### AOCC compiler (with Flang - Fortran Front-end)

Latest release: 3.0, March 2021  

### Architecture

| Generate instructions that runs on AMD 3rd Gen EPYC™ and AMD 3rd Gen Ryzen™ | -march=znver3 |
| Generate instructions for the local machine | -march=native |

### Optimization Levels

| Disable all optimizations | -O0 |
| Minimal level speed and code optimization | -O1/-O |
| Moderate level optimization | -O2 |
| Aggressive optimizations | -O3 |
| Maximize performance | -Ofast |
| Enable link time optimization | -fto |

### Enable loop optimizations

- -funroll-loops
- -enable-licm-vrp
- -enable-partial-unswitch
- -fuse-tile-inner-loop
- -unroll-threshold

### Enable advanced loop optimizations

- -unroll-aggressive

### Enable function level optimizations

- -ftodcalls
- -function-specialize
- -finline-aggressive
- -inline-recursion=\{1..4\} (use with ftto)
- -do-block-reordering=\{none, normal, aggressive\}

### Enable advanced vectorization

- -enable-strided-vectorization
- -enable-epilog-vectorization

### Enable memory layout optimizations

- -fremap-arrays (use with -fto)

### Profile guided optimizations

- -fprofile-instr-generate [1st invocation]
- -fprofile-instr-use [2nd invocation]

### OpenMP®

- -fopenmp

### For enabling streaming stores, memory bandwidth workloads

- -fnt-store

### Enable removal of un-used array computation

- -reduce-array-computations=3

### Other options

| Enable faster, less precise math operations (part of Ofast) | -ffast-math
| -ffreeprec-math |
| OpenMP® threads and affinity (N number of cores) | export OMP_NUM_THREADS=N
| export GOMP_CPU_AFFINITY="0-{N-1}"
| Enabling vector library | -fveclib=AMDLIBM |
| Link to AMD library | -L/libm-install-dir/lib -lalm |

### For Fortran Workloads

- Compile free form FORTRAN -ffree-form

### AMD Optimized Libraries

Latest release: 3.0, March 2021  

### AMD µProf (Performance & Power Profiler)

Latest release: 3.4, March 2021  
### GNU compiler collection (gcc, g++, gfortran)

**Latest release:** 11.1, April 2021  
**Recommended version:** GCC trunk, later than 5-Dec-2021  

#### Architecture
- Generate instructions that runs on AMD 3rd Gen EPYC™ and AMD 3rd Gen Ryzen™
  - `march=znver3`
- Generate instructions for the local machine
  - `march=native`

#### Optimization Levels
- **Disable all optimizations** (default)
  - `-O0`
- **Minimal level speed and code optimizations**
  - `-O1` / `-O`
- **Moderate level optimizations**
  - `-O2`
- **Aggressive optimizations**
  - `-O3`
- **Maximize performance**
  - `-Ofast`

#### Additional Optimizations
- **Link time optimization**
  - `-ftext`
- **Enable unrolling**
  - `-funroll-all-loops`
- **Generate memory preload instructions**
  - `-fprefetch-loop-arrays --param prefetch-latency=300`
- **Profile-guided optimization**
  - `-fprofile-generate` (1st invocation)
  - `-fprofile-use` (2nd invocation)

#### OpenMP®
- `-fopenmp`

#### Other options
- **Enable generation of code that follows IEEE arithmetic**
  - `-mieee-fp`
- **Enable faster, less precise math operations**
  - `-ffast-math`
- **Compile free form FORTRAN**
  - `-ffree-form`
- **OpenMP® threads and affinity (N number of cores)**
  - `exportOMP_NUM_THREADS=N`
  - `export GOMP_CPU_AFFINITY="0-{N-1}"`
- **Link to AMD library**
  - `/-L/libm-install-dir/lib -lalm`

### Glibc

**Latest release:** 2.33, February 2021  
**Recommendation:** 2.26 or later  
[https://www.gnu.org/software/libc/](https://www.gnu.org/software/libc/)

### Binutils

**Recommendation:** 2.36 or later  
[https://www.gnu.org/software/binutils/](https://www.gnu.org/software/binutils/)

### Microsoft® Visual Studio 2019

**Latest stable release:** 16.8.5, February 2021  
[https://www.visualstudio.com/](https://www.visualstudio.com/)

#### Architecture
- Generate instructions that runs on AMD 3rd Gen EPYC™ and AMD 3rd Gen Ryzen™
  - `/arch:[AVX|AVX2]`
- Optimize for 64-bit AMD processors
  - `/favor:AMD64 /d2vzeroupper`

#### Optimization Levels
- **Disable optimizations** (default)
  - `/Od`
- **Maximum optimizations (favor space)**
  - `/O1`
- **Maximum optimizations (favor speed)**
  - `/O2`
- **[link.exe] Eliminate unreferenced function and/or data**
  - `/OPT:REF`
- **[link.exe] Perform identical COMDAT folding**
  - `/OPT:ICF`
- **Output an informational message for loops that are auto-vectorized**
  - `/Qvec-report:[1|2]`
- **Enable automatic parallelization of loops, used in conjunction with #pragma loop() directive**
  - `/Qpar`
- **Output an informational message for loops that are auto-parallelized**
  - `/Qpar-report:[1|2]`

#### Additional Optimizations
- **Maintain the precision for floating-point operations through proper rounding**
  - `/fp:precise`
- **Optimize floating-point code for speed at the expense of floating-point accuracy and correctness**
  - `/fp:fast`
- **Whole Program Optimization (link-time code generation)**
  - `/GL`
- **Profile-guided optimization**
  - `LTCG:PGI` and `/LTCG:PGO`
## Intel® compilers (icc, icpc, ifort)

Latest release: 19.1

http://software.intel.com

### Architecture

- Generate instructions that runs on AMD 3rd Gen EPYC™ and AMD 3rd Gen Ryzen™
  - `march=core-avx2` (preferred) OR `axCORE-AVX2`

### Optimization Levels

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<tr>
<th>Optimization</th>
<th>Option</th>
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<tbody>
<tr>
<td>Disable all optimizations</td>
<td>-O0</td>
</tr>
<tr>
<td>Speed optimization without code growth</td>
<td>-O1</td>
</tr>
<tr>
<td>Enable optimization for speed including vectorization</td>
<td>-O2</td>
</tr>
<tr>
<td>Aggressive optimization</td>
<td>-O3</td>
</tr>
<tr>
<td>Maximize performance</td>
<td>-Ofast</td>
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### Additional Optimizations

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<th>Optimization</th>
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<tr>
<td>Aggressive unrolling</td>
<td>-unroll-aggressive</td>
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<tr>
<td>Disable improved precision floating divides</td>
<td>-no-prec-div</td>
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<tr>
<td>Enable vectorization</td>
<td>-vec</td>
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<td>Inter procedural Optimization</td>
<td>-ipo</td>
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<td>OpenMP®</td>
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<td>Profile generated optimization</td>
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<tr>
<td>Use optimized header definitions</td>
<td>-use-intel-optimized-headers</td>
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### Other Options

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<tr>
<th>Optimization</th>
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<tr>
<td>Floating point accuracy tuning</td>
<td>-fp-model</td>
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<td>Compile free form FORTRAN</td>
<td>-free</td>
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