Short Note

Residual offset-to-angle .....

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INTRODUCTION

Migration velocity analysis strongly relies on the analysis of the curvature of the reflectors in angle-domain common-image gathers (ADCIG). Unfortunately, because of uneven sampling of the wavefields, after transformation from the subsurface-offset domain image gathers (ODCIG) (Prucha et al., 2000; Sava and Fomel, 2000), ADCIGs can show curved events which can mislead migration velocity interpretation.

Motivated by the work of (**?**), here I propose a method to attenuate undesirable kinematic artifacts in angle-domain common-image gathers (ADCIG) which have their origin in badly sampled receiver or source wavefields. The most direct application of the method is to pre-process ADCIGs prior to migration velocity analysis, in such a way that the remaining curved events are only related to incorrect migration velocities. This method along with illumination compensation **citeguerra** are cheap ways to produce reasonable ADCIGs if compared to least-squares inversion (Prucha et al., 2000; Valenciano, 2006).

Numerical results show the bla,bla,bla....

BADLY SAMPLED RECEIVER WAVEFIELD

In a locally-constant velocity media, the source-wavefield is represented by the semi-circle

$$(x - x_s)^2 + z^2 = z_m^2 + (x_m - x_s)^2, \tag{1}$$

where x_s is the horizontal shot coordinate and (x_m, z_m) are the coordinates of the image point. Similarly, the receiver-wavefield is the semi-circle given by

$$(x - x_r)^2 + z^2 = z_m^2 + (x_r - x_m)^2, \tag{2}$$

where x_r is the horizontal receiver coordinate. To derive the analytical formula of the image in a ODCIG, $I(z, x, h_x)$, we must apply the multi-offset imaging condition

$$I(z, x, h_x) = \sum_{\omega} D^*(z, x - h_x, \omega) U(z, x + h_x, \omega), \tag{3}$$

where D is the downward is the source-wavefield, U is the receiver-wavefield, ω is frequency, h_x is the subsurface-offset. This means to evaluate equations 1 and 2 at different subsurface-offsets. So, equations 1 and 2 reads:

$$(x-h_x-x_s)^2+z^2=z_m^2+(x_m-x_s)^2 \tag{4}$$

and

$$(x+h_x-x_r)^2+z^2=z_m^2+(x_r-x_m)^2. \tag{5}$$

By summing these equations and taking into account that the image is formed when $x=x_m$, we get the following relation between depth and subsurface-offset at the image coordinate x_m:

$$z=\sqrt{z_m^2-h_x^2+h_x(x_r-x_s)}. \tag{6}$$

The computation of the ADCIG, Q, from the ODCIG, P,can be viewed as a process in which we compute (a) the derivative of z with respect to h_x evaluated at $h_x^\star$, where the slanted-path operator is tangent to z, obtaining the tangent of the reflection angle, γ, and (b) the depth, z_0, at which the slanted-path intersects the depth axis; and place at $Q(\gamma,z_0)$ the amplitude collected at $P(h_x,z)$. The derivative $\frac{dz}{dh_x}$ of the equation 5 is

$$\frac{dz}{dh_x}=\tan(\gamma)=\frac{x_r-x_s-2h_x}{2z}. \tag{7}$$

The depth, z_0, in the angle gather is given by

$$z_0=z-h\tan(\gamma). \tag{8}$$

Substituting the value for h_x from the equation 7 in equation 6 we get, after some manipulation:

$$z=\sqrt{z_m^2+\frac{(x_r-x_s)^2}{4}}\cos(\gamma). \tag{9}$$

The slope at $h_x=0$ is the tangent of the reflection angle, γ_0, at the image point, $I(z_m,x_m)$, correspondent to the considered source-receiver pair. From this we get:

$$\tan(\gamma_0)=\frac{x_r-x_s}{2z_m}. \tag{10}$$

From equation 10 and 9, z assumes the form

$$z=z_m\sqrt{1+\tan^2(\gamma_0)}\cos(\gamma)=z_m(\sec(\gamma_0)\cos(\gamma)). \tag{11}$$

According to equations 7, 10 and 11, h_x can be recast as

$$h_x=z_m(\tan(\gamma_0)-\sec(\gamma_0)\sin(\gamma)). \tag{12}$$

Finally, substituting equations 11 and 12 in the equation 8 we get

$$z_0=z_m(\sec(\gamma_0)\sec(\gamma)-\tan(\gamma_0)\tan(\gamma)). \tag{13}$$

Equation 13 if applied to the ADCIG resulting from the transformation to angle of the ODCIG given by equation 6 will focus the smeared energy at the point (γ_0,z_m) correspondent to the correct position of the ADCIG from a well-sampled receiver wavefield.

Figure 1, Figure 2, Figure 3. .

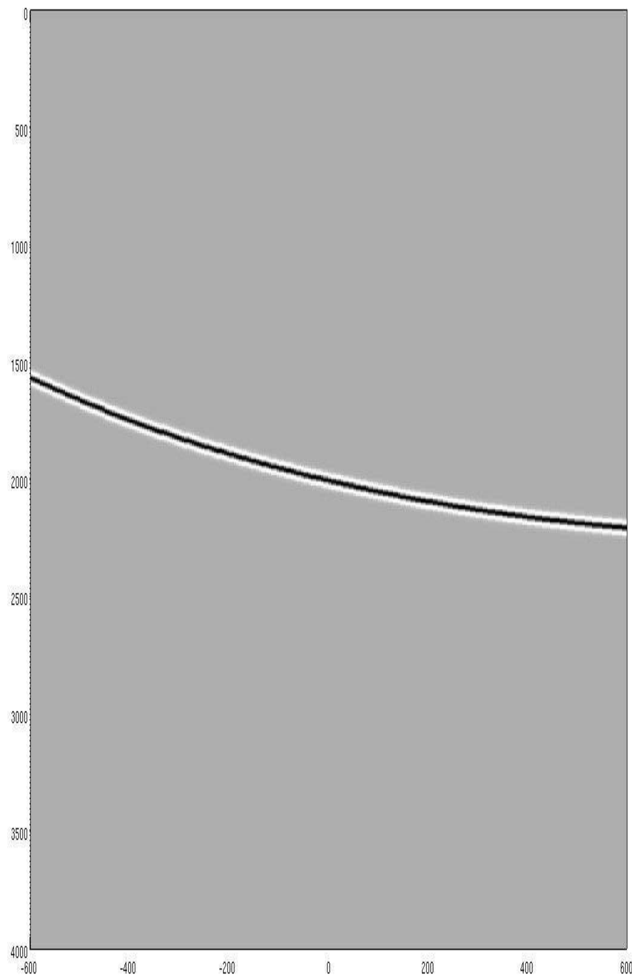

Figure 1: ODCIG badly sampled. odcig_bad [ER]

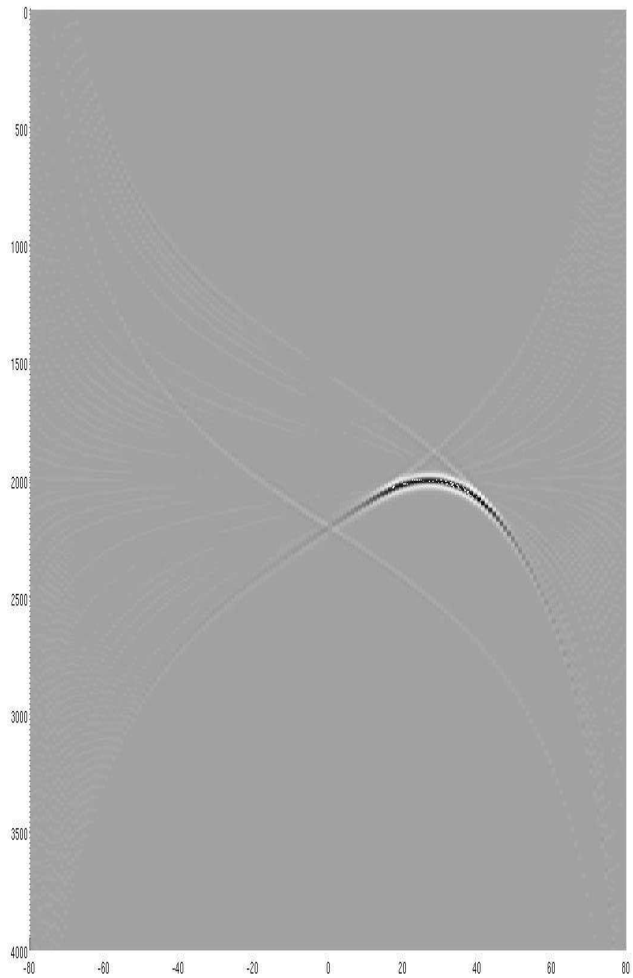

Figure 2: ADCIG resulting from the OFF2ANG of the ODCIG from Figure 1. adcig_bad [ER]

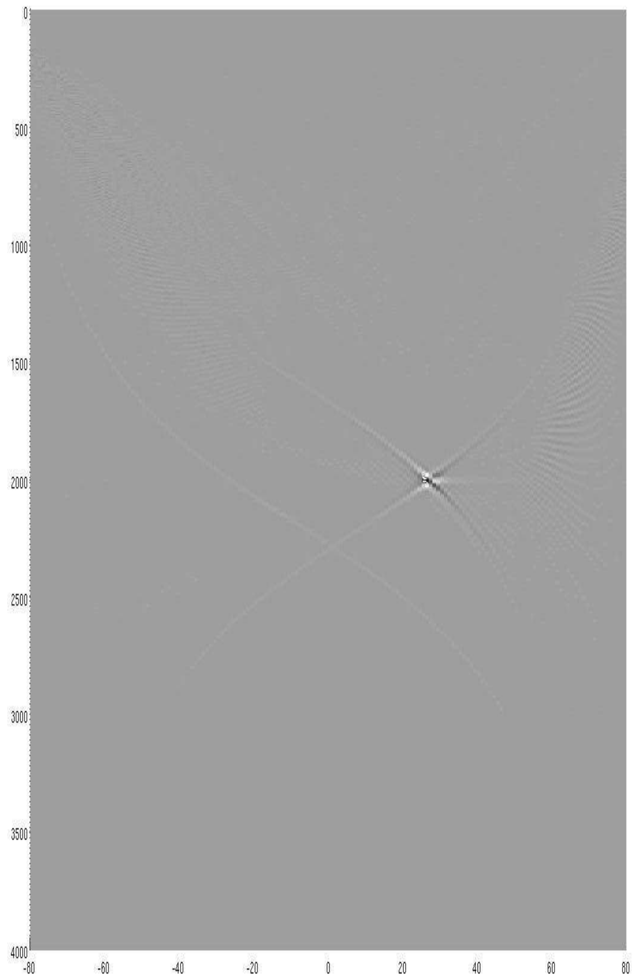

Figure 3: ADCIG resulting from the residual correction of the ADCIG from Figure 2 adcig2_bad [ER]

REFERENCES

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