2D Coupling Adaptive Finite Element Models: Problems and Ideas

DEKLIM project ‚PLASMA'

2D self-adaptive FE atmospheric model,

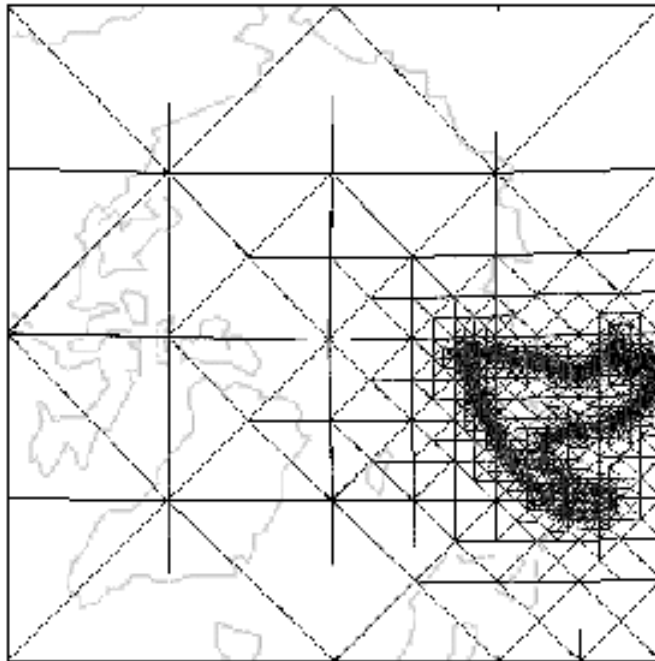physics currently: shallow water equations

components:

time-step $\Big\{$ parallel mesh adaption

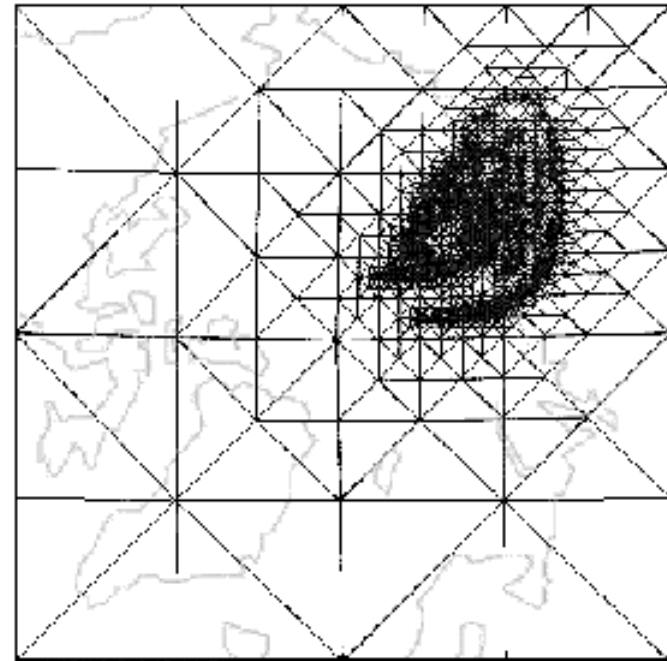   parallel linear solver

   local error estimation

Changing grid

•extensive re-meshing at each time-step
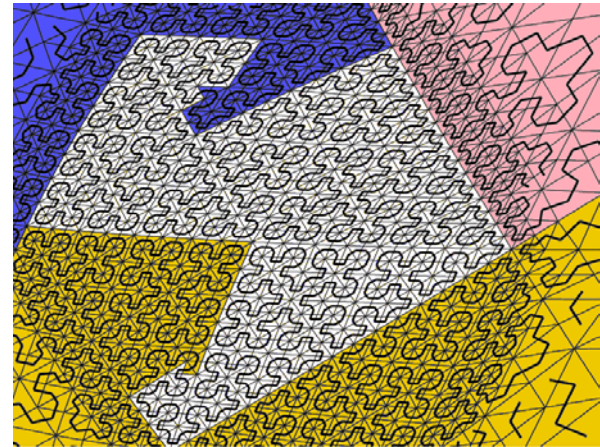
Element bi-sectioning on the Sphere

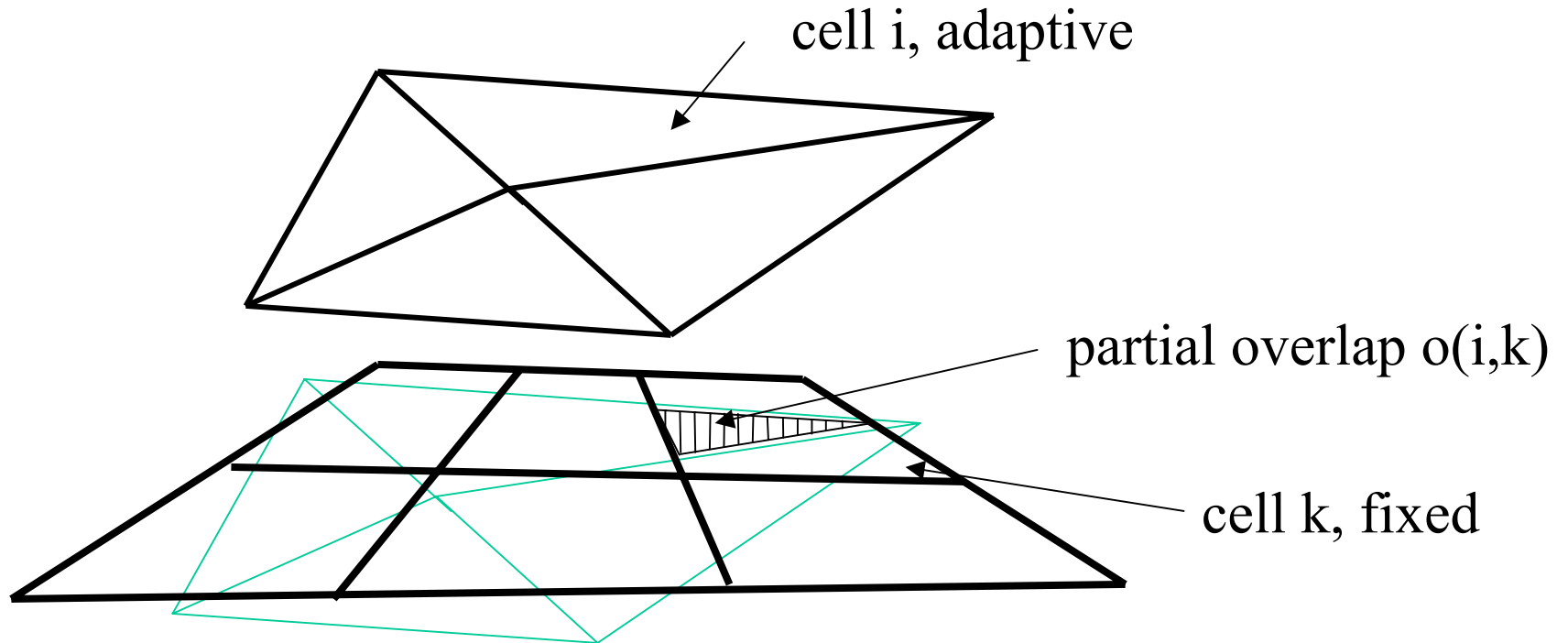- Space-Filling-Curve from mesh generator by bi-section refinement
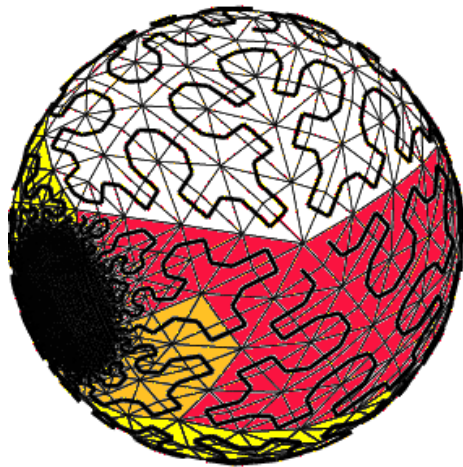
SFC on the sphere

SFC-partitioning

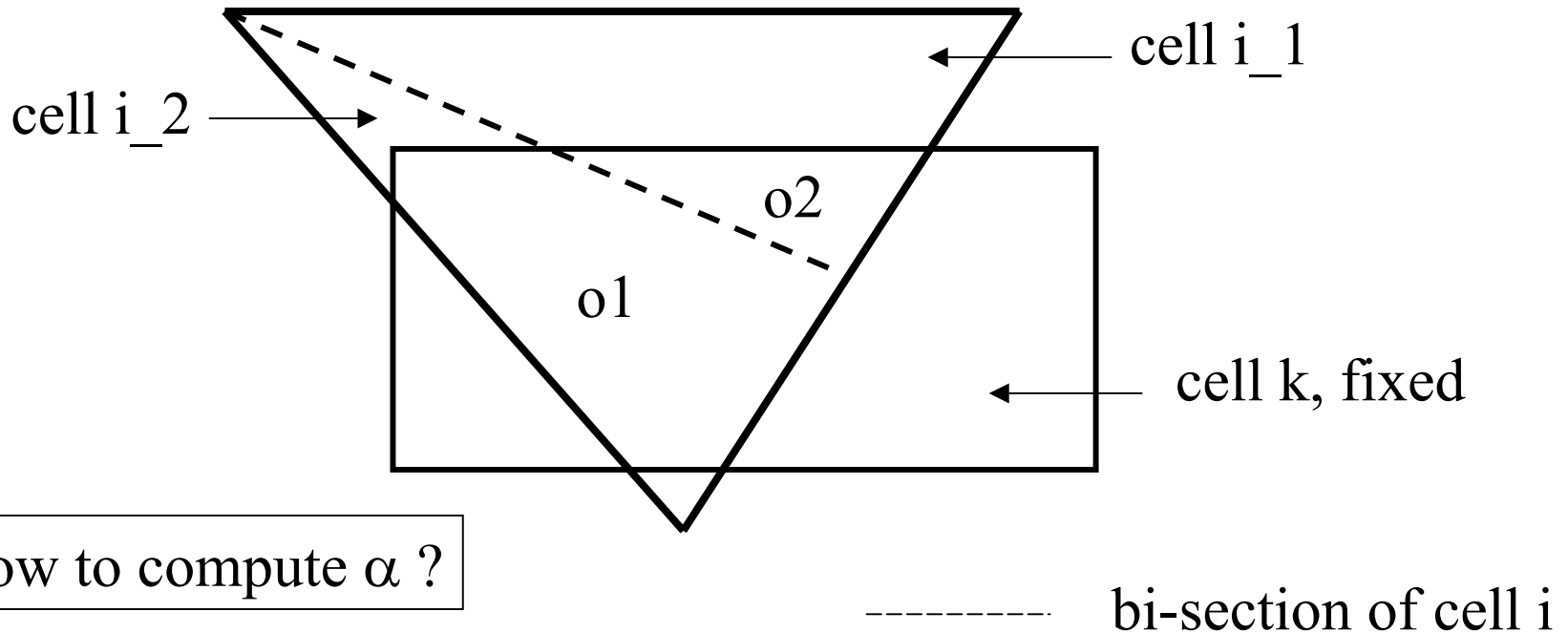# Coupling to a fixed grid model

cell i, adaptive

partial overlap o(i,k)

cell k, fixed

Overlap bi-section

coarsening : $o(i,k) = o(i\_1,k) + o(i\_2,k)$, known before refinement

refinement : $o(i\_1,k) = \alpha\, o(i,k)$, $0 <= \alpha < 1$, unknown
$o(i\_2,k) = (1-\alpha)\, o(i,k)$

cell i_1

cell i_2

o2

o1

cell k, fixed

how to compute α ?

--------- bi-section of cell i

Overlap bi-section

- overlapping cells k with cell i are known
➤ α can be computed w/o searching cells
- k cells geometry is fixed
➤ α can be computed w/o communication
- requires all k cells overlapping with coarsest mesh

Overlap computation

- precisely : by line-integration (SCRIP)
- roughly : by point-counting
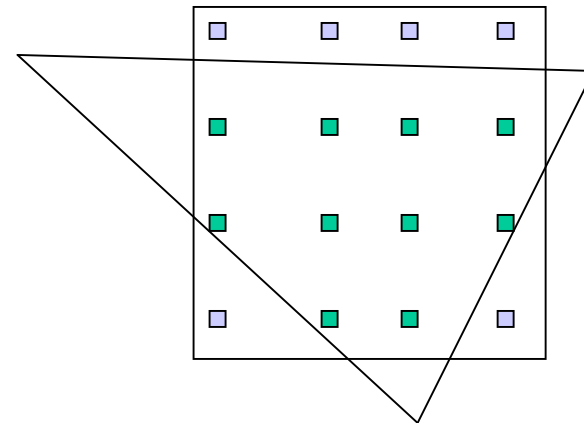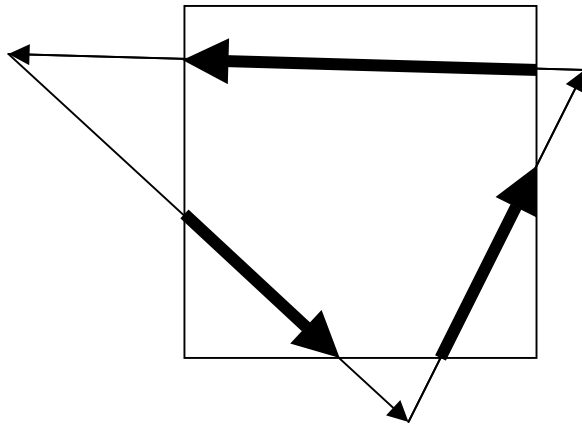
Future Problems

- Coupling of adaptive levels in stacked model

$\longrightarrow$ requires extensive search down the hierarchy of coarse elements