

# Implementation Techniques for Numerical Methods in Atmospheric Models

ROBERT KLÖFKORN<sup>1</sup>, BEN JAMROZ<sup>2</sup>

<sup>1</sup>Institute for Mathematics Applied to Geosciences

<sup>2</sup>Technology Development Division

Computational Information Systems Laboratory

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# Asynchronous communication with MPI in HOMME (CAM-SE)

## Pack and Send

```
MPI_Waitall(  $\mathcal{L}_p^s$  ) ; wait for previously posted Isend
for  $q \in \mathcal{L}_p^s$  do
  for  $e \in \mathcal{E}_q$  do
    packData( e, q ) ;                               pack data to MPI message buffer
  end
  MPI_Isend( q ) ;                                   send data in message buffer to rank q
end
```

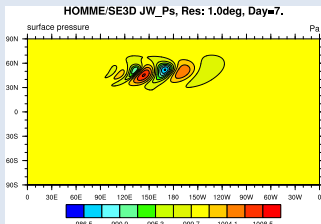
## Computation

might require algorithm restructuring

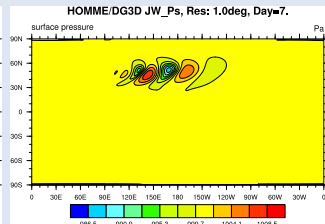
## Receive and Unpack

```
 $n_r \leftarrow 0$ 
while  $n_r < |\mathcal{L}_p^r|$  do
  ; check if msg is available, if yes then  $q$  contains the corresponding rank
  if MPI_Testany(  $\mathcal{L}_p^r, q$  ) then
    for  $e \in \mathcal{E}_q$  do
      unpackData( e, q ) ; unpack data from MPI msg buffer
    end
    reset MPI_Request for  $q$  to MPI_REQUEST_NULL  $n_r \leftarrow n_r + 1$  ; increase
    received counter
  end
end
```

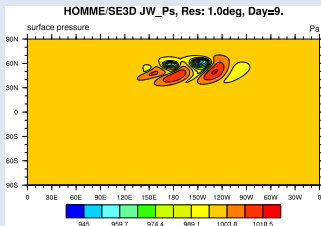
# Jablonowski-Williamson test case: surface pressure



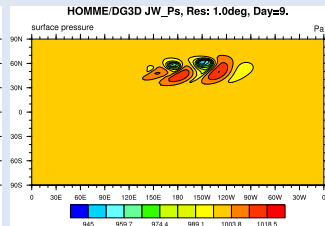
(a) SE (day 7)



(b) DG (day 7)



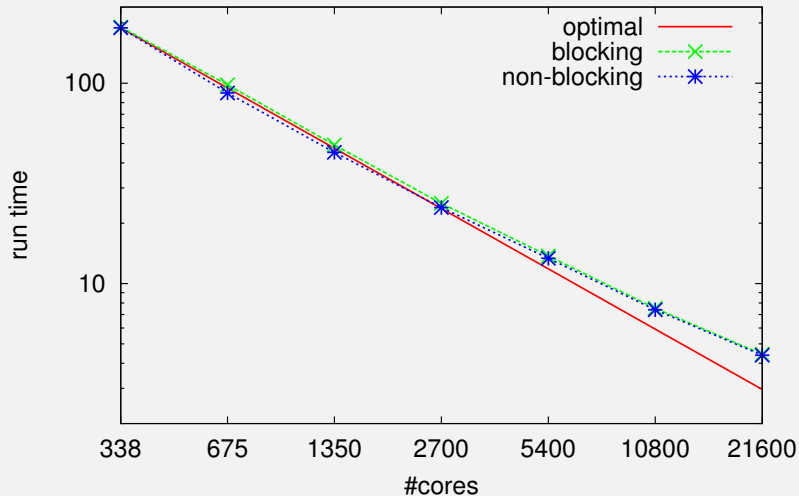
(c) SE (day 9)



(d) DG (day 9)

# SE strong scaling $n_e = 120$ , $np = 4$

## SE-ASPBARO-NP4-ne120



# DG strong scaling $n_e = 120$ , $np = 6$

