NEMO on ThunderX2

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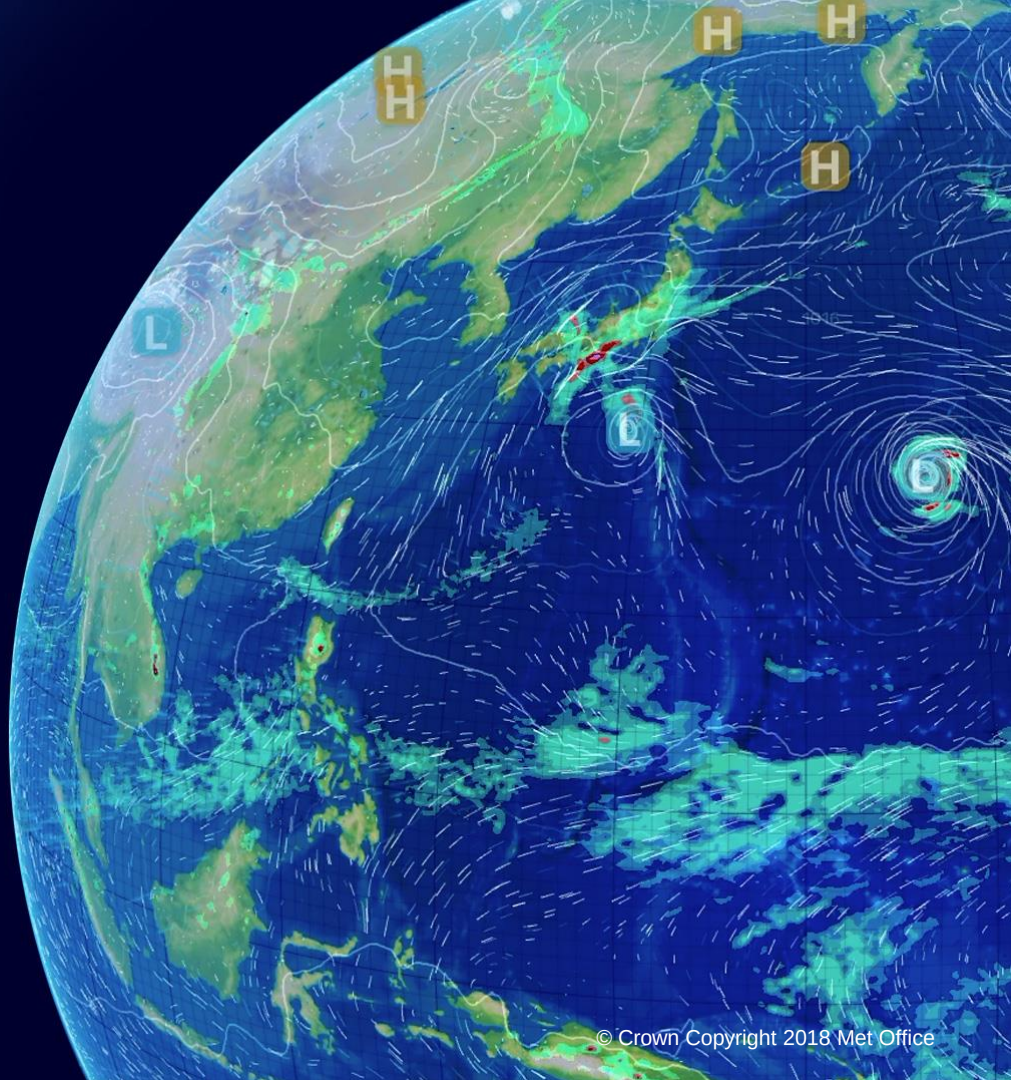

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Technical details

- Comparing Intel Broadwell with Cavium ThunderX2
- ThunderX2 currently single-socket only. (Used single-socket for **both** Broadwell and ThunderX2.)
- Cray compiler on both platforms. Broadwell: 8.5.8; ThunderX2: 8.6.4
- Hardware fault: ThunderX2 essentially without cache.
- Constrained to GYRE benchmark due to Cray compiler bug with ORCA1-LIM3.
- (Not yet tested with ARM compiler.)

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Overall performance

Platform	HT or SMT	1/12 degree	1/24 degree
Broadwell	1,1	554	2300
ThunderX2	2,4	475	1699
Speedup		**1.2x**	**1.4x**

Routine-level breakdown

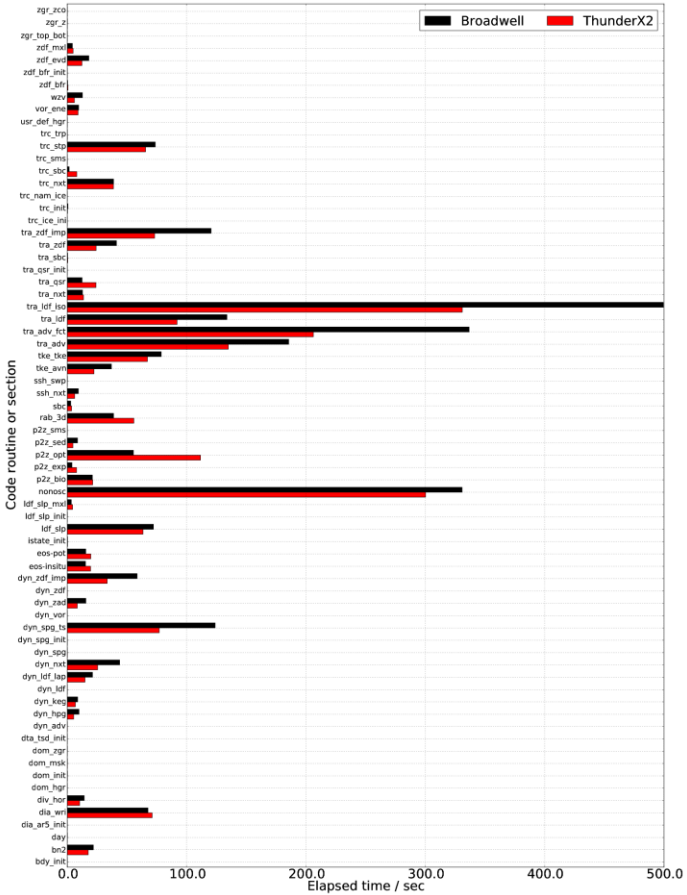
(1/24 degree)

Notable gains –
the top four costs:

- tra_ldf_iso
- tra_adv_fct
- nonosc
- tra_adv

Notable losses:

- rab_3d
- p2z_opt



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Separating memory and compute

$$T_1 = T_m + T_c$$

$$T_2 = \frac{1}{2}T_m + T_c$$

$$T_c = 2T_2 - T_1$$

$$T_m = 2(T_1 - T_2)$$

- T_1 : Fully committed
- T_2 : Half-committed

- T_c : Compute time
- T_m : Memory time

(Compute resources constant.)

Memory vs. compute time

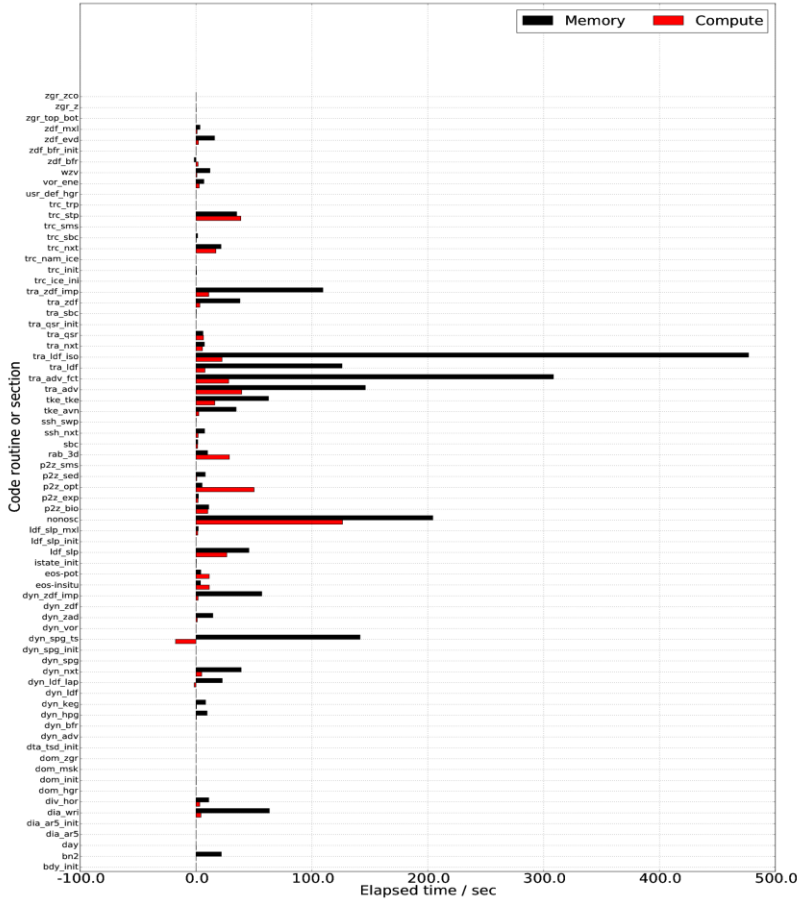
Broadwell. Derived from single vs. dual socket.

Notably memory-bound sections – the top four:

- tra_ldf_iso
- tra_adv_fct
- nonosc
- tra_adv

Notably compute-bound:

- rab_3d
- p2z_opt



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Take-home messages

- ThunderX2 beats Broadwell. (Single-socket.)
- Best performance with over-decomposition + SMT.
- Asynchronicity smoothing out bandwidth demands?
  (Hardware fault: eliminates cache.)
- Compute-bound routines perform better on Broadwell.
  (Note: early hardware and compilers, however.)