L	+39.5	0.310	0.000	219.5	0.310
Levkas West	M	+26.1	0.300	0.075	220.1	0.309
Souli/Thesprotika	N	-17.9	-0.031	0.074	274.8	0.080
Pente Dendra	P	-18.2	-0.031	0.074	274.5	0.080
Aetolia	Q	-23.3	-0.217	-0.136	8.8	0.256

Conventions:
Vector angle is expressed in degrees relative to grid north. Left lateral and normal dip-slip components are negative; right lateral and thrust are positive. For the boundary elements the sense of motion refers to looking accross the boundary into the region being studied. Rates are expressed in displacement per unit time. Multiplying the figures listed by 100 gives rates in mm/yr. Bracketed figures are calculated by the program; unbracketed are input.