

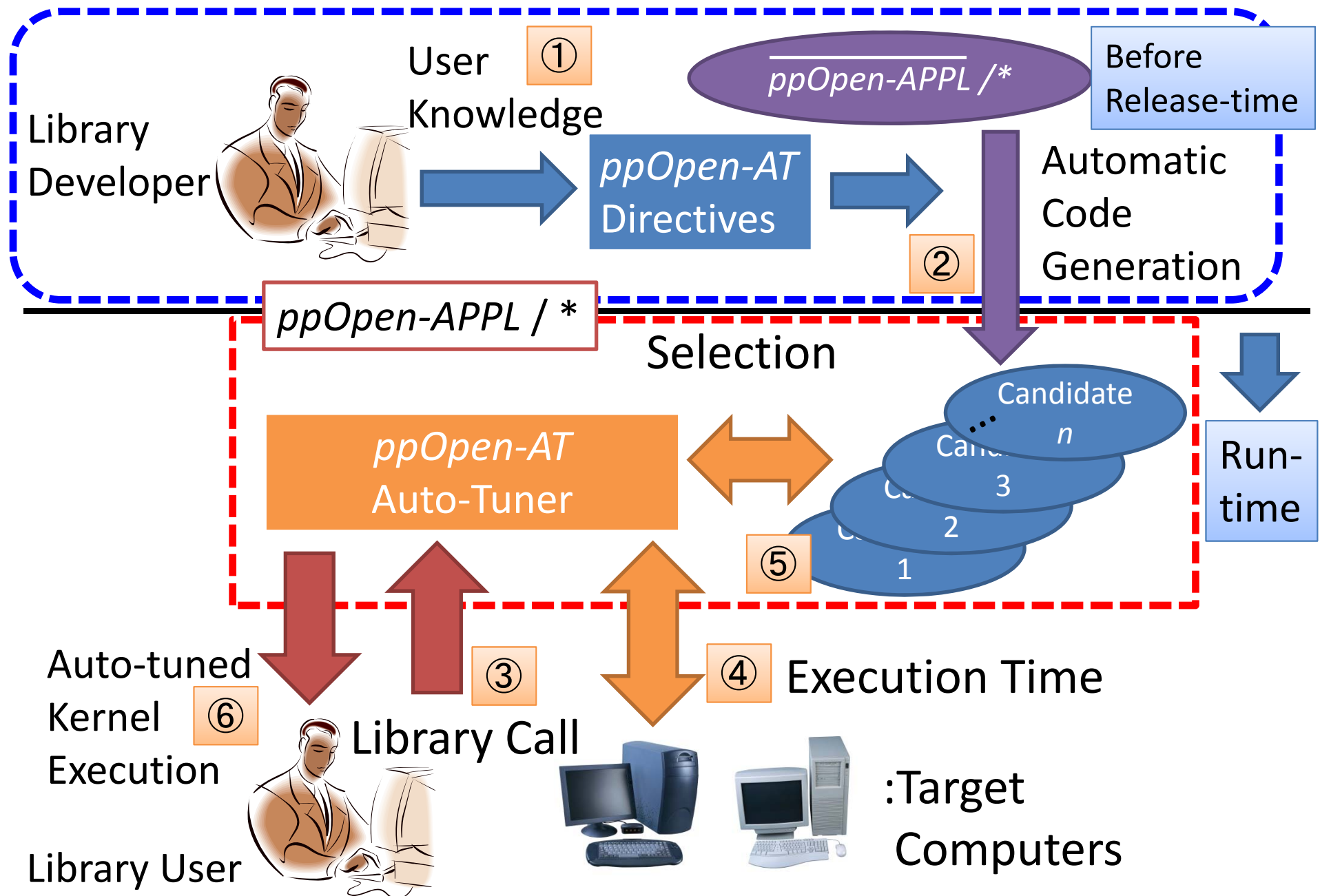


Overview of *ppOpen-AT/Static*
for *ppOpen-APPL/FDM* ver. 0.2.0

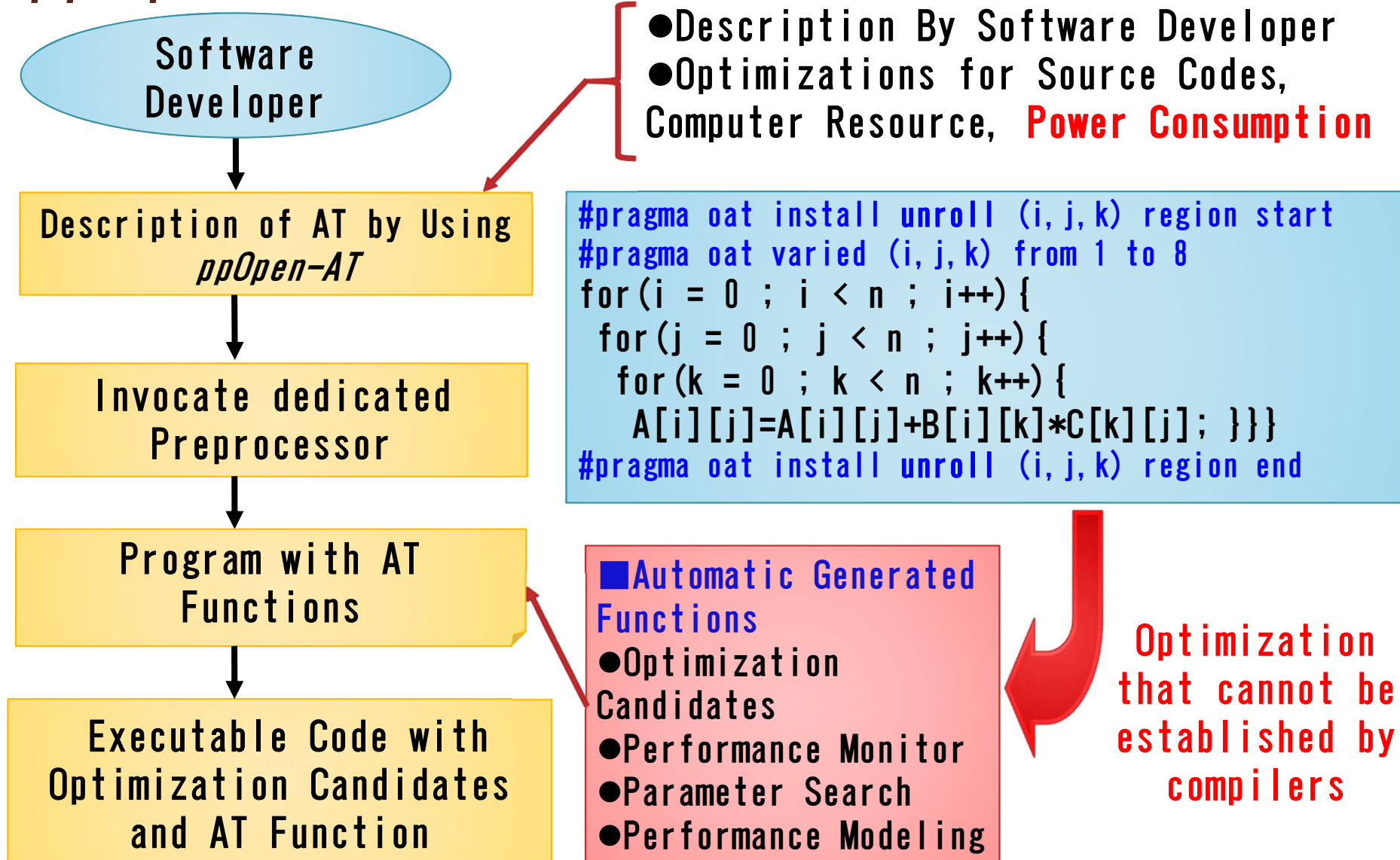
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As of July 30th, 2014

ppOpen-AT System



A Scenario to Software Developers for *ppOpen-AT*



Target Application

- **Seism_3D**: Simulation for seismic wave analysis.
- Developed by Professor Furumura at the University of Tokyo.
 - The code is re-constructed as **ppOpen-APPL/FDM**.
 - **version 0.2.0**
 - **OMP parallelization is implemented.**
- **Finite Differential Method (FDM)**
- **3D simulation**
 - 3D arrays are allocated.
- Data type: **Single Precision** (real*4)

Target Computation Kernels in Current Implementation

1. Kernel *update_stress*

- 8 Kinds of Candidates with Loop fusion and Loop Split.

2. Kernel *update_vel*

- 5 Kinds of Candidates with Loop Fusion and Loop Split, and reordering of statements.

3 Kinds of Candidates with Loop Fusion and Loop Split.

3. Kernel *update_stress_sponge*

4. Kernel *update_vel_sponge*

5. Kernel *ppohFDM_pdiffx3_p4*

6. Kernel *ppohFDM_pdiffx3_m4*

7. Kernel *ppohFDM_pdiffy3_p4*

8. Kernel *ppohFDM_pdiffy3_m4*

9. Kernel *ppohFDM_pdiffz3_p4*

10. Kernel *ppohFDM_pdiffz3_m4*

Additional Kernels in Next Release (Planned in Nov. 2014)

- 3 Kinds of Candidates with Loop Fusion and Loop Split for data packing and unpacking.

11. Kernel *ppohFDM_ps_pack*

12. Kernel *ppohFDM_ps_unpack*

13. Kernel *ppohFDM_pv_pack*

14. Kernel *ppohFDM_pv_unpack*

An Example of Seism_3D Simulation

- West part earthquake in Tottori prefecture in Japan at year 2000. ([1], pp.14)
 - The region of 820km x 410km x 128 km is discretized with 0.4km.
 - $NX \times NY \times NZ = 2050 \times 1025 \times 320 \doteq 6.4 : 3.2 : 1$.

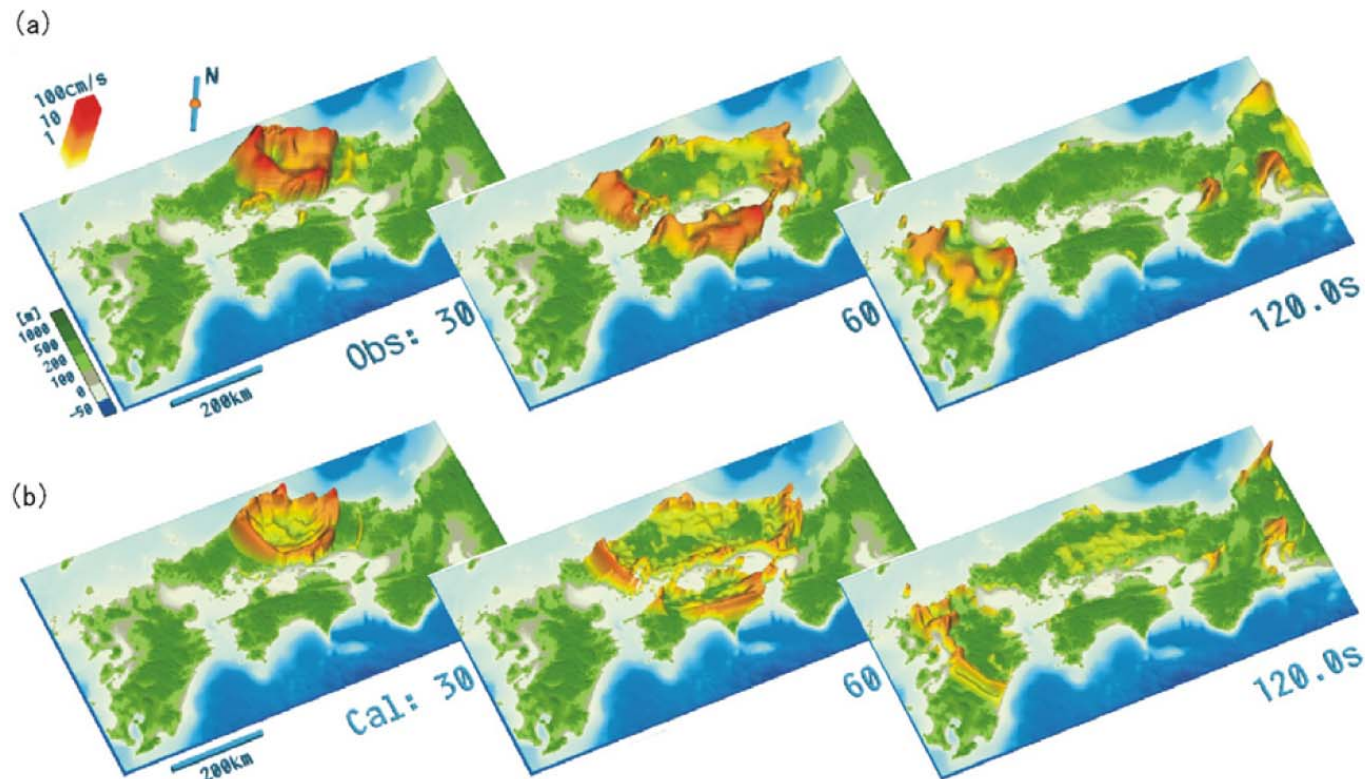
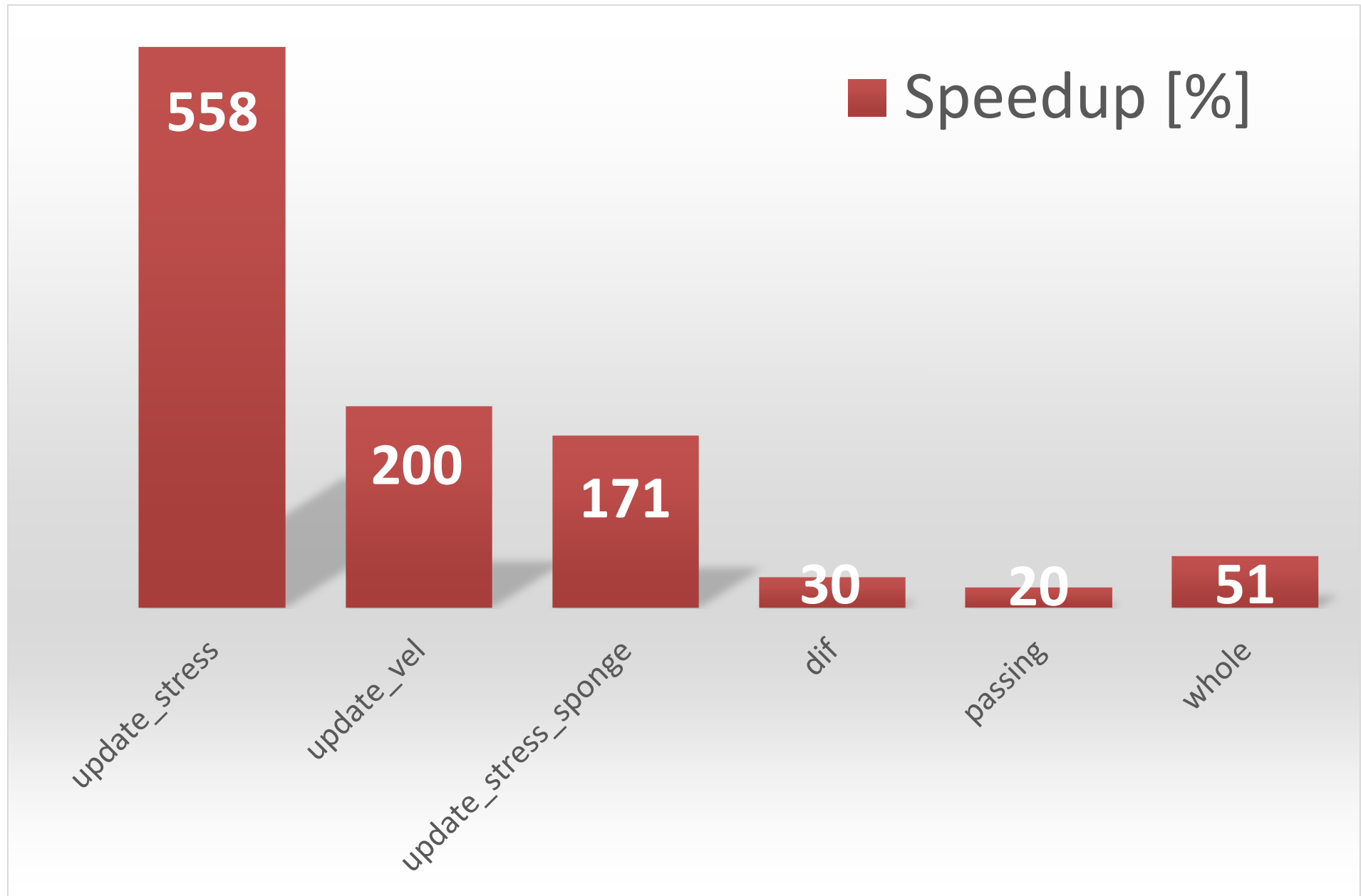


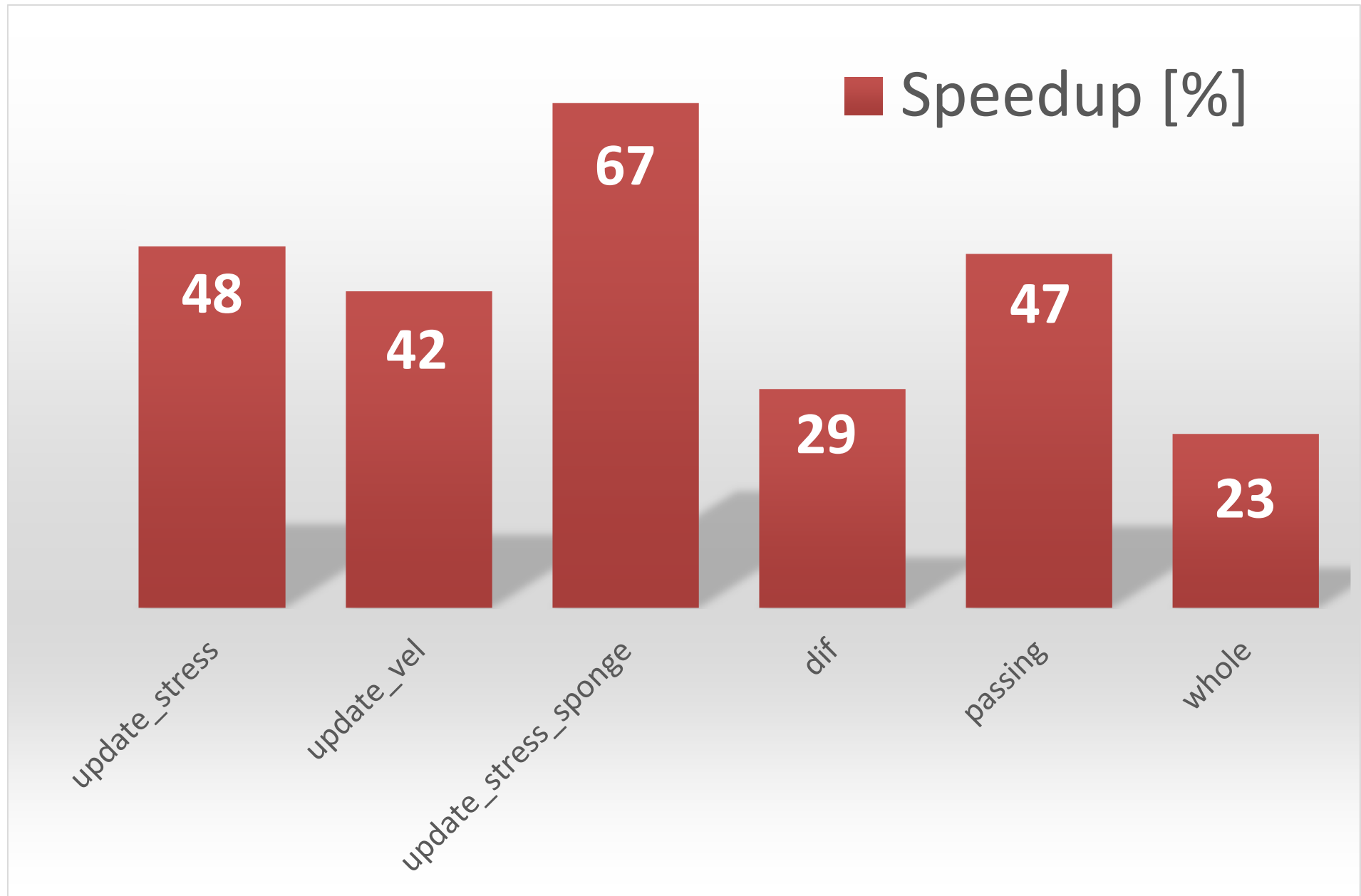
Figure : Seismic wave translations in west part earthquake in Tottori prefecture in Japan. (a) Measured waves; (b) Simulation results; (Reference : [1] in pp.13)

[1] T. Furumura, "Large-scale Parallel FDM Simulation for Seismic Waves and Strong Shaking", Supercomputing News, Information Technology Center, The University of Tokyo, Vol. 11, Special Edition 1, 2009. In Japanese.

Maximum AT Effect (Xeon Phi, 8 Nodes)



Maximum AT Effect (Ivy Bridge, 8 Nodes)



Maximum AT Effect (FX10, 8 Nodes)

