TRIP and SEAM

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TRIP contributions to SEAM

1. Provided benchmark modeling software
2. Assisted in vendor qualification QC, spot checks of production run
3. Identified serious deficiencies in standard FD modeling accuracy - ongoing research

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IWAVE - public domain 3D acoustic modeling

designed and implemented by Igor Terentyev, with assistance from Tanya Vdovina, Xin Wang, Dong Sun, WWS

- maximally standard software dependencies - ISO C99, MPI 1, OpenMP
- complete acoustic modeling package - staggered grid velocity/pressure formulation, 2nd order in time, 2nd - 14th order in space
- implements NPML and free surface BCs, optional on all faces
- calibrated point source, array source options, trace and movie output
- parallelism - loop level (domain decomposition, threads) and task level (parallelization over shots)
- disk data formats: model - SEP/RSF; data - SEGY/SU
- web documentation, demo package

No other public domain FD package has all of these features, let alone those planned for future releases

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IWAVE - public domain 3D acoustic modeling

Ongoing development:

- Most recent release: 1.3 - TRIP web site
- IWAVE is a *framework* - modular software production environment, identifies minimal user-supplied function set to create FD app - "scheme builder" package in rel. 1.4
- 1.4 beta version includes CD acoustics (nonstag.), isotropic elastodynamics schemes, also non-wave, non-FD apps
- conformant to TSOpt timestepping simulator structure $\Rightarrow$ C++ wrapper design to form foundation of IWAVE++ waveform inversion package

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IWAVE - public domain 3D acoustic modeling

Our approach: extreme conservatism - good basic design (loops crafted for maximal speed, care with data exchange), but no "tricks"

Did not include (so far)

- expanding computational grid
- multiple grid sizes or stretched vertical (/horizontal) grid at depth
- multiple schemes for PML vs. non-PML zones
- Lax-Wendroff extrapolation
- etc.

Some of these planned for release 1.5 & beyond.

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Participation in SEAM QC

Vendor qualification phase: assisted with evaluation of vendor submissions (Tanya) - minority able to correctly compute free space field

Spot check runs (8) using IWAVE at UT TACC (Teragrid), 2048 - 4096 cores, 7-15 hrs

Verified that overall features and almost all detail of Tierra production data can be reproduced - validated "anomalous" data

Final runs 08.10 - Shot near center of model, 500K traces

Display: IWAVE and Tierra lines, gx=10585 m

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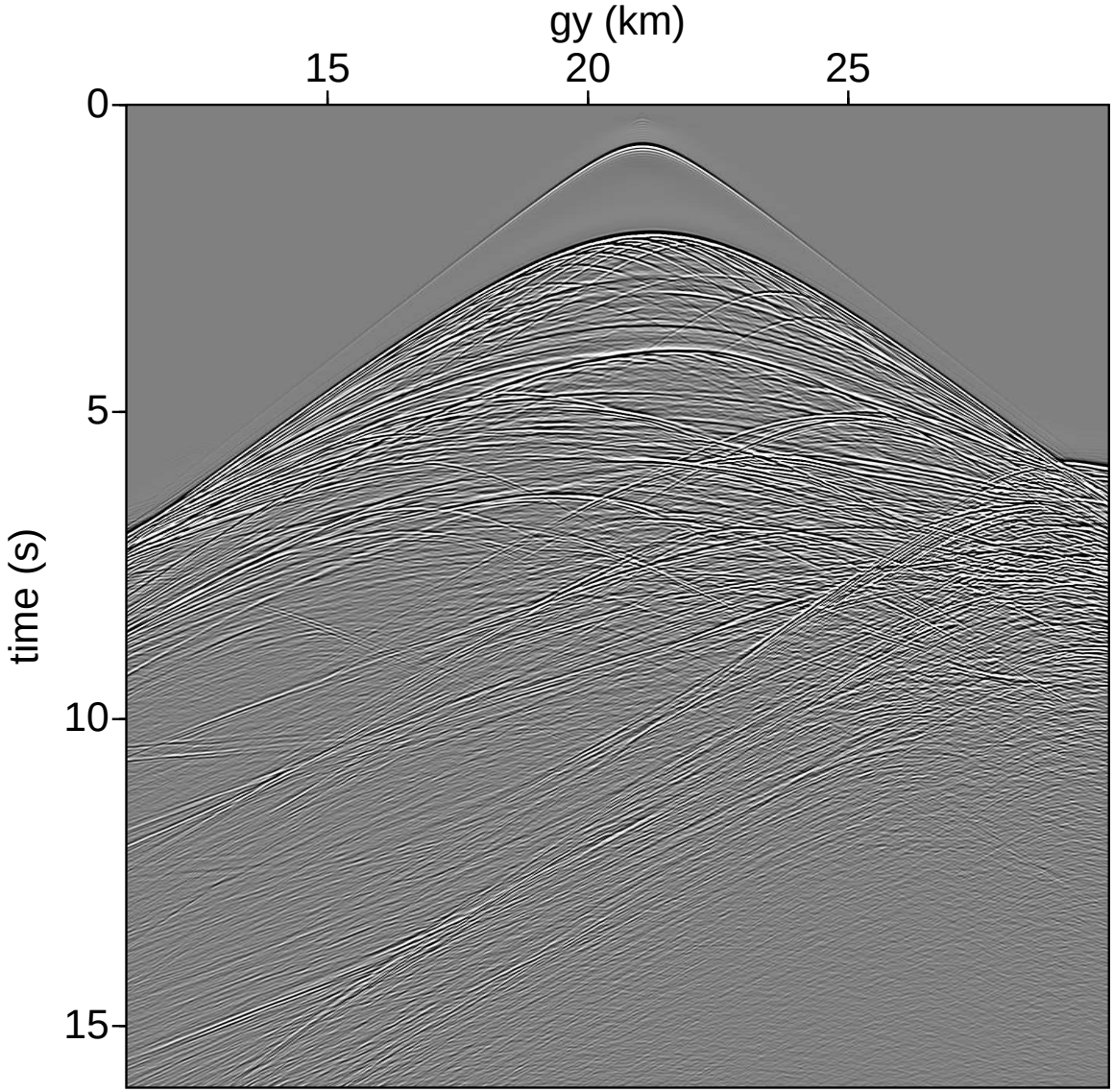
Participation in SEAM QC



IWAVE - gx = 10585 m

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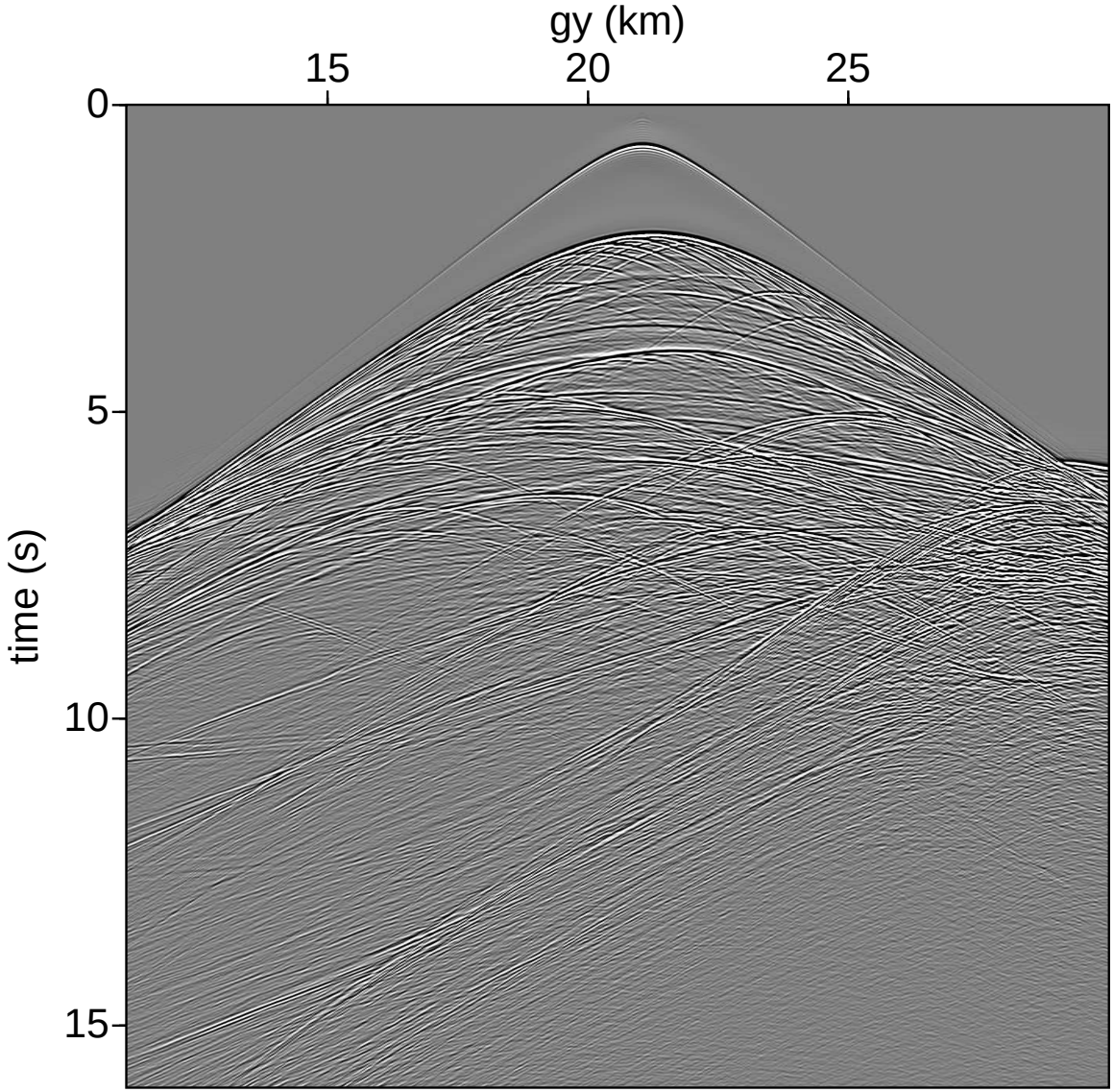
Participation in SEAM QC



Tierra - gx = 10585 m

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