exposure above it, except that it is more compressed. Artificial exposures on two additional slopes with opposing exposure directions, located 100 and 140 m SE of the road-cut, respectively, were excavated to a depth of several meters. The sheared gouge layer adjacent to the PSZ from its NE side and within it has, respectively, 1.8 and 2.2 higher FD than that of the massive gouge layer on the SW side. The general fracture pattern is similar to the one of the road-cut exposures. We are now in the process of studying additional exposures along the Anza section of the San Jacinto fault and the Gorman area of the San Andreas fault. Our observations show several manifestations of asymmetry in gouge and fracture properties that are compatible overall with theoretical predictions for a wrinkle-like rupture pulse along an interface between different elastic materials (Ben-Zion, JMPS, 2001, and references therein). The wrinkle-like pulse has a preferred propagation direction that is the same as the loading direction on the slower side of the fault, and dynamic dilation at the rupture front with large fault-normal motion on the slower side. If such ruptures occur repeatedly on a fault that separate different media, we expect the following signals on the slower side: 1. higher FD in the gouge and in the host rock, 2. fault-parallel tension fractures with increasing density towards the PSZ, 3. higher morphological degradation driven by the increased FD, 4. reasonable consistency of items 1-3 along the fault. Our initial observations agree with these expectations, assuming that the slower side of the faults in our study areas is on the NE and the preferred direction of rupture propagation is to the SE. If these signals indeed represent the mechanical behavior of wrinkle-like rupture pulses, continuing studies can provide improved understanding of earthquake behavior and refined estimates of ground shaking associated with large faults separating different media. Updated results will be presented in the meeting.

S42C-0190 1330h POSTER

Examining tendencies of in-plane rupture to migrate to material interfaces

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Recent work indicated that rupture along a material interface has remarkable dynamic properties, which may be relevant to a number of geophysical problems, and that material interfaces are mechanically favoured locations for rupture propagation. Here we examine tendencies of 2D in-plane rupture to migrate spontaneously to material interfaces by performing a numerical parameter-space study in a model consisting of 3 media with 9 possible faults, 2 of which are material interfaces. The calculations employ a generalized version of the second-order finite-difference code used by Andrews (1973) and Andrews & Ben-Zion (1997). The faults are governed by Coulomb friction, and in some cases also Kelvin-Voigt viscosity. In general, a rupture along a material interface governed by Coulomb friction does not have a continuum limit (e.g., Adams, 1995; Ranjith & Rice, 2001). A Kelvin-Voigt viscosity provides regularization of the problem for a limited range of propagation distances and grid-refinements. Ruptures in our work are nucleated by a symmetric bilateral expanding pore pressure source, and may then continue to propagate (or not) along one or more faults. Using different nucleation locations (fault 1-9), different rheological parameters and initial stress, and different velocity contrasts, we examine the range of conditions for which ruptures migrate spontaneously to material interfaces and continue to propagate there in a self-sustaining manner.

S42C-0191 1330h POSTER

The Magnitude and Energy of Large Earthquakes

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Several magnitudes were introduced to quantify large earthquakes better and more comprehensive than M_s: M_W (moment magnitude; Kanamori, 1977), M_E (strain energy magnitude; Purcaru and Berckhemer, 1978), M_t (tsunami magnitude; Abe, 1979), M_m (mantle magnitude; Okal and Talandier, 1985), M_e (seismic energy magnitude; Choy and Boatwright, 1995). Although these magnitudes are still subject to different uncertainties, various kinds of earthquakes can now be better understood in terms or combinations of them. They can also be viewd as mappings of basic source parameters: seismic moment, strain energy, seismic energy, stress drop, under certain assumptions or constraints. We studied a set of about 90 large earthquakes (shallow and deeper) occurred in different tectonic regimes, with more reliable source parameters, and compared them in terms of the above magnitudes. We found large differences between the strain energy (mapped to M_E) and seismic energy (mapped to M_e), and between M_E of events with about the same M_w. This confirms that no 1-to-1 correspondence exists between these magnitudes (Purcaru, 2002). One major cause of differences for "normal" earthquakes is the level of the stress drop over asperities which release and partition the strain energy. We quantify the energetic balance of earthquakes in terms of strain energy E_{st} and its components (fracture (E_g), friction (E_f) and seismic (E_s) energy) using an extended Hamilton's principle. The earthquakes are thrust-interplate, strike slip, shallow in-slab, slow/tsunami, deep and continental. The (scaled) strain energy equation we derived is: $E_{st}/M_0 = (1+e(g,s))(E_s/M_0)$, $e(g,s) = E_g/E_s$, assuming complete stress drop, using the (static) stress drop variability, and that E_{st} and E_s are not in a 1-to-1 correspondence. With all uncertainties, our analysis reveal, for a given seismic moment, a large variation of earthquakes in terms of energies, even in the same seismic region. In view of these, for further understanding of earthquakes behaviour we introduce energy classes, and present first results.

S42C-0192 1330h POSTER

The Energetics of Gravity Driven Faulting

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Tectonic stress is reasonable attributed to gravity acting on the earth's density structures. The gravity collapse seismic mechanism assumes the earthquake fault fails and slips in direct response to the gravitational tectonic stress. Gravity collapse is simple but it involves some unusual energetics. In particular, gravitational potential energy is released from the stress-causing density structures. This energy is split between the seismic wave energy and an increase in locked-in elastic strain energy. In classic elastic rebound, the change in the locked-in elastic strain field drives slip on the fault. In gravity driven faulting, it stops slip on the fault. A change in gravitational potential energy implies a change in the density structure. The gravitational body force is directly dependent on density so a change in the density structure implies a change in the body force field. If the body force field changes, there must be volumetric body-force displacements. These are in addition to the displacements generated by slip on the fault surface. Their nature and significance remain largely unexplored. The gravity collapse mechanism provides a simple explanation for the occurrence of deep focus earthquakes in temperature/pressure environments that preclude the gradual accumulation of locked-in elastic strain energy. It also accounts for the dual-plane character of some Wadati-Benioff zones, post-seismic regional displacements that resemble the co-seismic regional displacements, and induced tectonic activity at a distance from the epicentral region. To the extent that tectonic stress originates from gravity acting on the Earth's density structures, the gravity collapse mechanism is fundamentally simple. It does not require the creation of a locked-in elastic strain field prior to the earthquake.

S42D MCC: Level 1 Thursday 1330h

Coda the Destroyer: Rupture Kinematics and Dynamics II Posters

(joint with T)

Presiding: **D Lavallee,** Institute for Crustal Studies**; A M Rubin,** Princeton University

S42D-0193 1330h POSTER

Rupture Propagation for Stochastic Fault Models

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The inversion of strong motion data of large earhquakes give the spatial distribution of pre-stress on the ruptured faults and it can be partially reproduced by stochastic models, but a fundamental question remains: how rupture propagates, constrained by the presence of spatial heterogeneity? For this purpose we investigate how the underlying random variables, that control the pre-stress spatial variability, condition the propagation of the rupture. Two stochastic models of prestress distributions are considered, respectively based on Cauchy and Gaussian random variables. The parameters of the two stochastic models have values corresponding to the slip distribution of the 1979 Imperial Valley earthquake. We use a finite difference code to simulate the spontaneous propagation of shear rupture on a flat fault in a 3D continuum elastic body. The friction law is the slip dependent friction law. The simulations show that the propagation of the rupture front is more complex, incoherent or snake-like for a prestress distribution based on Cauchy random variables. This may be related to the presence of a higher number of asperities in this case. These simulations suggest that directivity is stronger in the Cauchy scenario, compared to the smoother rupture of the Gauss scenario.

S42D-0194 1330h POSTER

Stochastic Model of Complexity in Earthquake Slip Distributions

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Finite-fault source inversions reveal the spatial complexity of earthquake slip or prestress distribution over the fault surface. The basic assumption of this study is that a stochastic model can reproduce the variability in amplitude and the long-range correlation of the slip spatial distribution. The model is tested for the 1992 Landers earthquake and the 1994 Northridge earthquake and the results are compared with the stochastic model derived for the 1979 Imperial Valley earthquake. For the three earthquakes, we show that the average power-spectra of the raw, i.e., non-interpolated, data follow a power law behavior with scaling exponents close to unity. For the three earthquakes, we have found that non-Gaussian distributions, i.e., the Levy distributions, are better suited to describe the spatial variability of slip over the fault. The values of the Levy parameters differ from one earthquake to the other. We discuss the variation in parameter values from one earthquake to another and its signification for earthquake properties. We also show that a stochastic characterization of the slip amplitude based on a Gaussian distribution fails to reproduce the spatial variability observed in the original slip distribution. Especially, the "extreme" large slip valuesfrequently defined as asperitiesare present in the synthetic slip amplitude based on a Levy distribution but are missing in their Gaussian counterpart. The results obtained for the Imperial Valley, Landers and Northridge earthquakes suggest that some features of the slip spatial complexity are universal and can be modeled accordingly. If this is proven correct, this will imply that the spatial variability and the long-range correlation of any slip or stress distribution can be described with the help of five parameters: a scaling exponent controlling the spatial correlation and the four parameters of the Levy distribution constraining the spatial variability.

S42D-0195 1330h POSTER

The dynamic rupture process of the 2001 Geiyo, Japan, earthquake

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Dynamic rupture simulation of the 2001 Geiyo earthquake (Mw = 6.7) was carried out based on the kinematic model. The space-time distribution of slip of the earthquake i.e., the kinematic mode, was investigated by inverting the nearfield strong ground motion data and teleseismic waveform data(Yagi and Kikuchi, 2001). Two asperities are identified. The rupture mainly propagated 20 km to the south. In constraint of the above source model, we have constructed a dynamic rupture model of the earthquake. In dynamic simulation, we used a fourth-order staggered-grid, finite-difference scheme to the three-dimensional equation of motion. Our scheme includes absorbing boundary conditions and the slip-weakening model on the fault plane. We assumed the slip weakening friction law. The initial model of the stress drop distribution was estimated by OkadaOs code imposing the kinematic slip distribution on the fault. Assuming the above stress drop, a uniform Dc and then kinematic rupture time distribution on the fault, dynamic simulation was carried out. The final slip, the rupture process, moment rate time function are used to adjust the dynamic parameters. The distribution of Dc was estimated by using peak value of inverted slip rate time function (Mikumo et.al., 2003). We applied this heterogeneous Dc model to dynamic simulation. The dynamic rupture with heterogeneous Dc distribution generate rupture history, final slip distribution, moment rate time function that approximately matched those determined by the kinematic inversion.

S42D-0196 1330h POSTER

3-D Dynamic Rupture Simulation of the 1995 Kobe Earthquake with a heterogeneous initial stress field

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The 16 January 1995 Kobe earthquake (Mw 6.9) occurred near the city of Kobe in western Japan, causing tremendous damage. We investigate the dynamic rupture process of the Kobe earthquake by spontaneous rupture modeling of a 3-D dynamic shear crack that reproduces the slip distribution found from kinematic waveform inversion of strong motion data. We find that using the heterogeneous initial stress field obtained from the static stress drop distribution computed from the kinematic slip model superimposed on a uniform final stress field successfully generates a dynamic model with a slip and rupture time distribution consistent with the kinematic source inversion. Large surface rupture was generated from high local stress drop of up to 50 bars beneath Awaji Island. Relatively small or negative stress drop with a large slip weakening distance beneath the city of Kobe might explain the lack of surface rupture in this area. Ide and Takeo (1997) suggest depth dependent slip weakening distances on the order of 0.5 - 1 m by analyzing the joint behavior of stress and slip inferred from their kinematic waveform inversion although they recognized that these values probably represent an upper bound. Although there are strong tradeoffs between the slip weakening distance and the yield stress (Guatteri and Spudich, 2000), our dynamic analysis with assumption of uniform yield stress just above the maximum initial stress indicates that the slip weakening distance, especially near the nucleation area, should be smaller (with an upper bound of 0.1 m) than the estimate of Ide and Takeo (1997) in order for rupture to propagate spontaneously.

S42D-0197 1330h POSTER

Grid Approach for Kinematic Source Inversion

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In seismic tomography for local parameterization of the spatial functions to be reconstructed (e.g., seismic velocities) there are two basic approaches: one is the block (cell) approach and the other is the grid approach. In the block approach the medium under study is divided into many blocks (cells) and the seismic velocity in every block is taken as unknown parameter. In the grid approach grid nodes are adopted to model the earth structure and velocities at the nodes are taken as unknown parameters; the velocity at any point in the model is calculated by interpolation from those at the nodes surrounding the point. In the grid method the velocity is continuous everywhere, while in the block method artificial velocity discontinuities are introduced into the model between the blocks. In kinematic source inversion the above two approaches, the block approach and the grid approach, can also be considered. The multi-time window linear inversion (e.g., Hartzell and Heaton, 1983) belongs to the block approach, which is now a most popular method and has been widely applied to broadband seismic records including teleseismic and strong-ground motion records to estimate spatio-temporal slip distribution on seismic fault planes of middle to large earthquakes. In this method the fault plane is conventionally divided into many subfaults (cells) to express spatial variation, and each subfault is represented by a single or many point sources placed at constant intervals on the planar surface. Such conventional subfault discretization corresponds to the block approach of seismic tomography, and it is not continuous at the subfault boundaries. Since this conventional subfault discretization is used by most existing methods for kinematic source inversion applied to waveform data, they may all be categorized into the block approach. One exception is Ide and Takeo's (1997, JGR) method, which belongs to the grid method. In their method the spatio-temporal distribution of slip velocity is expanded with the linear b-spline basis functions in 2D space as well as in time. This discretization can give a slip distribution continuous everywhere. In the present study we propose an extension of this grid method. Main extension is that the effect of the rupture propagation is included even under the sub-grid level by using the presentation of slip velocity with an explicit rupture propagation term, which has recently been exploited by Takenaka et al. (2002) for extracting spatially continuous slip distribution from results of conventional source inversion. Furthermore our method can also treat slip direction change on the fault plane unlike Ide and Takeo's original method. In the presentation we demonstrate the feasibility of our method by using simulation data.

S42D-0198 1330h POSTER

Estimating the Variations in the Finite-Fault Source Models Determined from Inversion of Ground Motion Data

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Although significant uncertainty is embodied in the source model deduced from the inversion of seismograms, it is unclear how much the uncertainty exists in practice. In general the uncertainty in the final solution can arises from every major element of the inversion procedure. This study primarily focuses on estimating the variation of finite fault solution induced by incomplete data set and by uncertainty in inversion process when the velocity structure is known. We apply a bootstrap statistical method to quantify this variation. The bootstrap method is a re-sampling procedure through which an arbitrarily large number of bootstrap data sets are generated from the original data. Having a bootstrap data set, we can determine a fault model. By statistically analyzing all the resulting solutions we can derive the variance and covariance of the best solution. To mitigate the large computational effort required by a global method to invert the data, a quasi-Newton method, based on the trust region algorithm, is used to invert the bootstrap data sets after the global inversion of the original data finds a starting model. As an application of this method we re-analyze the ground motion data from the 1989 Loma Prieta M 6.9.

S42D-0199 1330h POSTER

Numerical Study on Multi-Scaling Earthquake Rupture

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We develop a new numerical scheme using a renormalization and a 3Dboundary integral equation method in order to simulate a multi-scaling dynamic rupture. We are able to simulate how a small earthquake grows up to a large one in spatially heterogeneous field of fracture energy G_c or critical slip-weakening distance D_c. We test the case where D_c grows according to a hypocentral distance L ($D_c \propto L^{\beta}$). This permits rupture to start in the very microscopic scale. When $\beta = 1$, we succeed to numerically show that rupture propagates at a constant rupture speed in a uniform initial stress field. This result still keeps the scaling relation of G_c and D_c inferred for earthquake rupture, but infers that no scale-dependent initial process is required for all size of events. The break in the proportional relation between D_c and L ($\beta \neq 1$) requires to keep energy balance around the rupture front. As a result, we observe that rupture is accelerated up to a speed even faster than the shear wave velocity ($\beta < 1$) or that arrested ($\beta > 1$). These simulations implies that important is the relation $D_c \propto L$ for a self-similar rupture propagation (cascading rupture), a scale-independent constant rupture velocity, and scale-dependent fracture energy G_c.

S42D-0200 1330h POSTER

What can Rotational Measurements Teach us About Earthquake Rupture Histories?

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The general motion of a deformable body is uniquely specified by 3 components of displacement (those measured by classical seismometers), 6 components of strain, and 3 components of rotation. While it is standard to observe translational motions, and quite usual to measure strain, rotations had little attention, partly because rotational effects generated by earthquakes were thought to be small (e.g., Bouchon and Aki, 1982), and partly because no instruments existed which directly measured absolute rotations. Recently, there has been a revival of interest for rotations due to a growing body of observational evidence that, at least in some cases, rotational motions are indeed strong (Takeo and Ito, 1997, Takeo, 1998), while, at the same time, very precise instruments are becoming available. Here, we numerically study the effects of various kinematic scenarios on rotations. In some cases, the effects on rotations appear much more marked than those on translations, i.e., rupture histories with very similar translational seismograms show pronounced differences in the collocated rotational motions. This is the case, e.g., for a circular crack rupture with constant slip velocity on the one hand, and a more realistic inverse square root singularity Kostrov-like slip-velocity profile on the other hand. We also report effect on rotations of fault segmentation and variation of rupture velocity. We anticipate that taking into account rotational measurements will help constraining inversions of kinematic rupture histories.

S42D-0201 1330h POSTER

Efficient Numerical Procedure for Reduction of Computation Time in BIEM for Elastodynamic Analysis of Non-planar Faults

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Recent progress in boundary integral equation method (BIEM) have been enabled us to analyze dynamic rupture process on fully non-planar fault geometry, such as steps, bendings, and branchings, in 2D (Kame and Yamashita, 1999) and 3D (Aochi, Fukuyama and Matsu'ura 2000; Fukuyama, Tada and Shibazaki 2002, Eos Trans. AGU 83(47)). In space-time boundary integral formulations, the stress on the fault surface is represented in terms of the slip history on the fault surface only as $\tau(\mathbf{x},\mathbf{t}) = \tau^{\mathbf{0}}(\mathbf{x},\mathbf{t}) + \mathbf{f}(\mathbf{x},\mathbf{t}) - \mu/\mathbf{2c}\dot{\mathbf{V}}(\mathbf{x},\mathbf{t})$ where μ is the shear modulus, c is the shear wave speed, V is the slip rate, τ^0 is the loading stress, and f is a linear function of prior slip-rate over the causality cone. f is expressed as a double convolution integral in space and time. Evaluation of the convolution integrals is the most computationally demanding part of the elastodynamic analysis. In order to reduce computation time, a spectral representation of f in space has been derived for a planar fault and significant reduction has been made by using Fast Fourier Transform algorism for convolution in Fourier domain. It is, however, usually difficult to derive a similar spectral representation for non-planar faults. We thus turn our attention to convolution in time. Here we apply " truncation of convolution integrals" to the time-space BIEM in 2D in-plane problem. This is originally introduced to 2D anti-plane spectral formulation by Lapusta et al.(2000) for a relatively slow process where the effect of wave is relatively small. The principle is very simple: We truncate the convolution integrals in time and replace the stress contribution from the rest of causality cone with the static one due to the accumulated slip, i.e., slip rate summed up inside the rest of the cone. For numerical implementation, we combine dynamic scheme with static scheme. We try to choose truncation time L as short as possible without much loss of the dynamic stress contribution, where we always assume L is smaller than the total time step N in computation. For a large time step N, computation time is expected to decrease from $N*N$ to $N*L$. The methodology can be readily extended to 3D BIEM without any modifications. Preliminary examples of the application of truncation will be shown. First dynamic rupture with several prescribed speeds is simulated on a planar fault both by the truncated convolution and by the full convolution. The result shows the amount of truncation time allowed in the simulation and the corresponding reduction time in computation. The truncation method will be tested in continuing simulations that require very fine cell size, e.g., rupture with high sub-Rayleigh speeds. For a precise representation of the wave-field around rupture front at that speed, we will make the

S

cell size about to 1/20 of the size that slip-weakening zone would have in very low-speed rupture.

S42E MCC: Level 1 Thursday 1330h

Magnum Force: Earthquake Source Posters *(joint with T)*

Presiding: **P Reasenberg,** U.S. Geological Survey**; J N Louie,** Nevada Seismological Laboratory, Mackay School of Mines

S42E-0202 1330h POSTER

Seismic Moment From Regional Surface Wave Amplitudes of Recent and Historic Earthquakes

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Accurate, consistent earthquake size estimates are important for seismic hazard assessment. In central Europe, seismic activity is low and long-term seismicity, available as intensities from written historical records, has to be incorporated for meaningful assessments. We determined the seismic moment M_o of 25 stronger 20^{th}-century earthquakes in Switzerland from surface wave amplitude measurements; these 25 events link the instrumental with pre-instrumental data and can be used to calibrate intensity-moment relations. We derived our amplitude-moment relation using digital regional data from 18 earthquakes in and near Switzerland for which we had obtained M_o estimates from regional moment tensor analysis. The surface wave amplitude measurements were carried out at empirically determined, distance dependent dominant reference periods T_Δ. The distance attenuation term of the standard surface wave magnitude (M_S) relation $S(\Delta) = log\,(A/T)_{max} + 1.66\,log\Delta$ is distance independent for maximum amplitudes measured at periods T_Δ. Assuming a linear relation between $log\,M_o$ and M_S, we obtain $log\,M_o = S(\Delta) + 21.90$ for the digital data. Uncertainties of ±0.3 for the 21.90-constant term translate into M_o uncertainties of a factor of 2, which were verified with an additional, independent data-set. Our relation allows fast, direct M_o estimation for current earthquakes and, after re-calibration of the constant, can be applied in other regions of the World. We applied our relation to analog seismograms of 25 early-instrumental earthquakes in Switzerland. The analog data, recorded on mechanical and electromagnetic seismographs, were collected from several European observatories. Amplitude measurements from scans were performed at large amplifications on a computer screen and corrected for differences between T_Δ and the actual measurement periods. The resulting size estimates range from moment magnitude $M_w = 4.5$ to 5.8. The $M_w = 5.8$ 1946 event was the largest earthquake in Switzerland during the 20^{th}-century. Uncertainties for the early-instrumental events are on the order of 0.4 magnitude units.

S42E-0203 1330h POSTER

On the Characterisation of a PGA Virtual Distribution of Historical Earthquakes.

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The proposed procedure is aimed at the characterization of a virtual PGA distribution of historical earthquakes occurred in a given seismogenic zone, with respect to a macroseismic approach by which some significant parameters of the earthquakes, as epicentre, strike, felt area, magnitude are analytically deduced with a vectorial characterisation of macroseismic intensity. A geometric representation of a PGA virtual distribution, depicted through ellipses that have centres coinciding with the calculated epicentre of the earthquake and envelope the homonymous points of PGA, represents an important reference for seismic hazard studies and allows a configuration of different levels of seismic vulnerability within a damage scenarios characterisation. A comparison of the PGA and intensity virtual distributions (Teramo et al., 1998) of a same earthquake allows moreover a verification between the damage level depicted for a given intensity level and the corresponding PGA value, that is particularly important within seismic studies of monumental and historical buildings damaged from earthquakes.

S42E-0204 1330h POSTER

DETERMINATION OF THE RUPTURE PLANE FOR SMALL EARTHQUAKES RECORDED BY LOCAL NETWORKS.

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A correct determination of the rupture plane of an earthquake is quite important for seismotectonic studies, particularly for regions, such as northern Baja California, where in many places recorded earthquakes are both small and few. For large earthquakes the rupture plane is readily determined from the aftershock spatial distribution or by fitting observed and synthetic seismograms; but when there are not enough well-located aftershocks and the event is small and, therefore, recorded locally so that there is a large influence of the local structure (including lateral heterogeneity) and site effects on the dominant high frequencies in the seismograms, the above mentioned techniques do not work. In these cases, fault plane solutions from first motion polarity and a (double couple) point source model give two nodal planes among which it is not possible to distinguish the fault plane from the auxiliary one. For a dense network operated in northern Baja California, we found that it is possible to identify the rupture plane from the Doppler effect produced by directivity. We first tried this technique on a ML = 3.6 event that occurred near the NW end of the San Miguel fault some 4km from the Vallecitos fault. For this event, directivity clearly shows the rupture propagating in a NE-SW direction roughly perpendicular to the NW-SE orientation of the nearby large faults. The technique was then applied to sample earthquakes of some of the seismicity patches in northern Baja California, where recorded earthquakes are small and epicenters do not conform to documented faults or to regional seismicity patterns. The tectonics implications of the results are discussed in detail.

S42E-0205 1330h POSTER

Ambiguous Source Radiation in Anisotropic Media and Consequences for the Interpretation of Earthquakes Mechanisms

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Anisotropic material properties are usually neglected during inversions for earthquake source parameters using conventional methods. Here we investigate the effects of homogeneous and heterogeneous anisotropy within the source region on the radiated wavefield. Based on formulations for the moment tensor and the Green's function in anisotropic media, we find that anisotropy can greatly influence the radiation pattern. For example, apparent non-double-couple components can be produced for pure shear sources when the axes of anisotropic symmetry are oriented arbitrarily with respect to the fault plane. The direction of slip on the fault may affect the total seismic moment, which is in contrast to the isotropic case. Furthermore, similar moment tensors can be created by either pure shear or tensile faulting in anisotropic host media, if the fault plane is generally oriented. When anisotropy in the source region is not accounted for, erroneous conclusions regarding the source mechanisms may be drawn. We find that the source mechanisms infered from synthetic radiation patterns for pure shear sources in anisotropic media may show characteristics which are similar to those deduced in recent studies on microearthquakes. However, the latter have been interpreted to show evidence of tensile faulting under the assumption of an isotropic host medium.

S42E-0206 1330h POSTER

Surface-wave Derived Focal Mechanisms in Mid-America

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In regions of low-to-moderate seismic activity, quantitative estimates of source size and faulting mechanism are important for definition of regional tectonics and for notification of the public. This task is challenging because the lack of low-frequency signal content, often due to a low signal-to-noise ratio, precludes the use of standard waveform inversion techniques, which would require detailed path-dependent velocity models to describe the high-frequency waveforms. Surface-wave spectral amplitudes, chosen using an expected Love- and Rayleigh-wave group velocity can be used to determine the source depth, seismic moment and to provide four candidate focal mechanisms from which the final solution is selected using the few waveforms with good signal-to-noise. The advantage of fitting the surface-wave spectral amplitudes is that the source parameter estimates are much less sensitive to the details of the Earth model than are time-domain waveforms. We have successfully determine source for moment magnitudes as small as 3.9 for mid-America and 3.4 elsewhere. As a result of determining focal mechanisms for 8 recent earthquakes, details of automatic processing will be presented.

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Moment Tensor Summation in the Mediterranean Area Revisited: Comparison Between CMT and non-CMT Mechanisms Catalogs

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The analysis of focal mechanisms of the earthquakes is routinely carried out in all seismotectonic studies. For the Mediterranean area, a recently published database (EMMA) of checked first-motion focal mechanisms available from the literature allows to extend back in time, and to a lower magnitude threshold the data coverage of CMT and RCMT on-line catalogs (Harvard Seismology, Istituto Nazionale di Geofisica e Vulcanologia and Eidgenössische Technische Hochschule). On a regular grid with mesh of one degree, we mapped the behavior of cumulative moment tensor in terms of both equivalent mechanism and horizontal projections of P and T axes. We correlate the patterns resulting from CMT catalogs and EMMA database to verify the ability of the formers to well describe the seismic deformation in this area. We also analyzed the completeness of different datasets comparing their cumulative scalar moment release (seismic flux) with those resulting from the ISC and PDE catalogs. The contribution of EMMA database is found to be particularly significant in areas characterized by low or moderate seismicity.

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Surface-Wave Focal Mechanism of the 30 March 2003 Yellow-Sea Earthquake Event

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