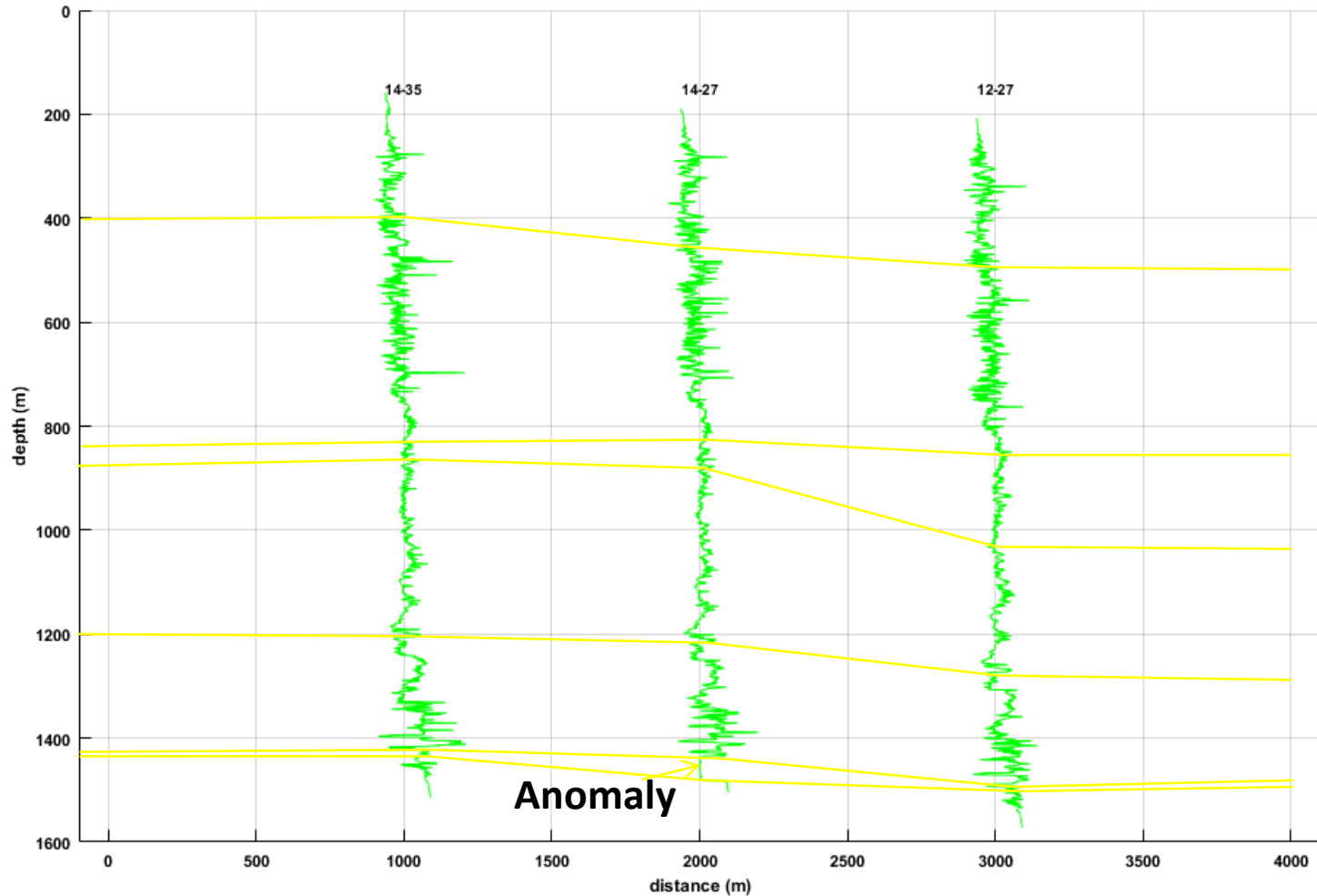


# A finite difference model for Hussar from interpolated well logs

Gary Margrave

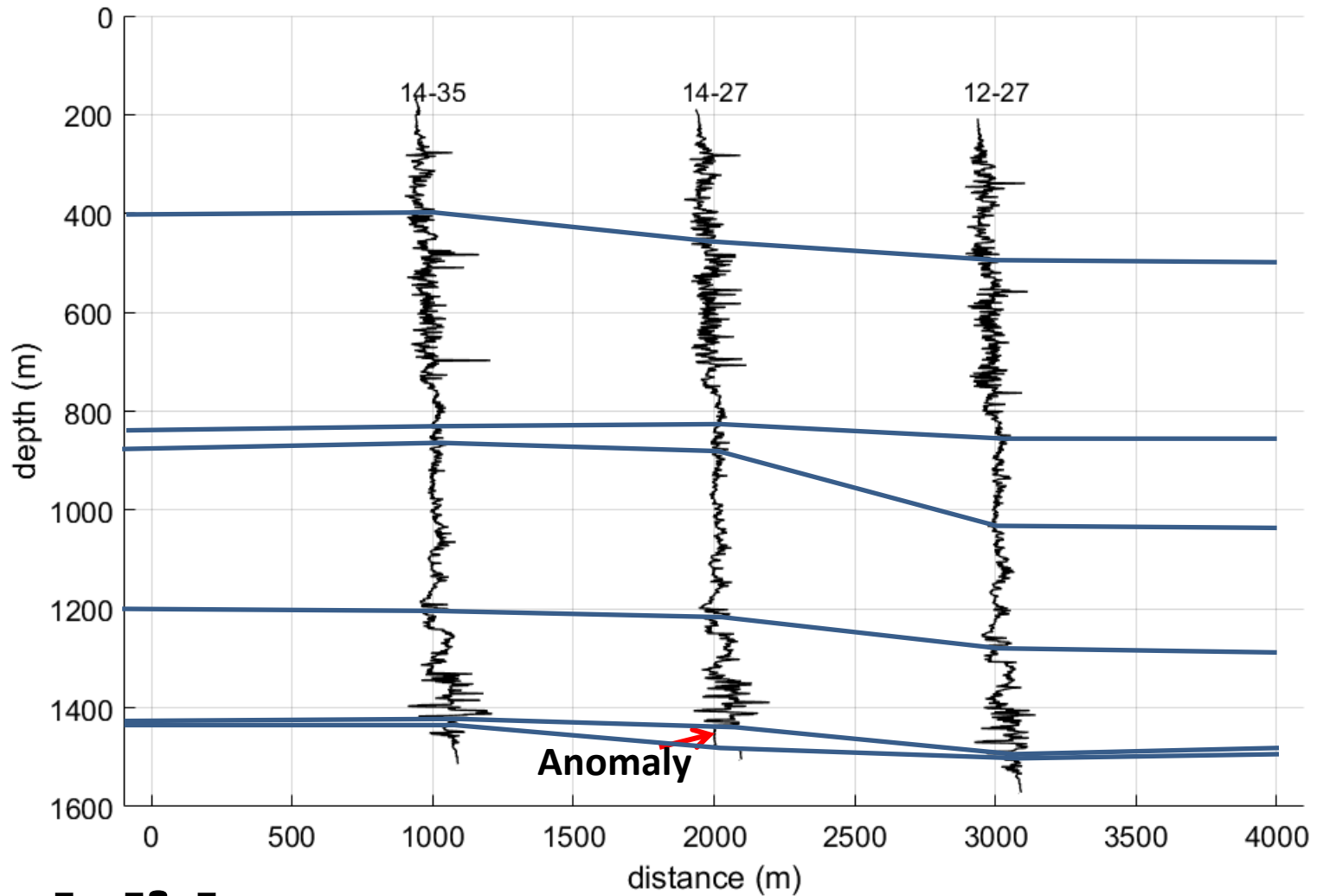
# Hussar sonic log section

horizons defined by formation tops



# Hussar sonic log section

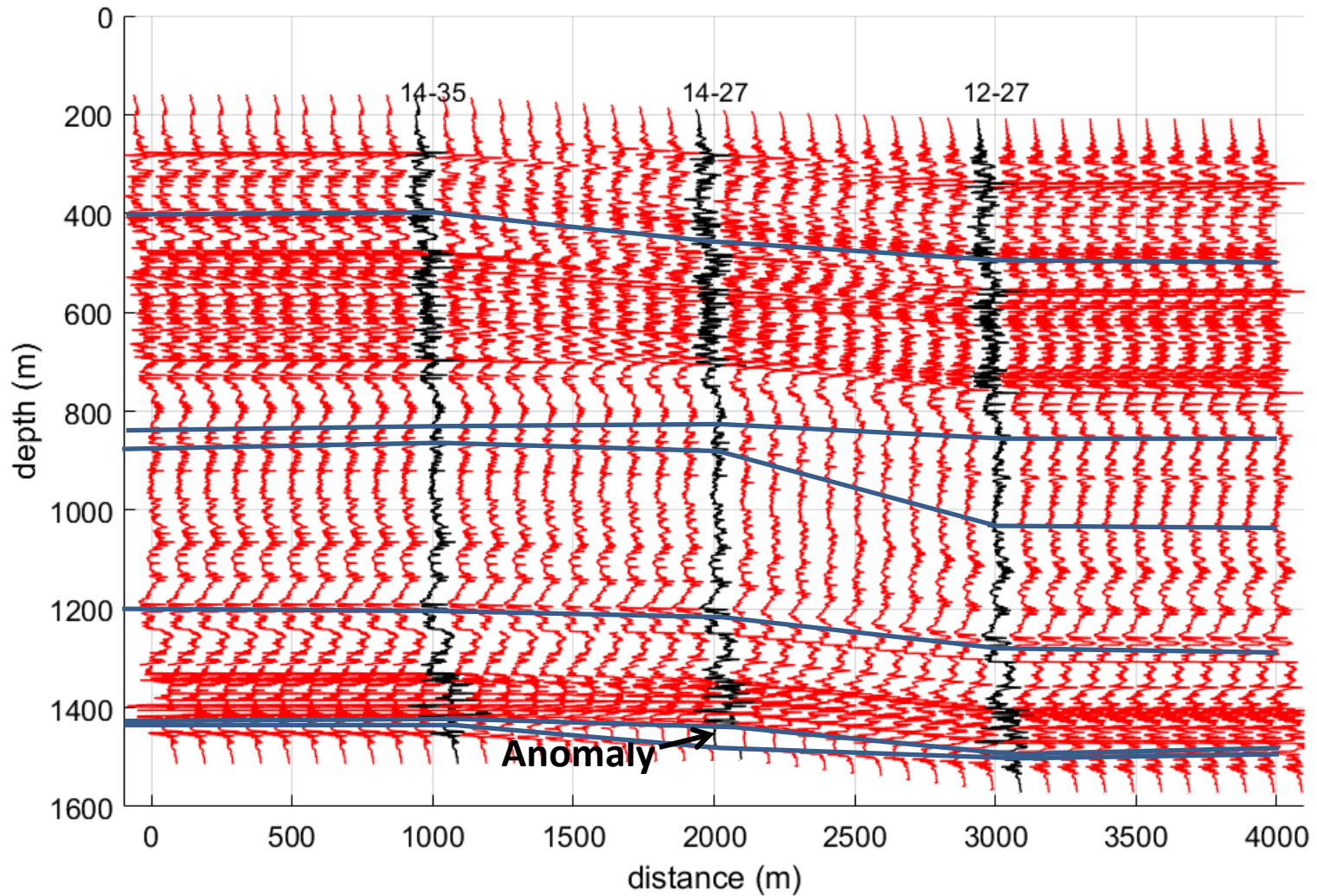
horizons defined by formation tops



**Good slide**

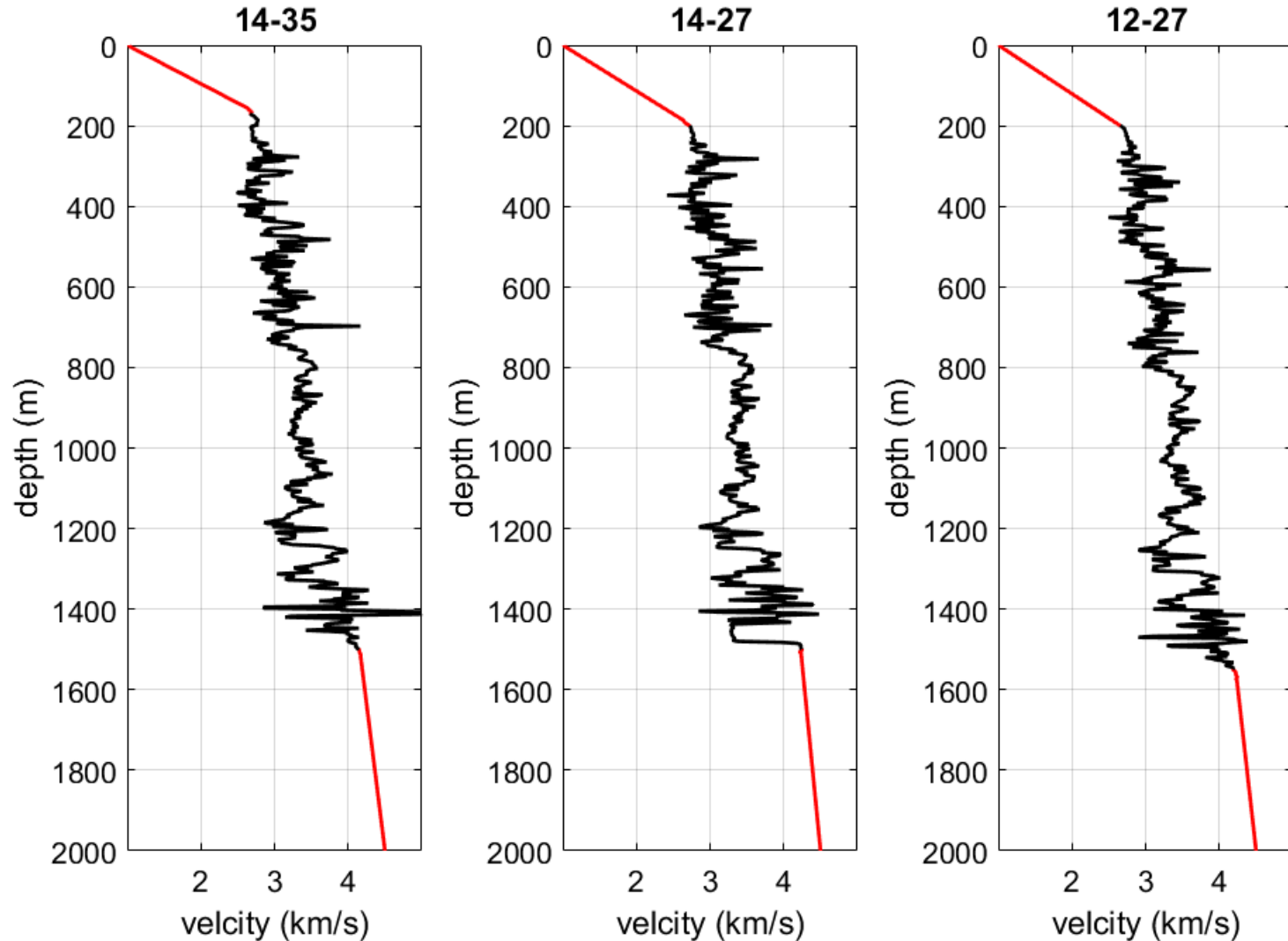
# Hussar sonic log section

Logs interpolated along horizons every 100m



# Hussar sonic log section

## Overburden and underburden

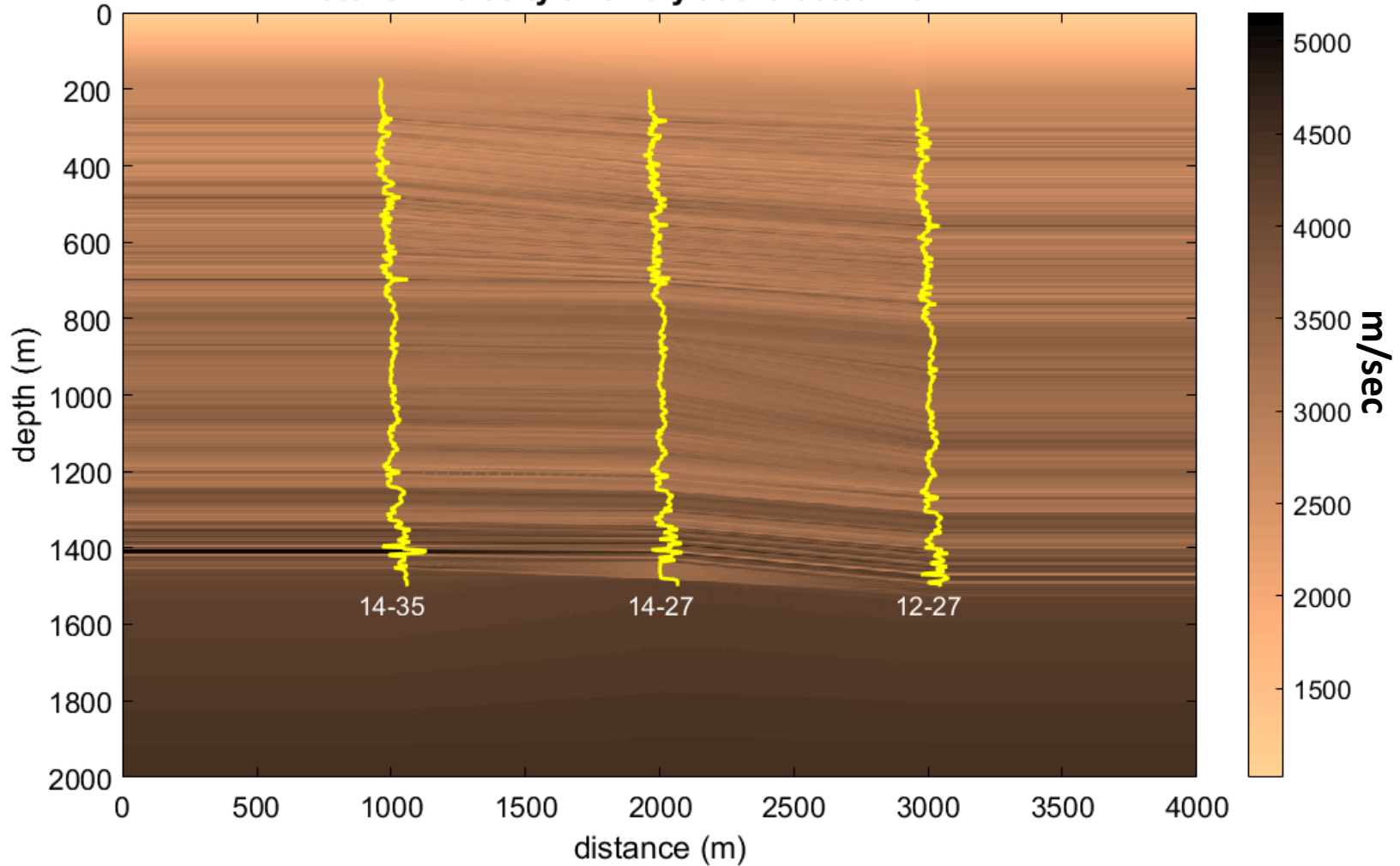


# Final Velocity section

grid:  $\Delta x = \Delta z = 2.5\text{m}$

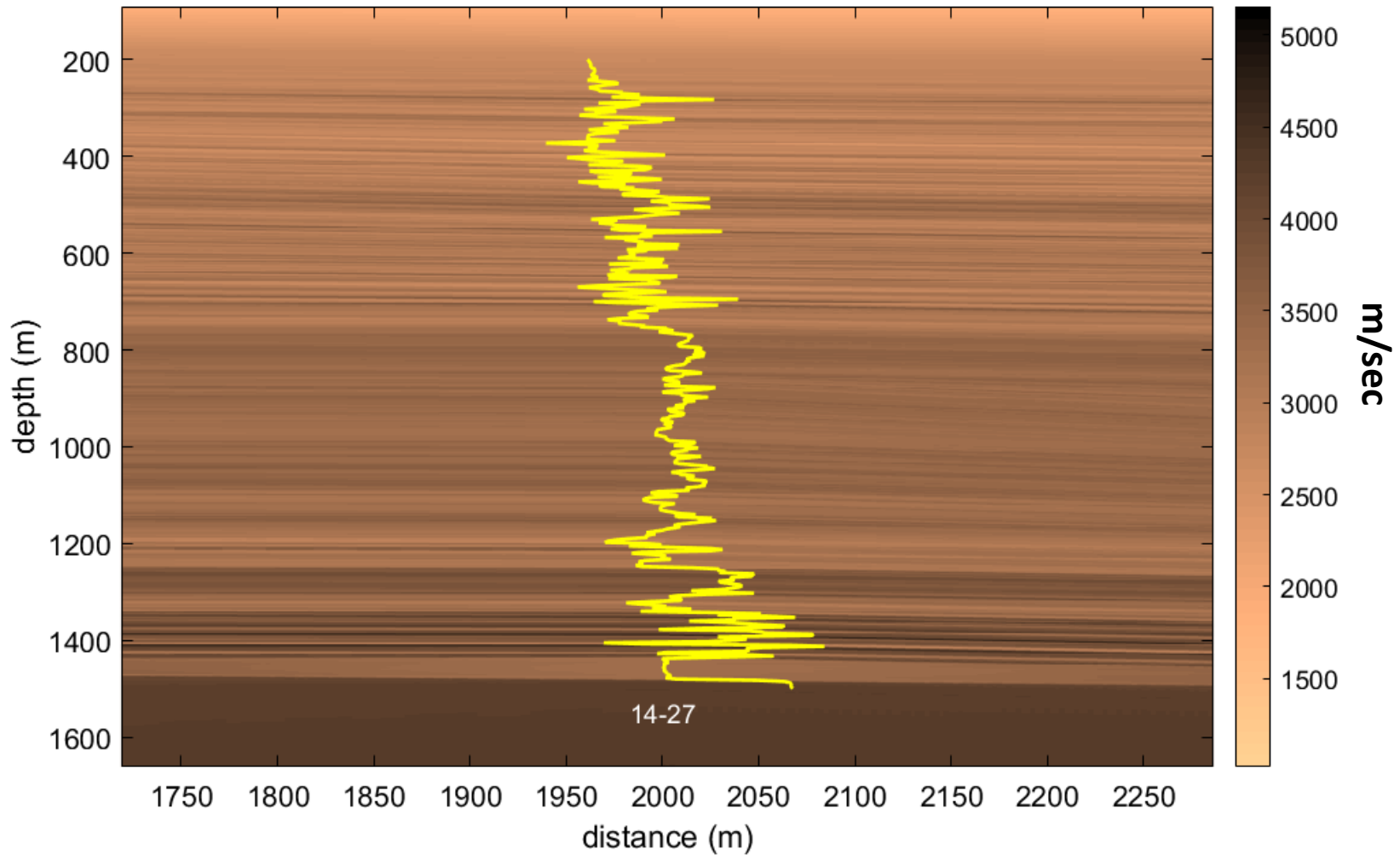
Hussar Velocity Model

Note low velocity anomaly at the bottom of 14-27

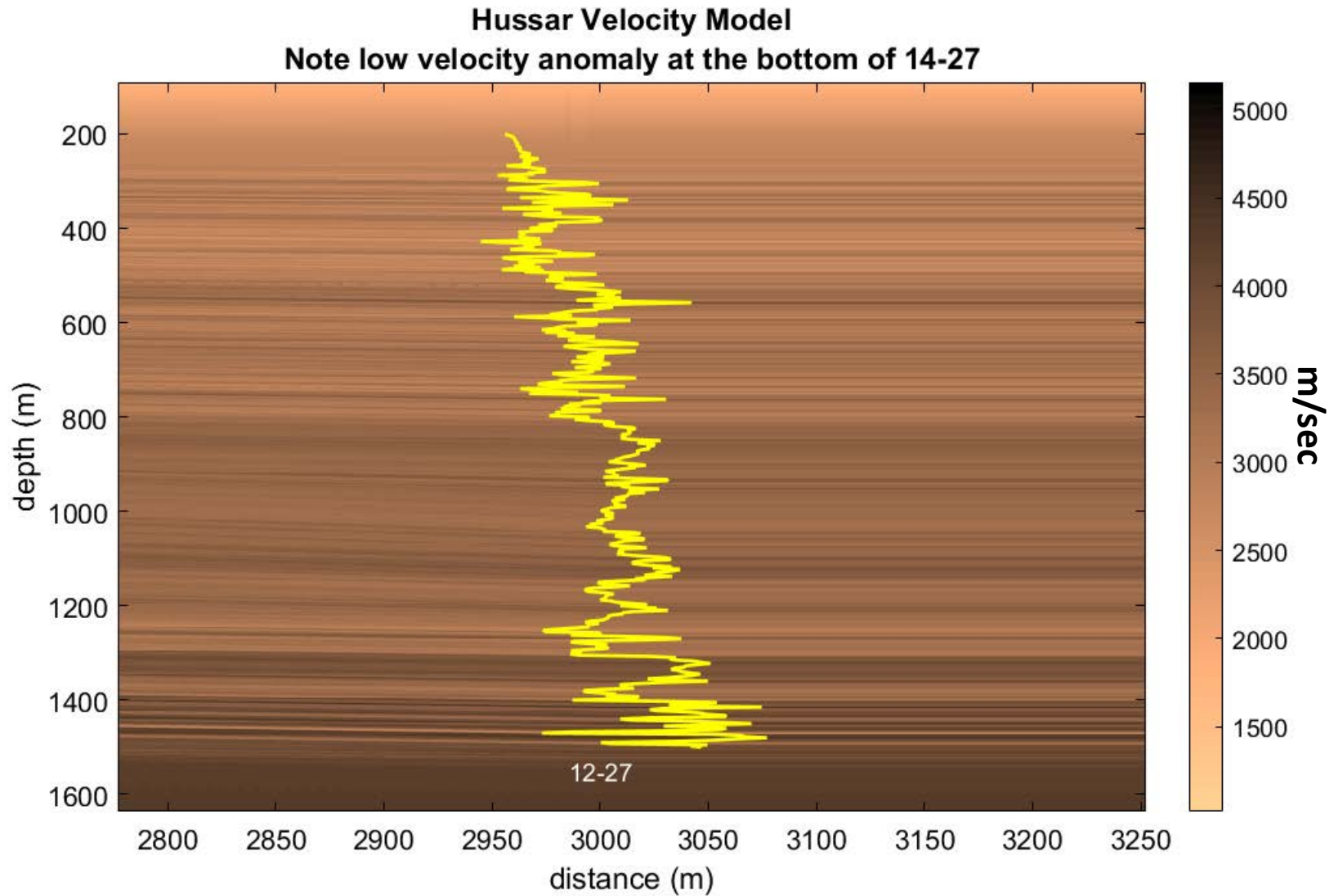


# Detail near 14-27

Hussar Velocity Model  
Note low velocity anomaly at the bottom of 14-27



# Detail near 12-27



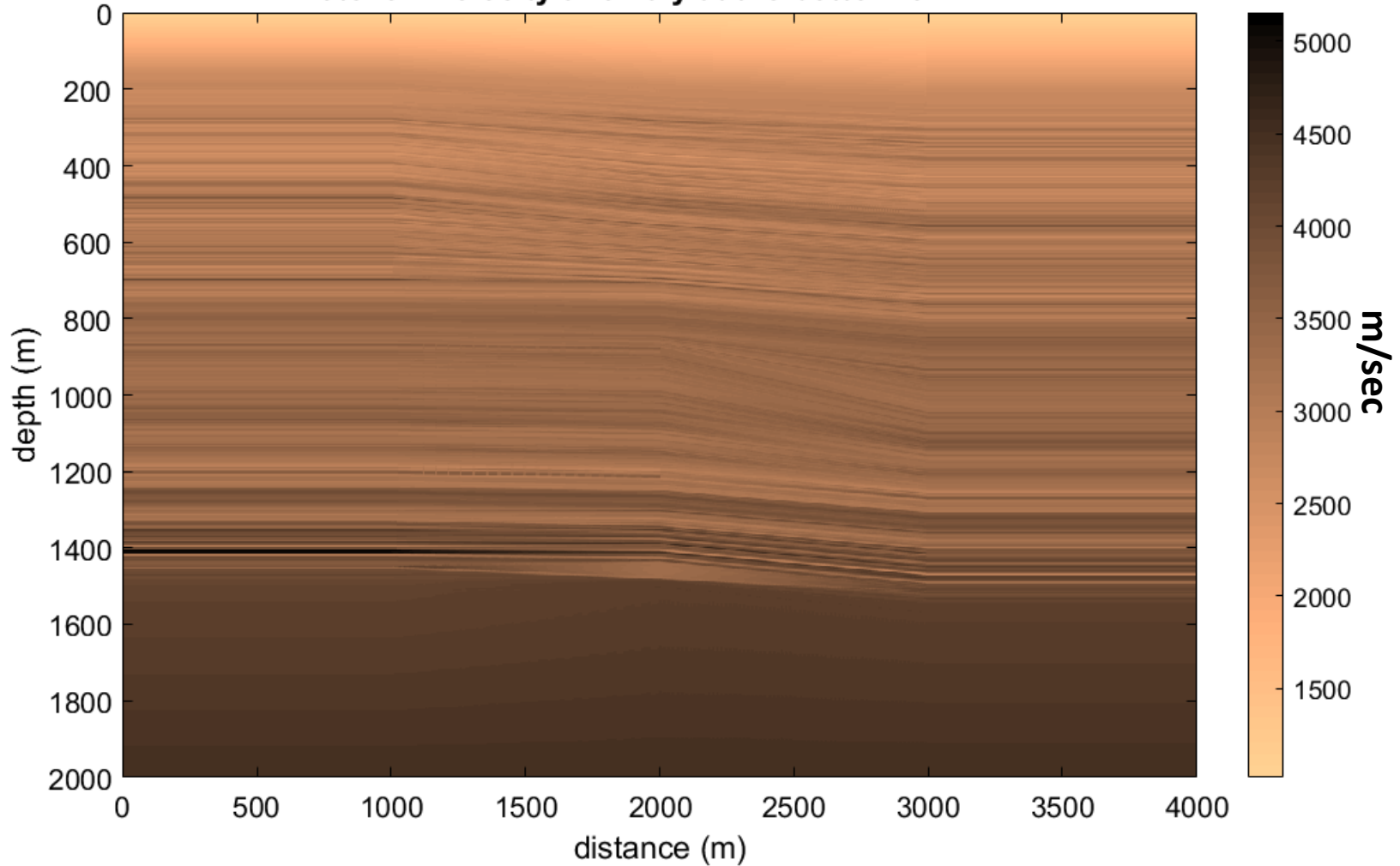


# Final Velocity section

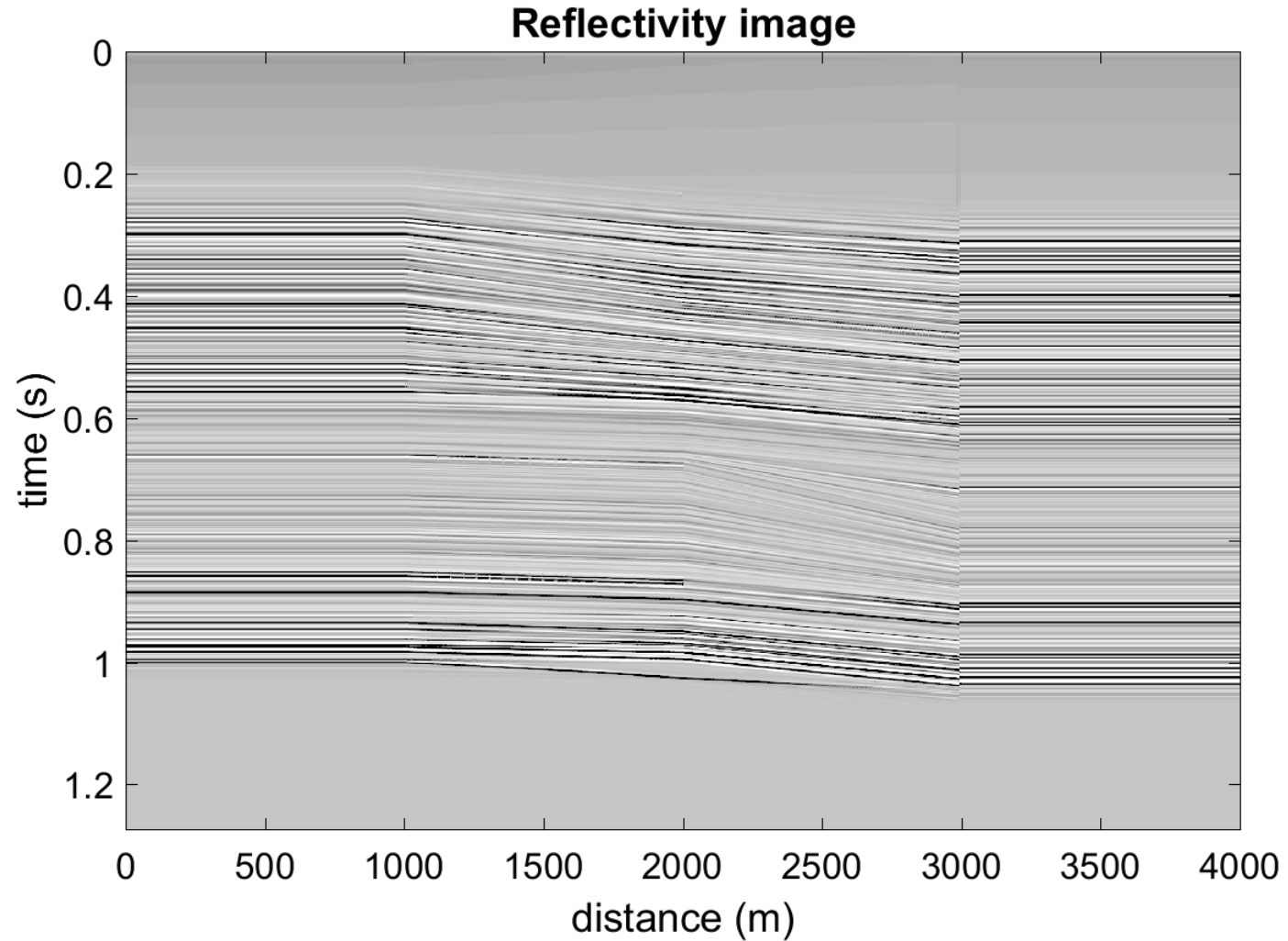
grid:  $\Delta x = \Delta z = 2.5\text{m}$

Hussar Velocity Model

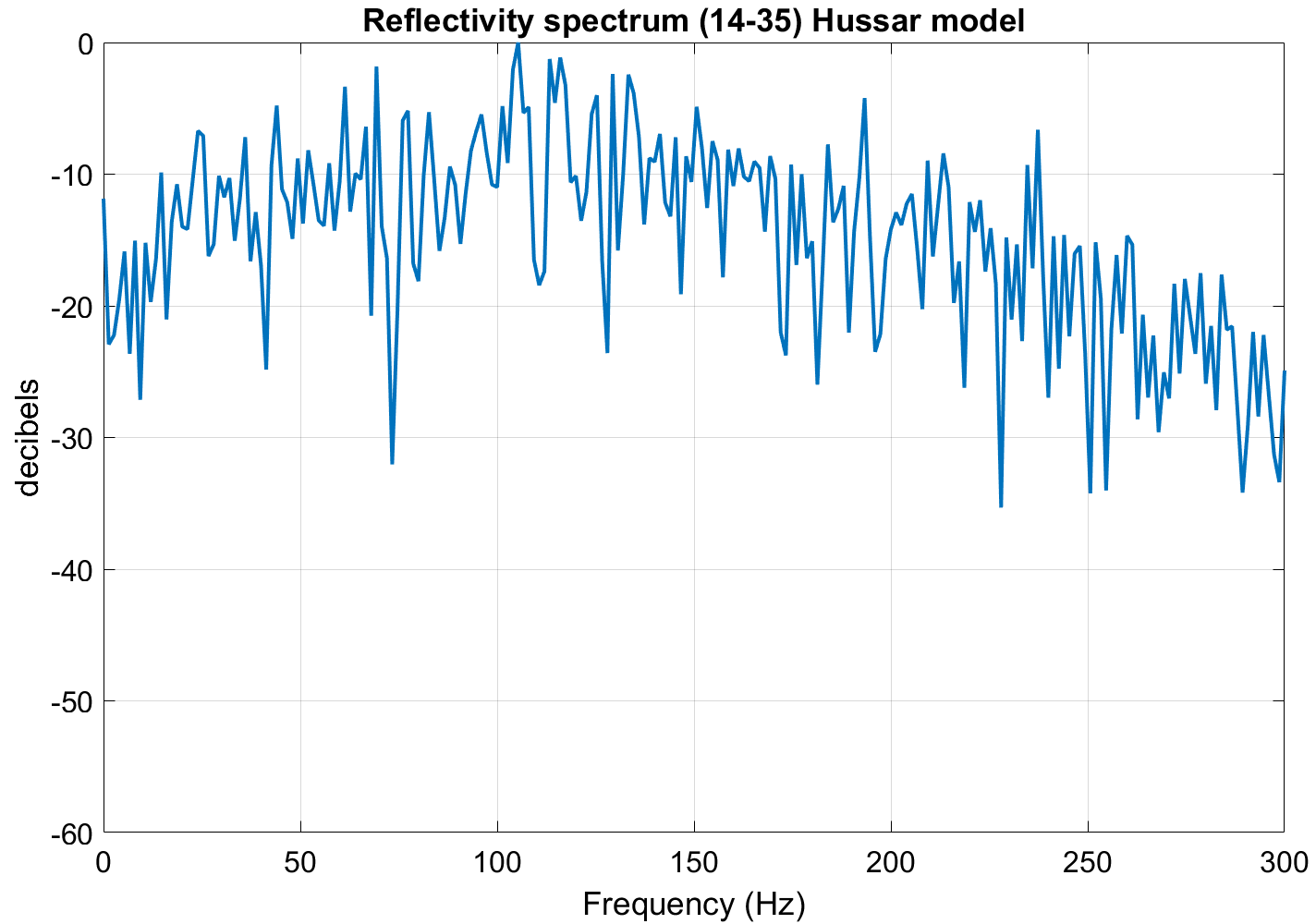
Note low velocity anomaly at the bottom of 14-27



# Reflectivity section



# Reflectivity spectrum



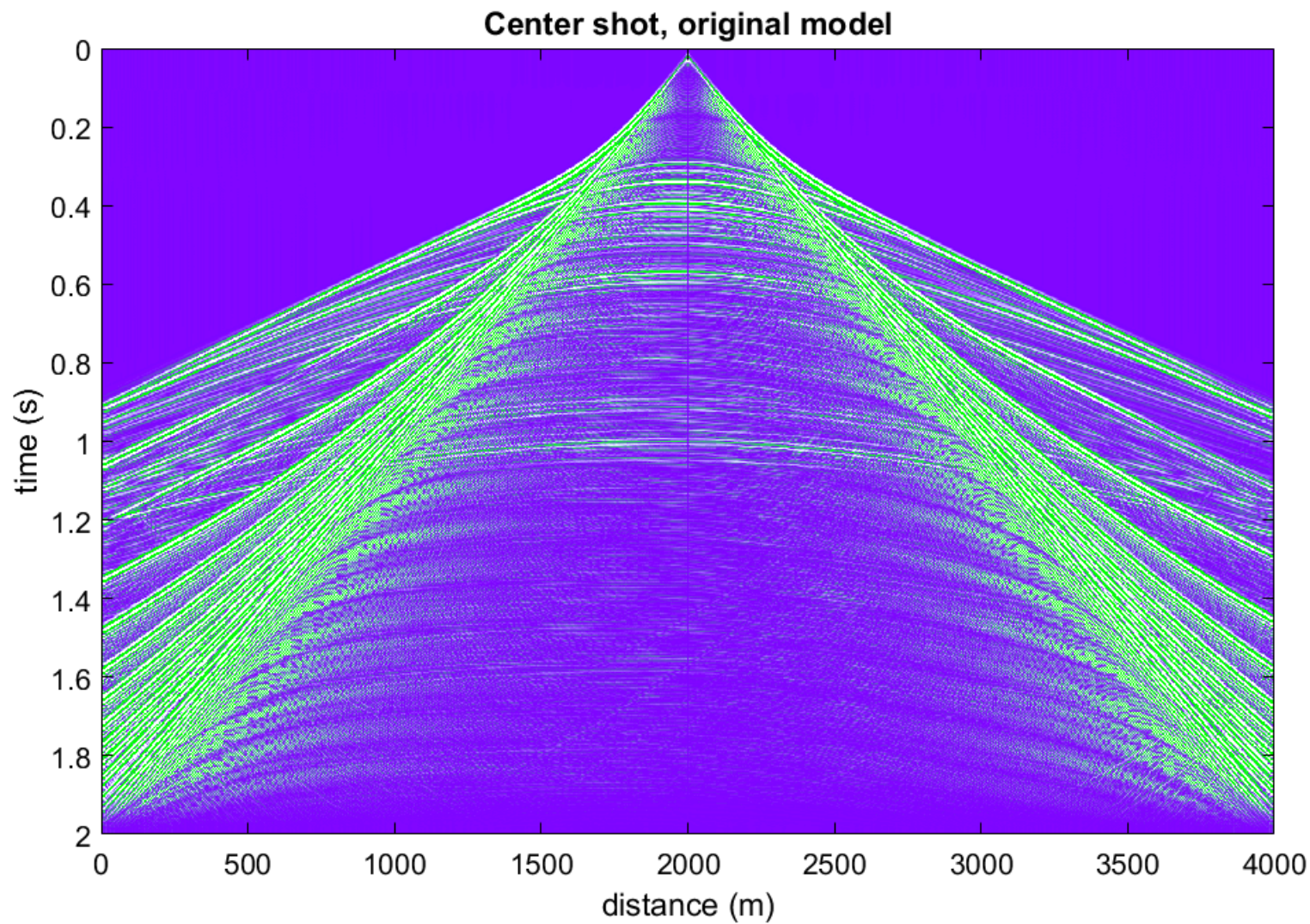
# Finite difference modelling

```
nshots=61; %number of shots
xshots=linspace(0,4000,nshots); %shot locations
zshot=0; %shots at zero depth
shots=cell(1,nshots); %cell array to store shots
dt=.002; %output time sample rate (s)
tmax=2; %trace length (s)
dx=2.5; %grid size (m)
dtstep=.00025; %time stepping size (s)
fdom=50; %wavelet dominant frequency
[w,tw]=wavemin(dtstep,fdom,tmax); %minimum phase wavelet
xrec=x; %a receiver every grid point
zrec=zeros(size(xrec)); %receivers at zero depth

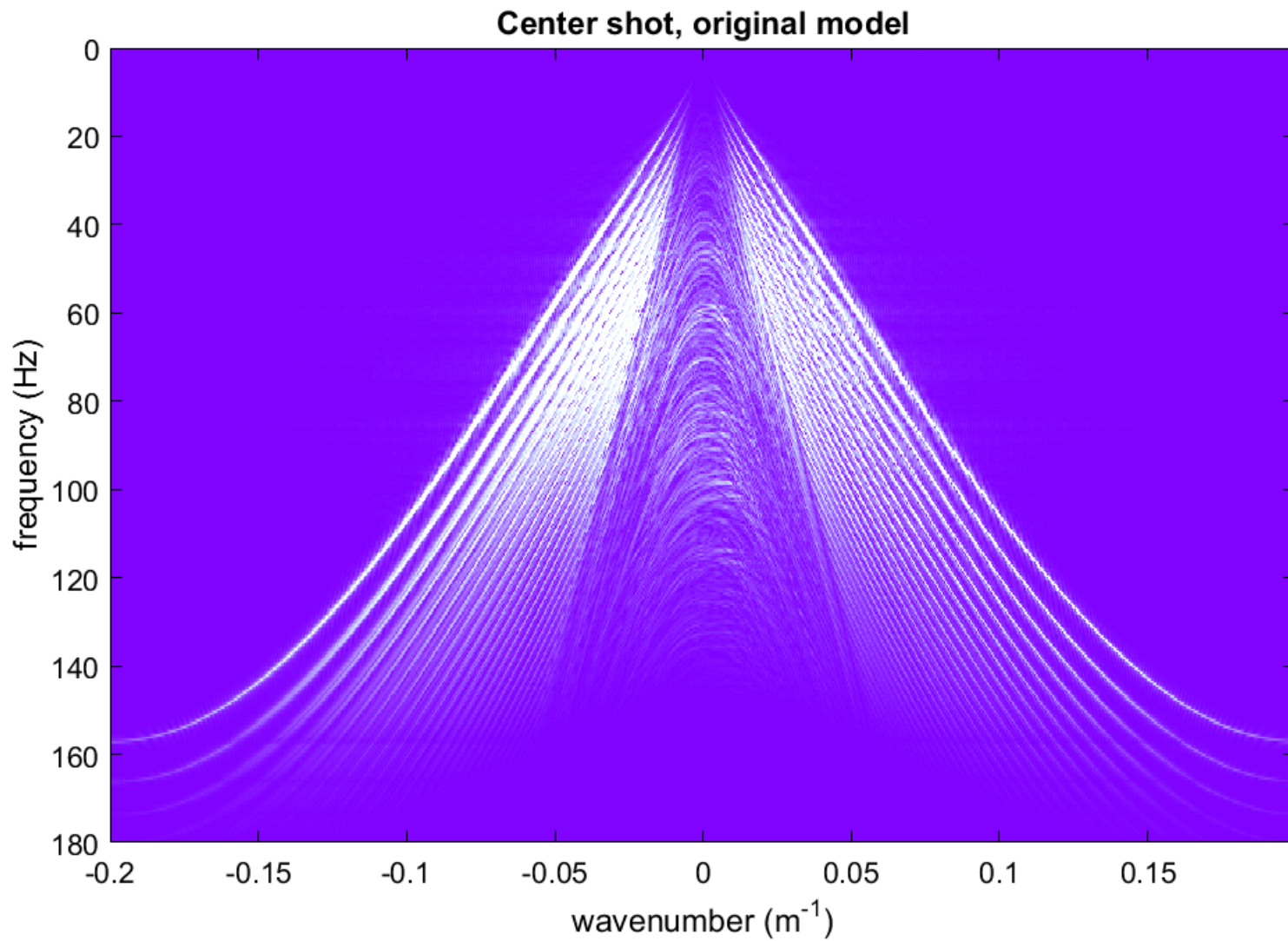
for k=1:nshots
    [shots{k},t]=afd_shotrec_alt(dx,dtstep,dt,tmax, vel xshots(k),zshot,xrec,zrec,w,tw,2);
end
```

# Example shot record

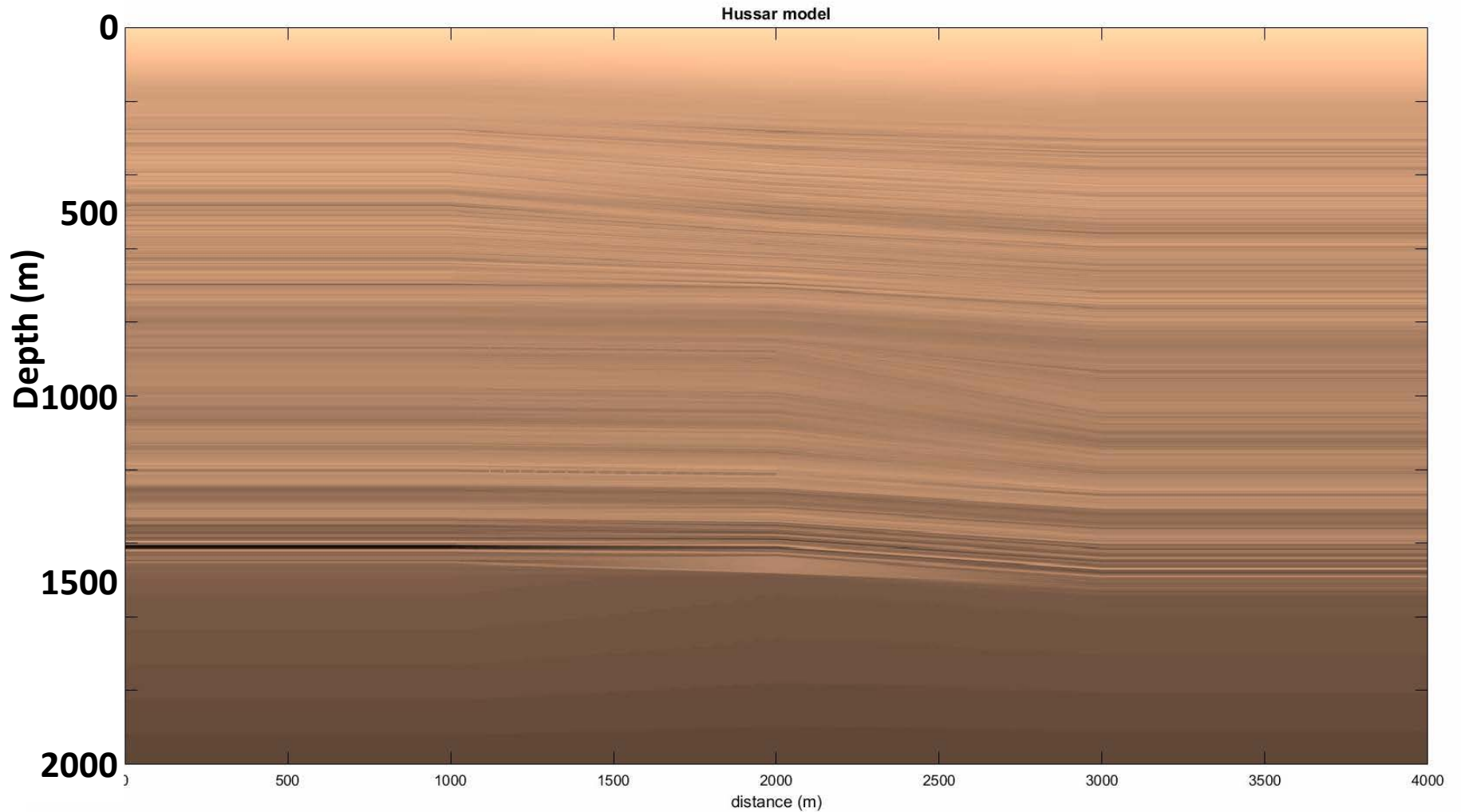
# Center shot



# Center shot f-k spectrum



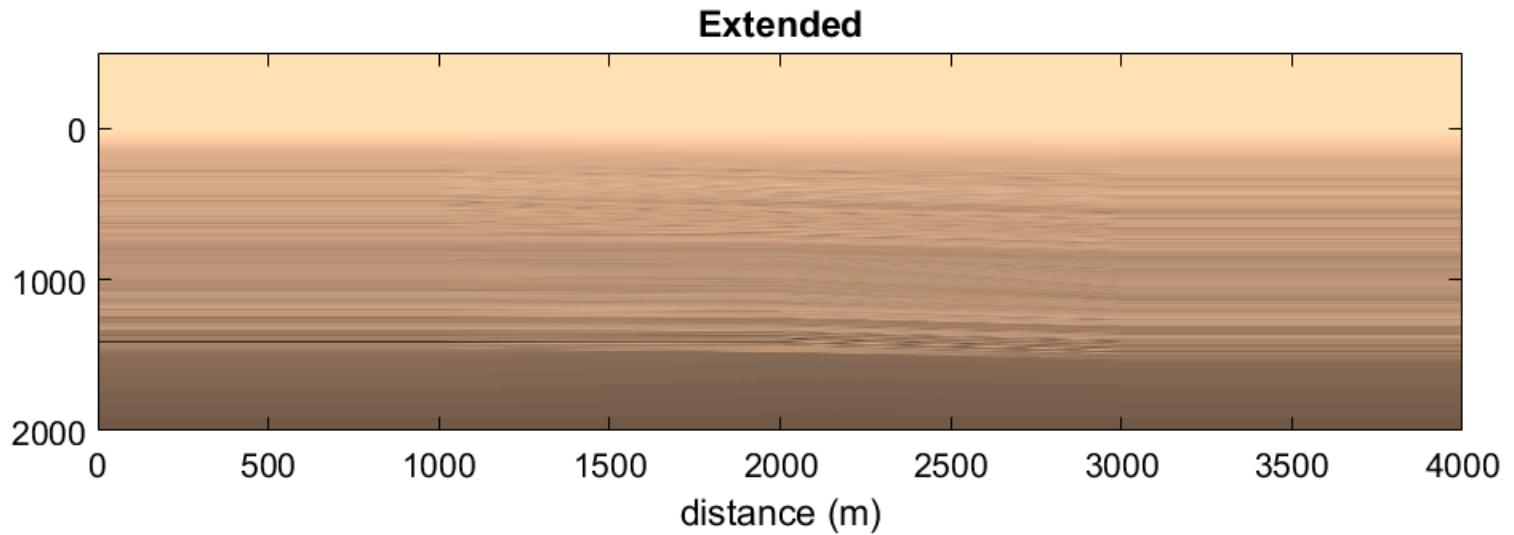
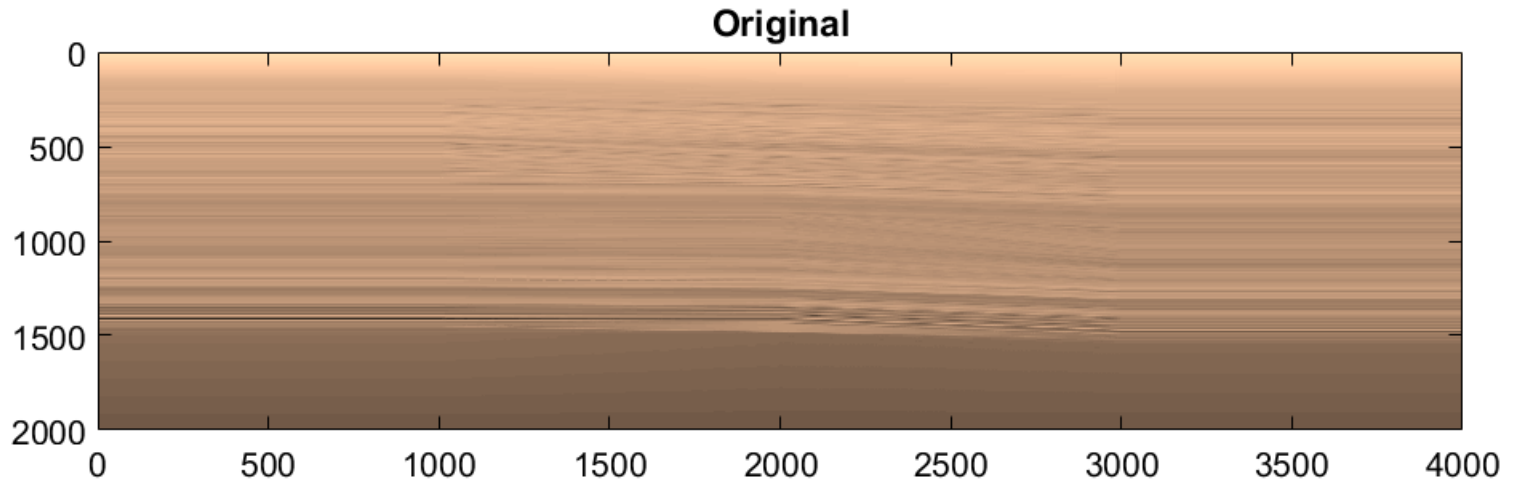
# Movie of this shot record



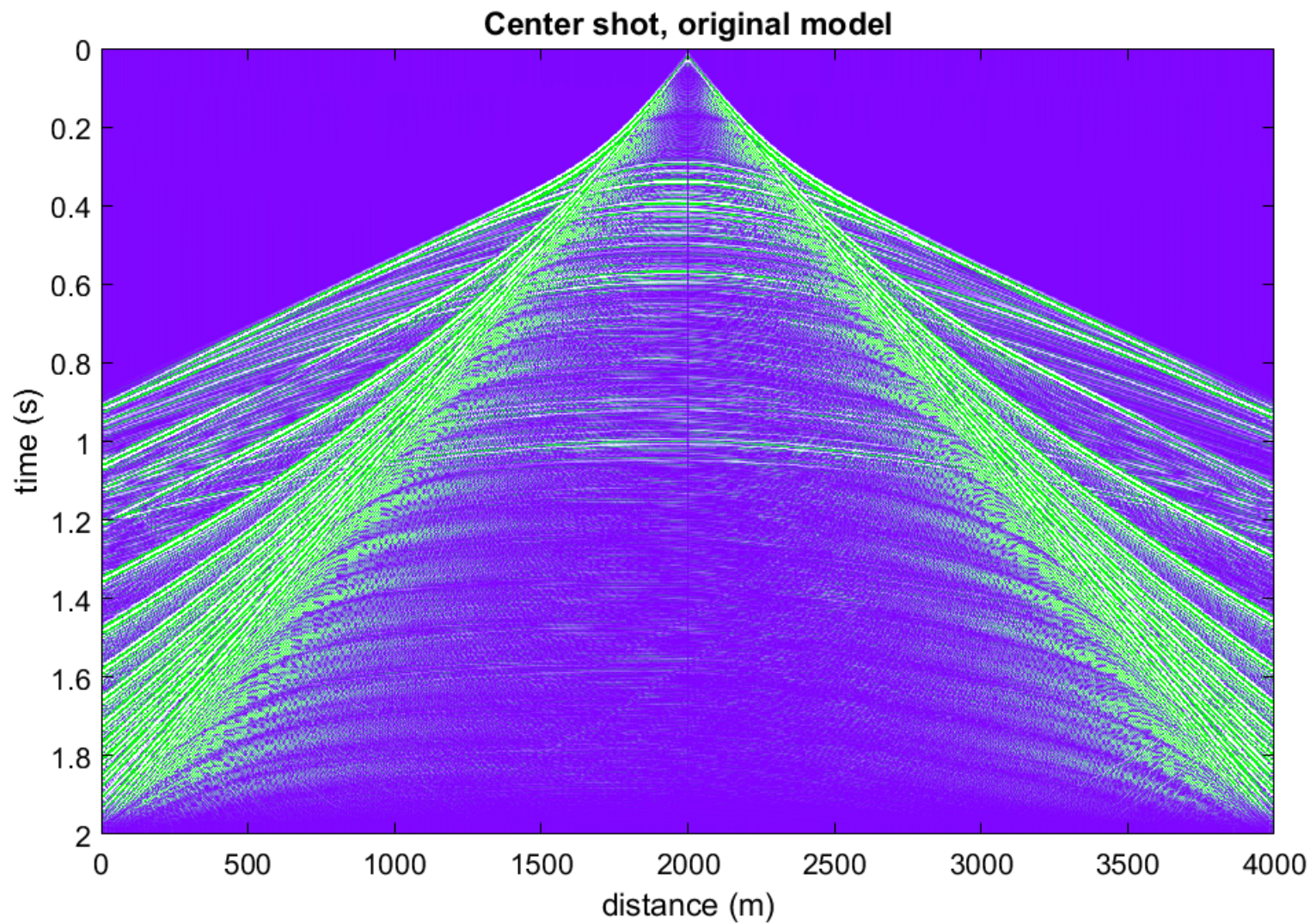


Shot record for extended model

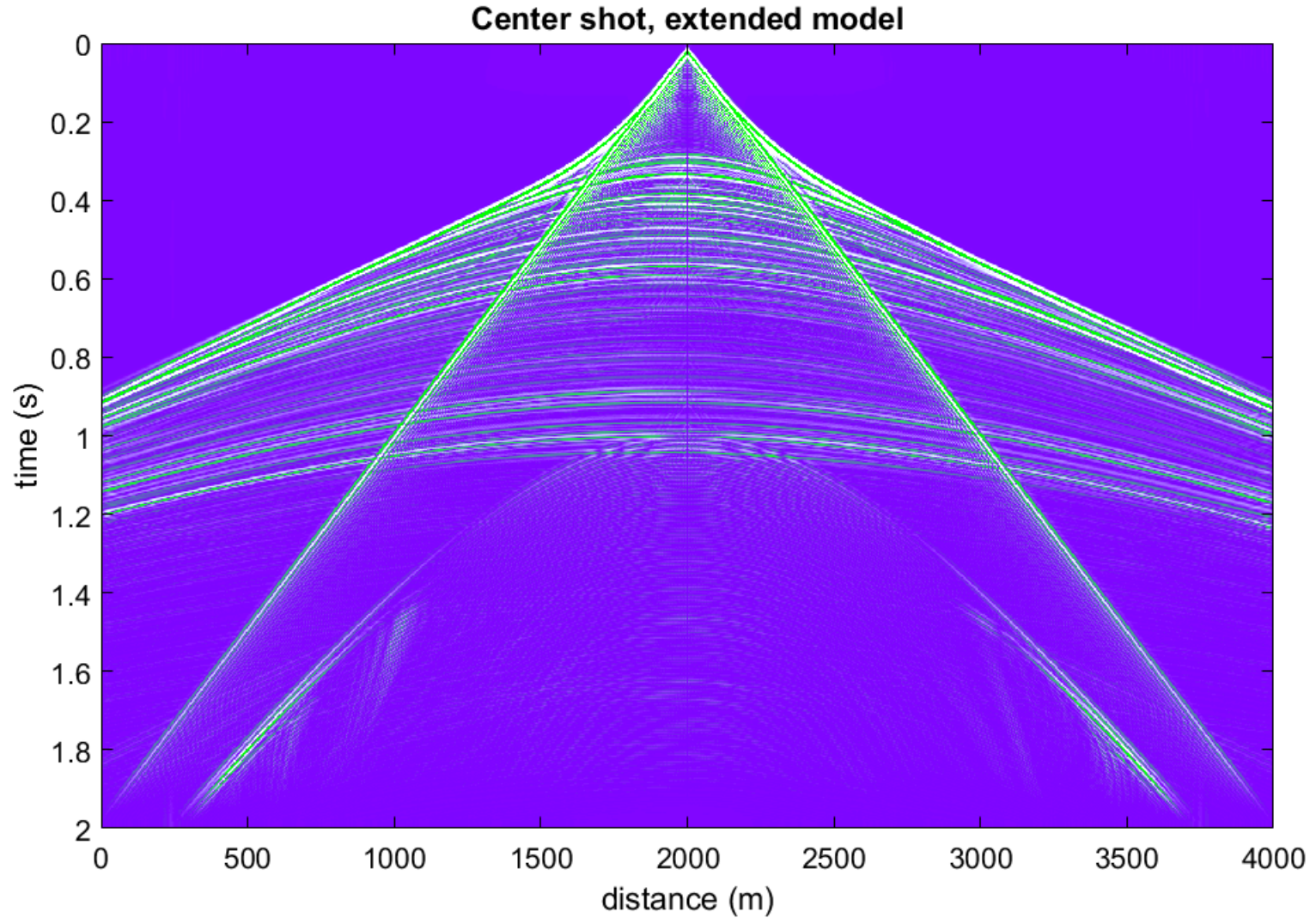
# Models



# Center shot

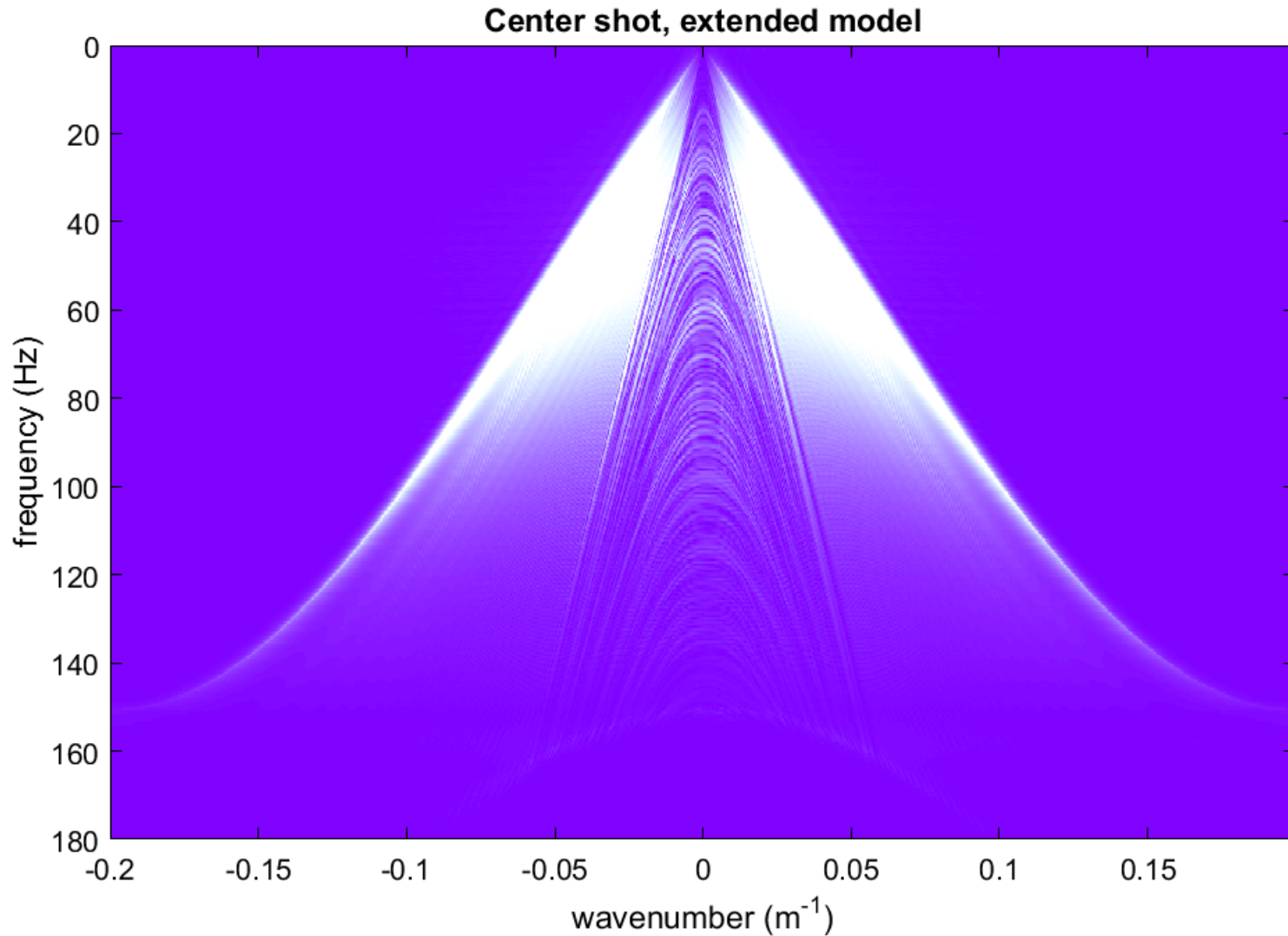


# Center shot extended model

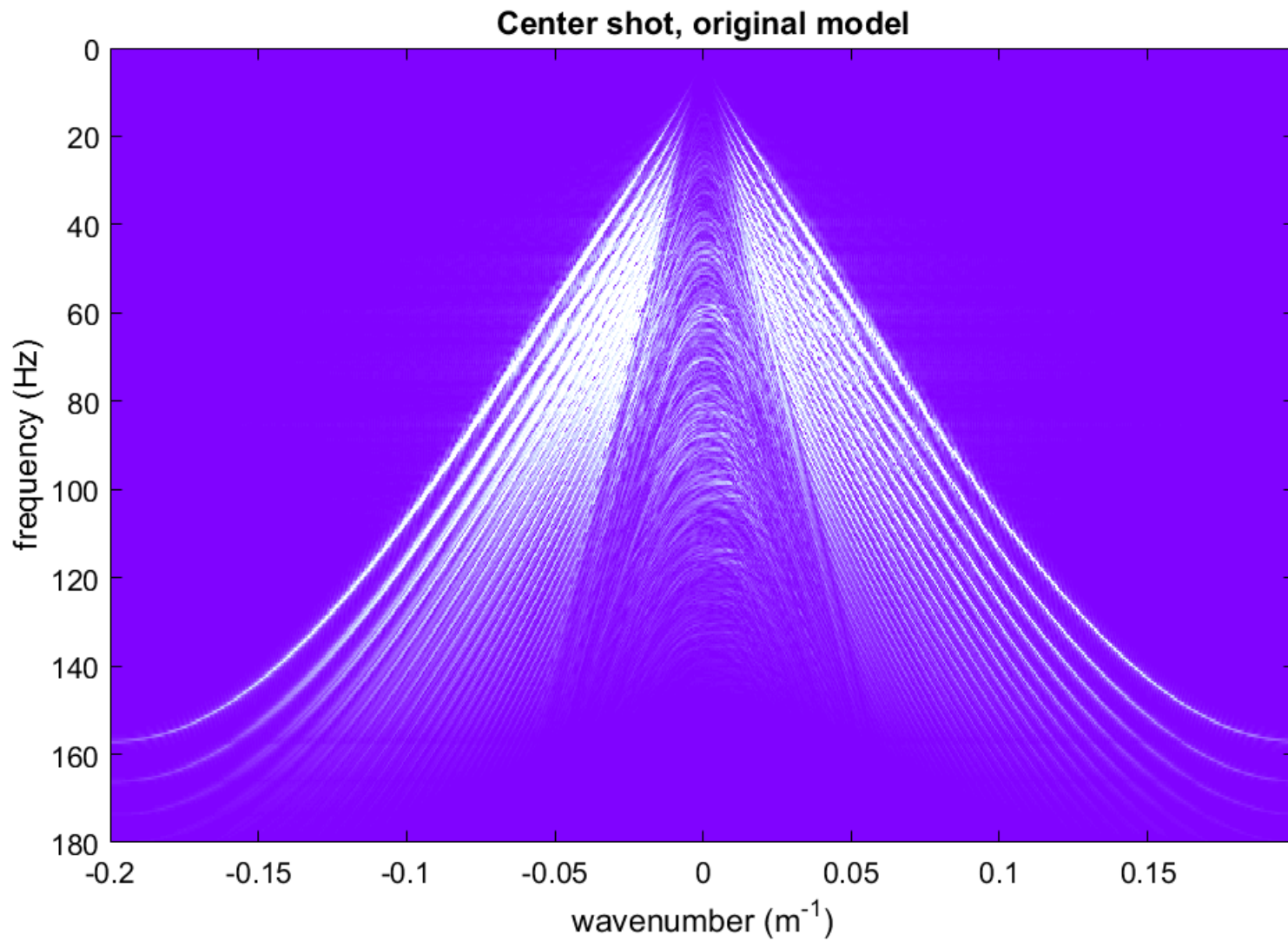


# Center shot

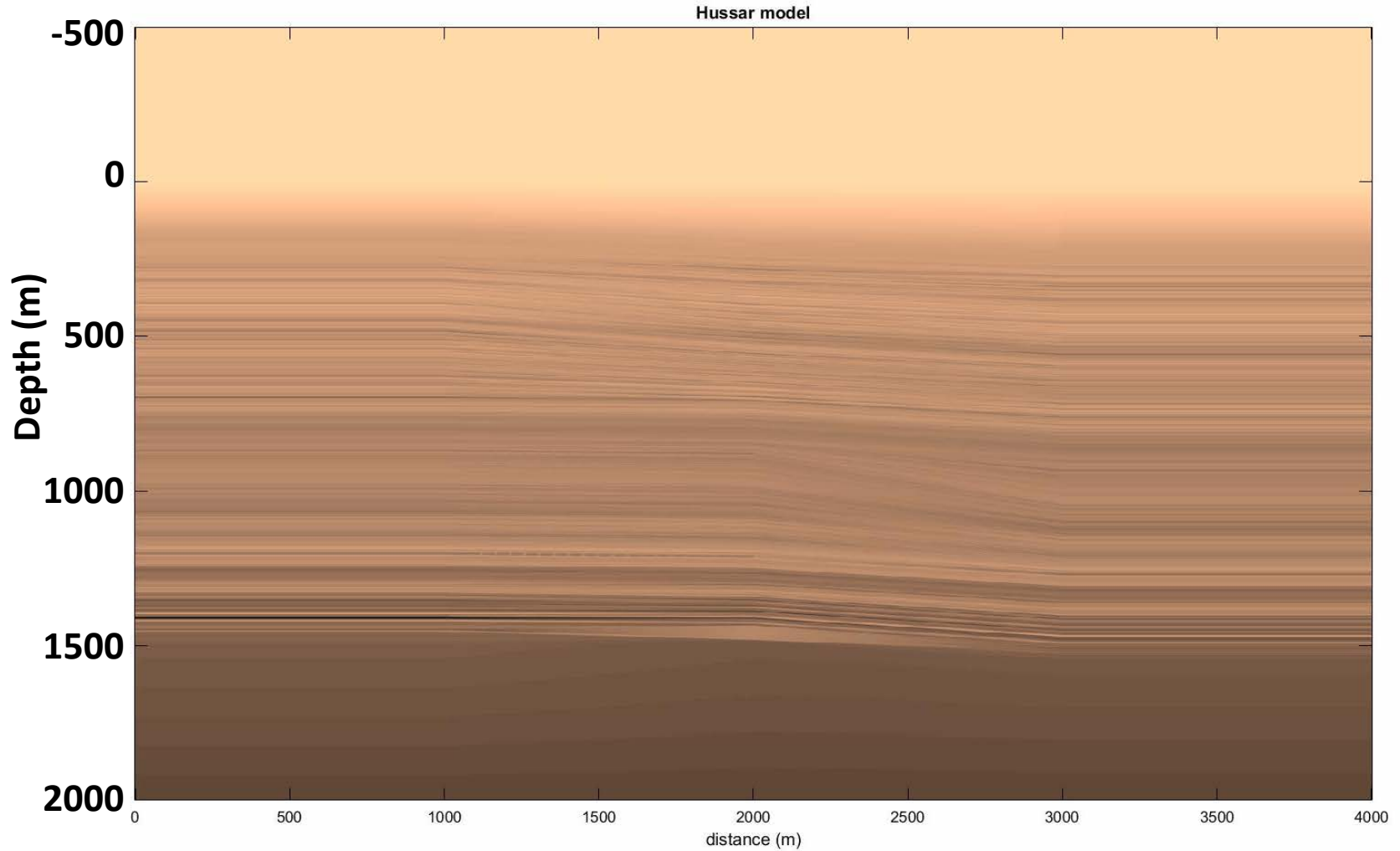
extended model, f-k spectrum



# Center shot f-k spectrum



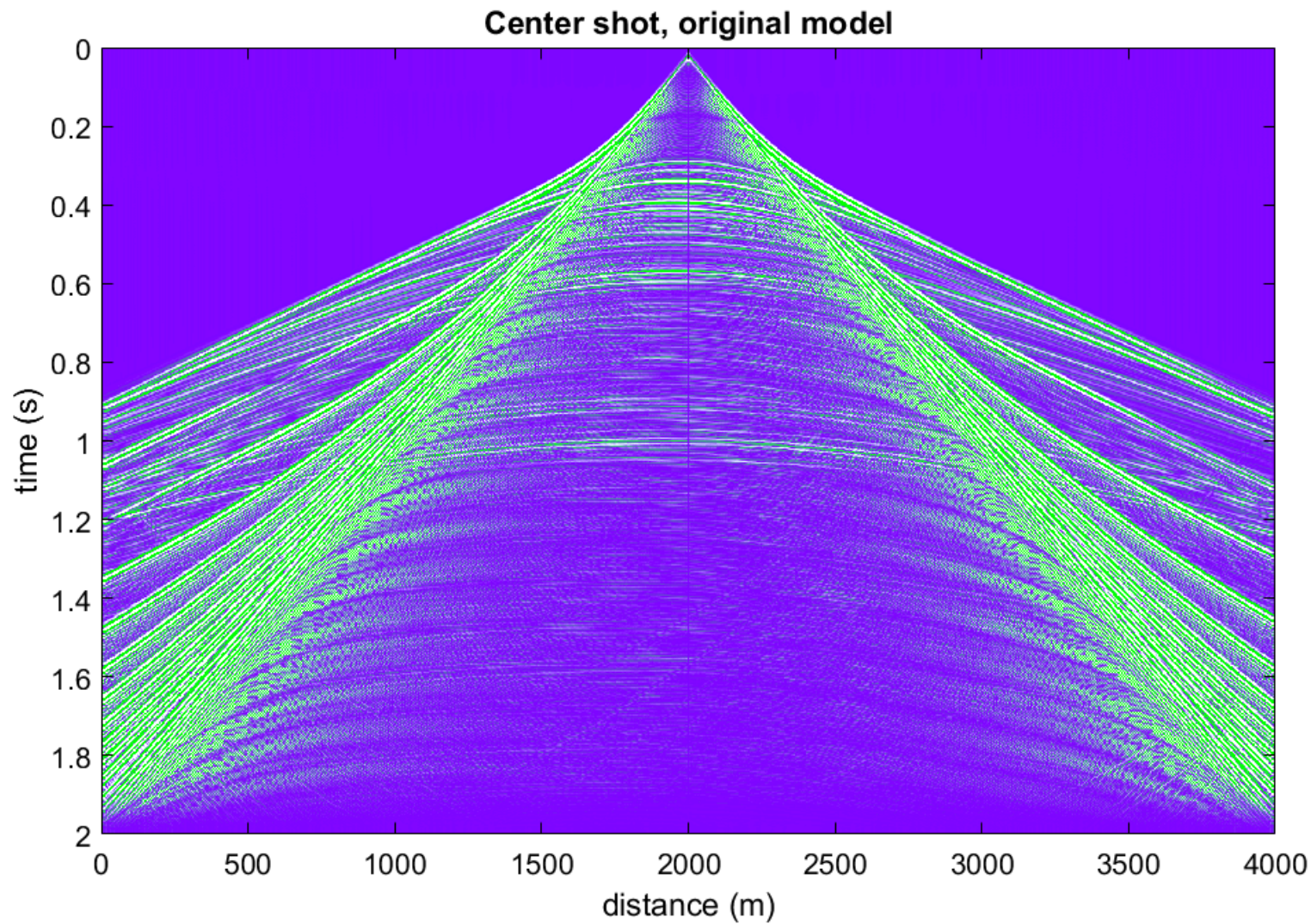
# Movie of center shot in extended model



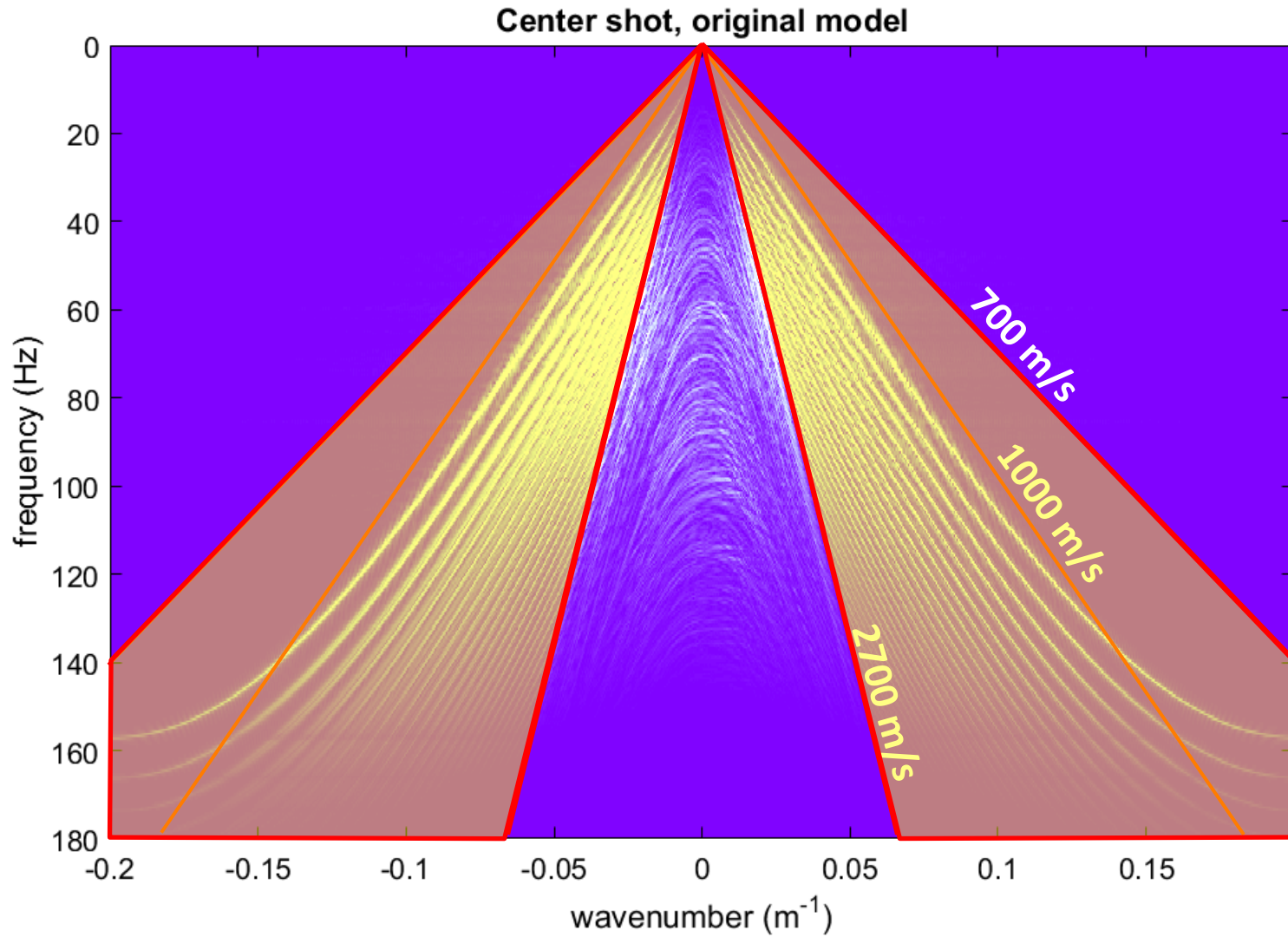
# Effects of f-k filter



# Center shot

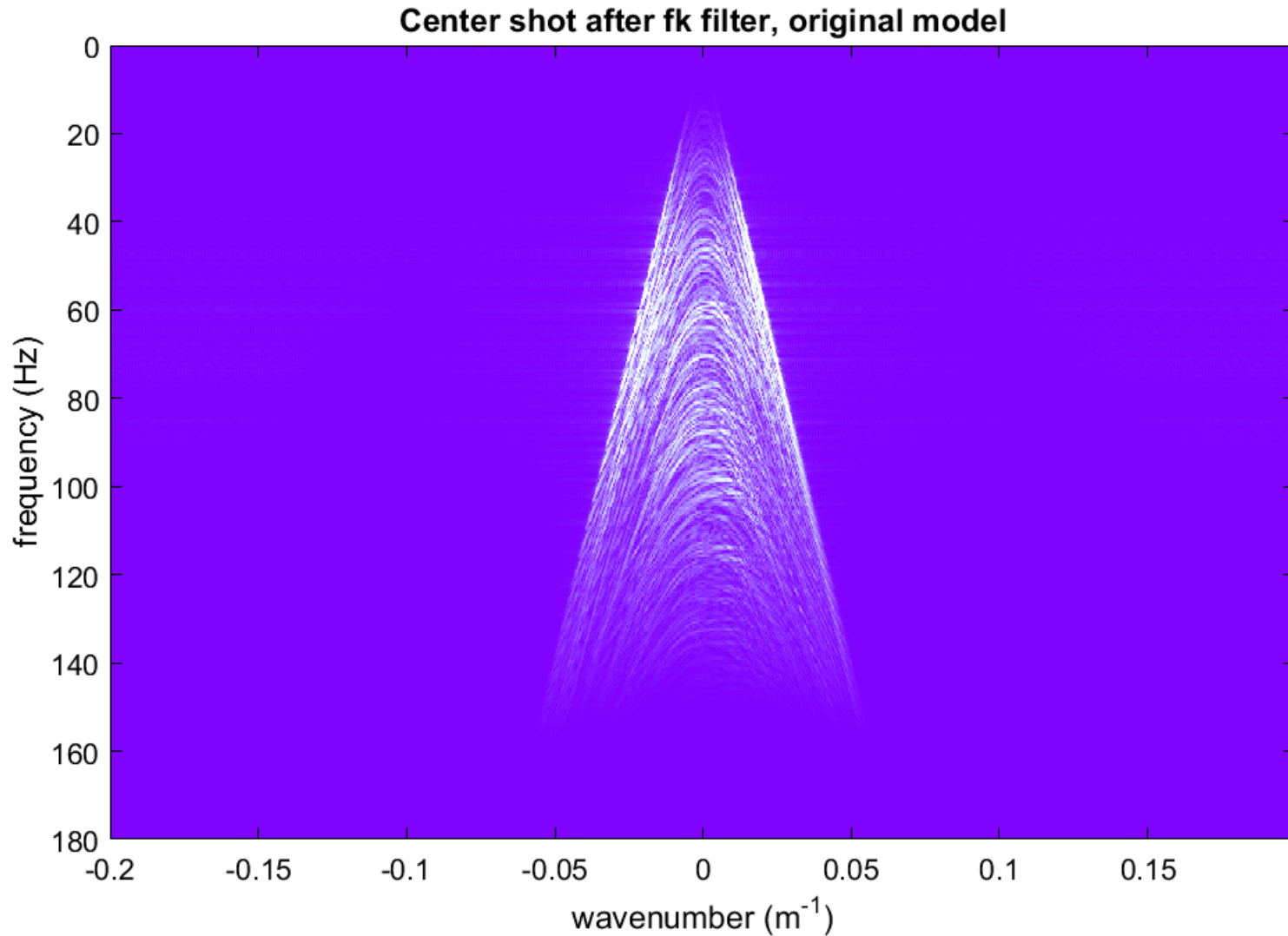


# Center shot f-k spectrum

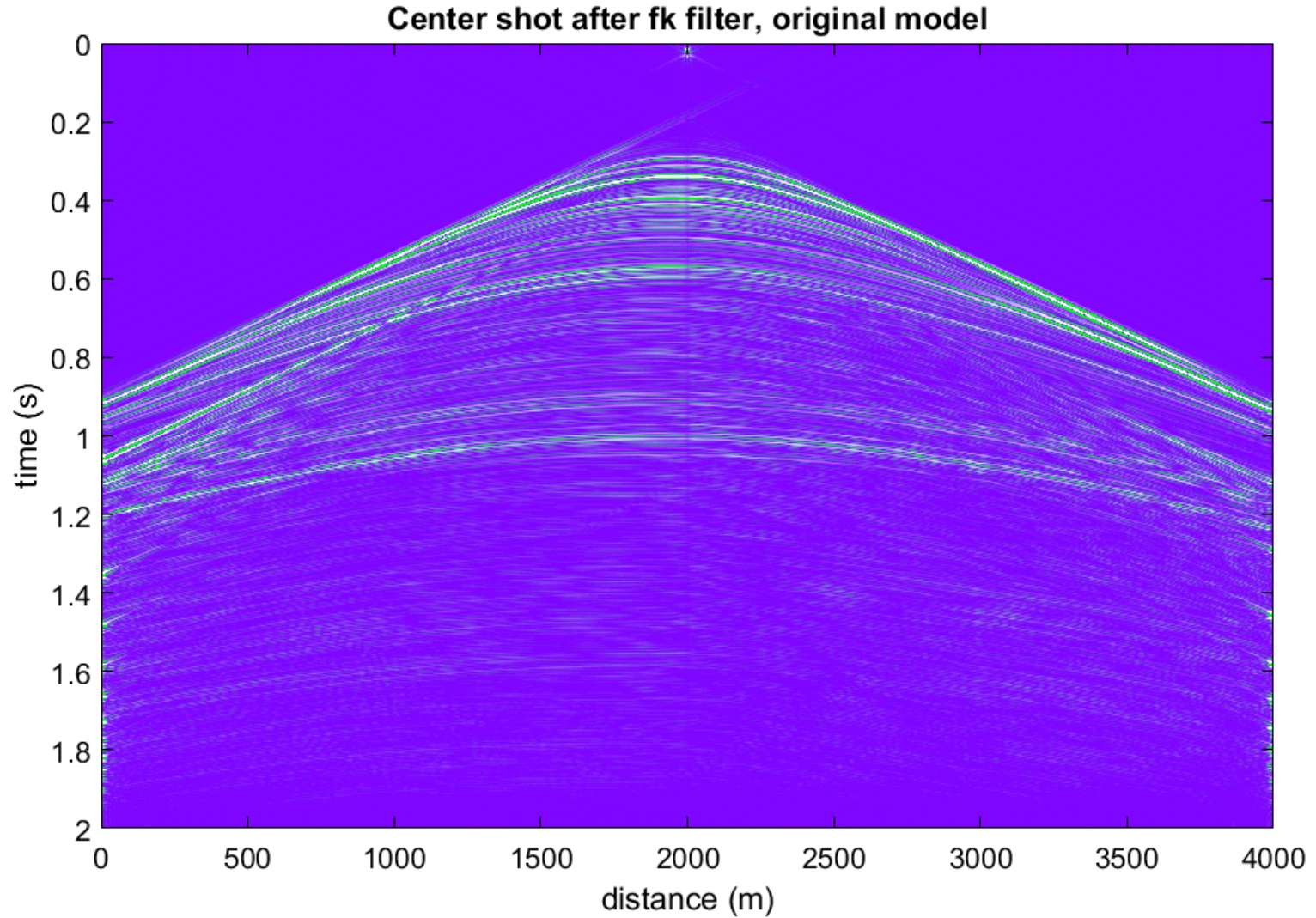


# Center shot

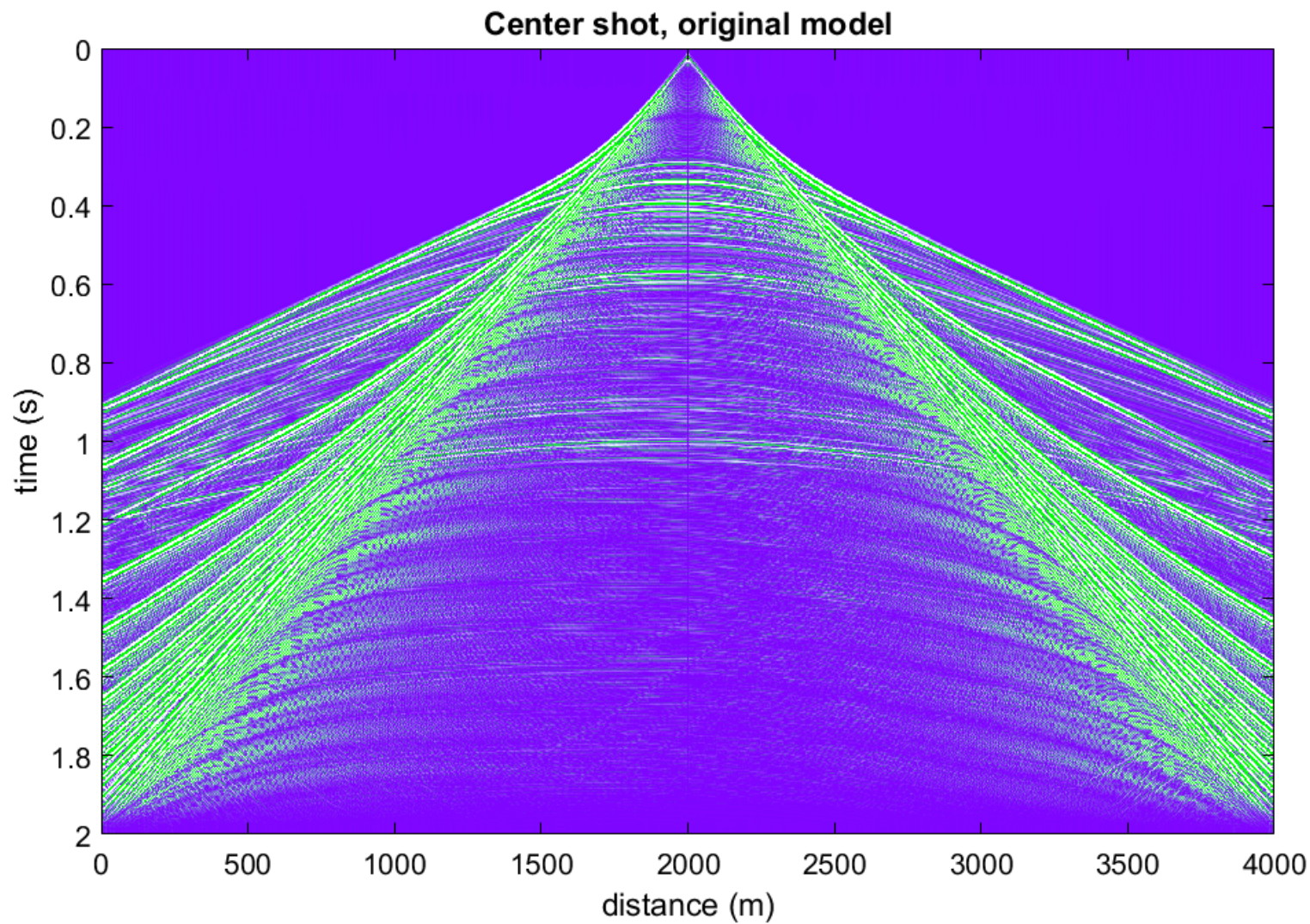
after f-k filter, f-k spectrum



# Center shot after f-k filter

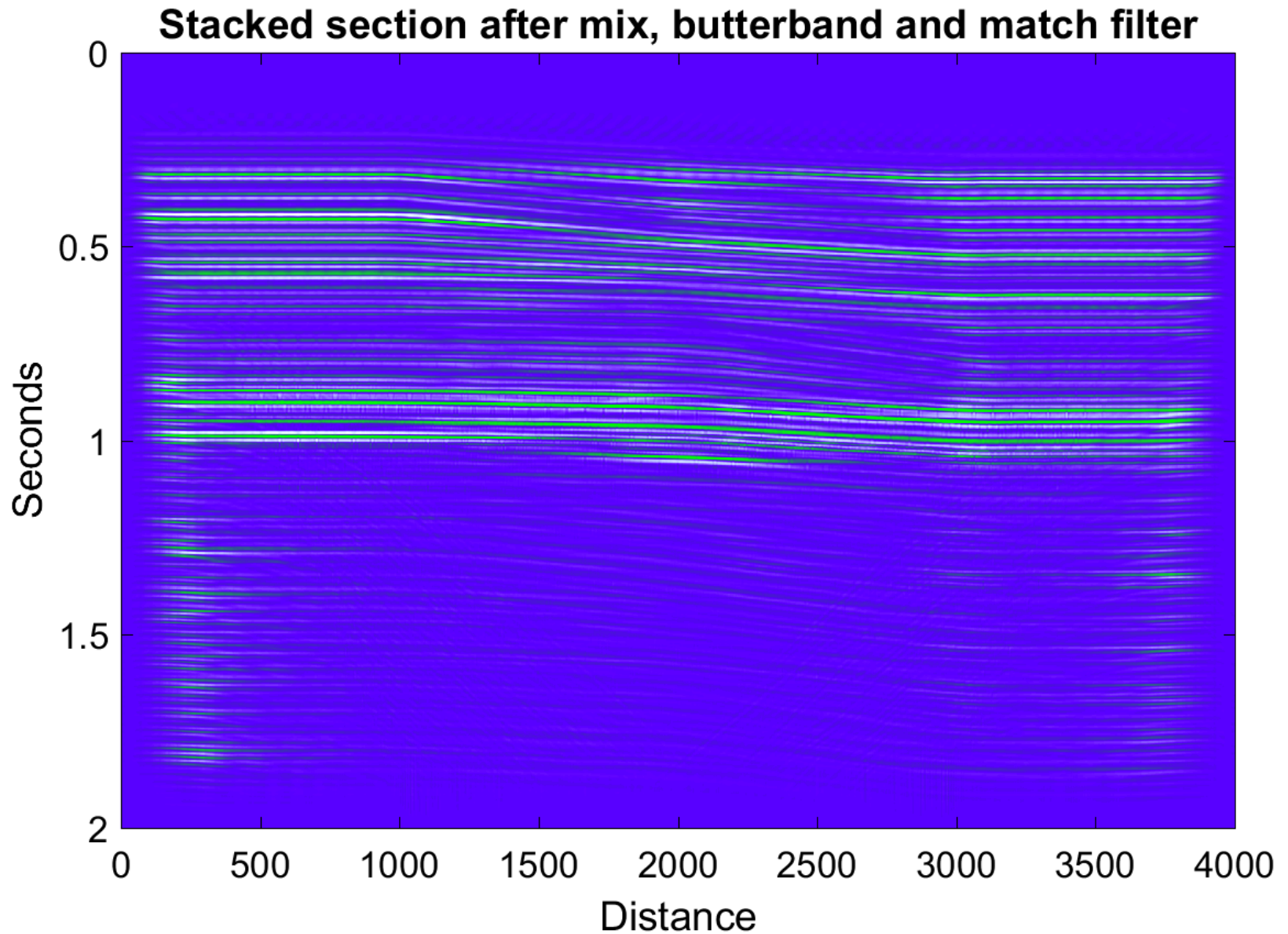


# Center shot

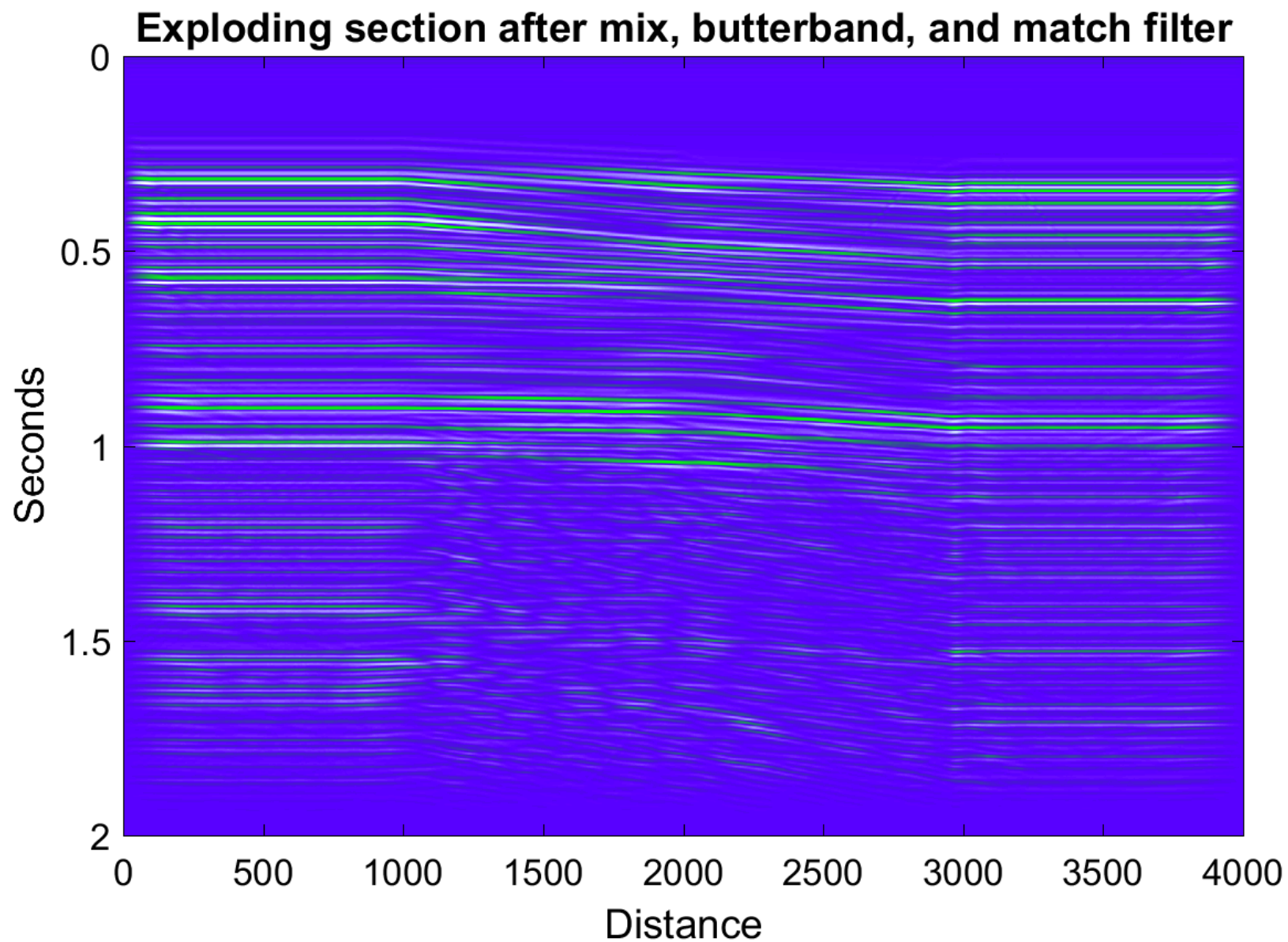


CMP stack

# CMP stack



# Exploding reflector





# Conclusions

A finite-difference dataset, using a velocity model build from interpolated well logs, is available as a model for Hussar.

The 'physics' is constant-density acoustic wave equation.

A very interesting surface wave effect is observed.

F-K filter is effective in removing the surface-related waves.

Data stack up well and contain rich stratigraphic detail.

Dataset can be downloaded from:

`/disk/enkidu1/data/Hussar/FiniteDifference/`

Anyone can use this for any reason.