Tracking Biological Particles using Elcirc

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Particle Types

- Passive
  - Massless Tracers (virtual particles)
  - Sediment (density & size)
- Biological
  - Benthic – move relative to bottom
  - Pelagic – move relative to surface
  - Vertical migrators – diurnal migration
  - Passive

Biological Behaviors

- Benthic, Pelagic & Passive
  - Seeding location constraints
    - Location
    - Depth
  - Seeding depth

Biological Behaviors

- Vertical Migrators
  - Seeding location constraints
    - Location
    - Depth
  - Migration Characteristics
    - Upper and lower depth limits
    - Ascent – descent rates
    - Ascent – descent times
  - Implementation
    - Time of day target depths
      - Linear interpolation between targets

Biological Behaviors

- Seeding Conditions
  - Time of Year
    - Background condtions
      - Temperature and Salinity
    - Atmospheric forcing
      - Wind
  - Tide State
    - Spring – Neap
    - Ebb - Flood
  - Geophysical
    - Water depth
    - Bottom type
    - Exposure

Biological Behaviors

- Life stage behavior (abalone)
  - Egg – passive
  - Larva – active (e.g.. Settle in appropriate environment)
  - Mortality (10 – 14 days)

Particle Movement

- Velocity interpolated from Velocity Field
- ΔV_t w.r.t Time
  - Change in velocity at current location
- ΔV_p w.r.t Position
  - Change in velocity between positions at t and t+1/2

- $P_{t+1} = P_t + (V_t + \Delta V_t + \Delta V_p)t$

Particle Trajectory Testing

- Against constant velocity fields
  - Call field generator before particle tracking to regenerate field
    - Rotation
    - Translation
  - Can test against post processor streamlines

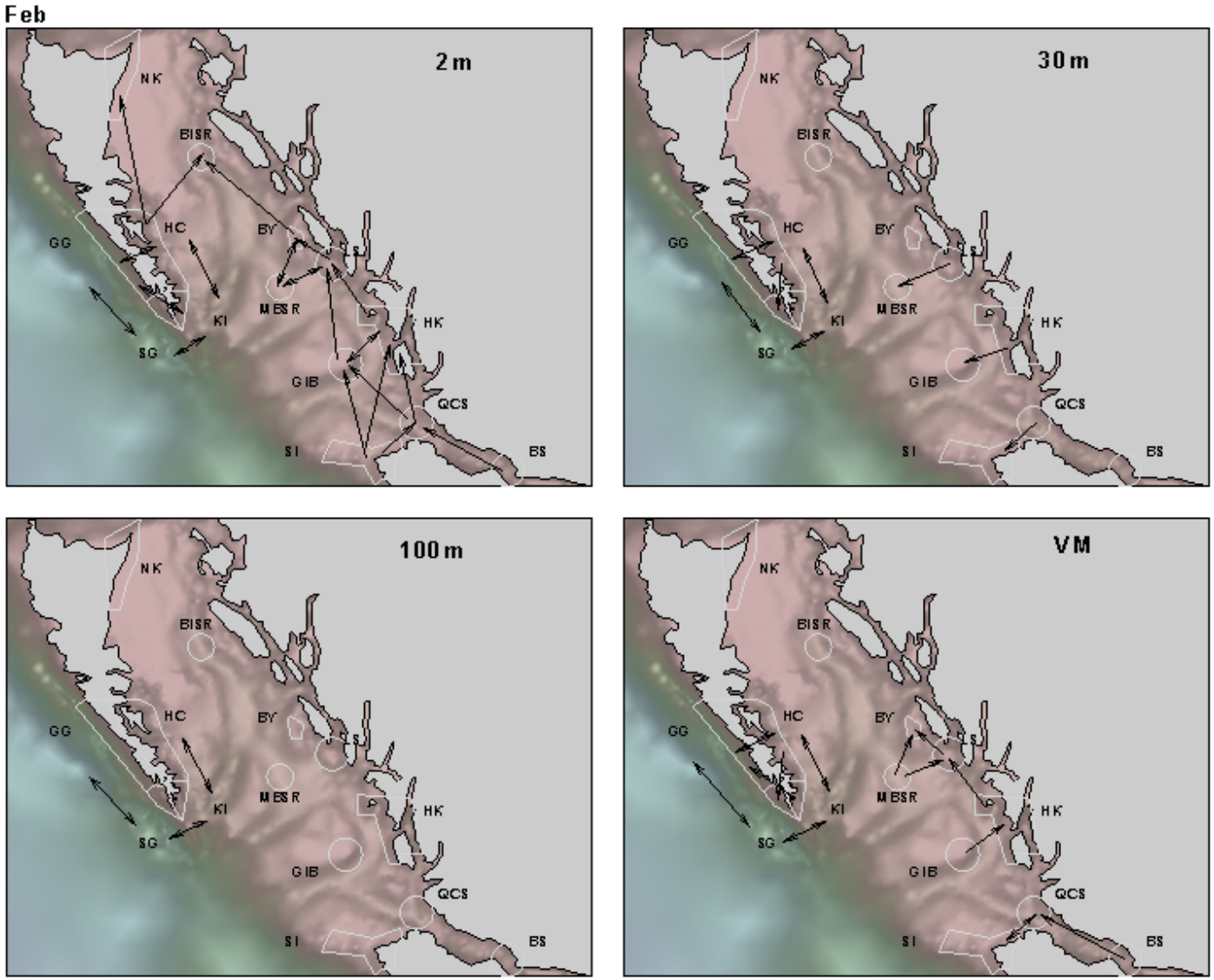
Seeding Strategies

- Large number of particles (5000)
  - Multiple insertion times
    - Different wind tide combinations
  - Grid within Area of Interest
    - Difficult to control No. of particles that pass all seeding criteria (eg max depth)
  - Random within Area of Interest
    - Exact no. of particles
    - Distribution may be uneven

Analysis

- Connectivity matrix
  - Count of particle originating in one area and terminating in another
- Track metrics for each particle
  - Distance traveled on path
  - Distance origin to termination
  - Average velocity
  - Duration

Presentation



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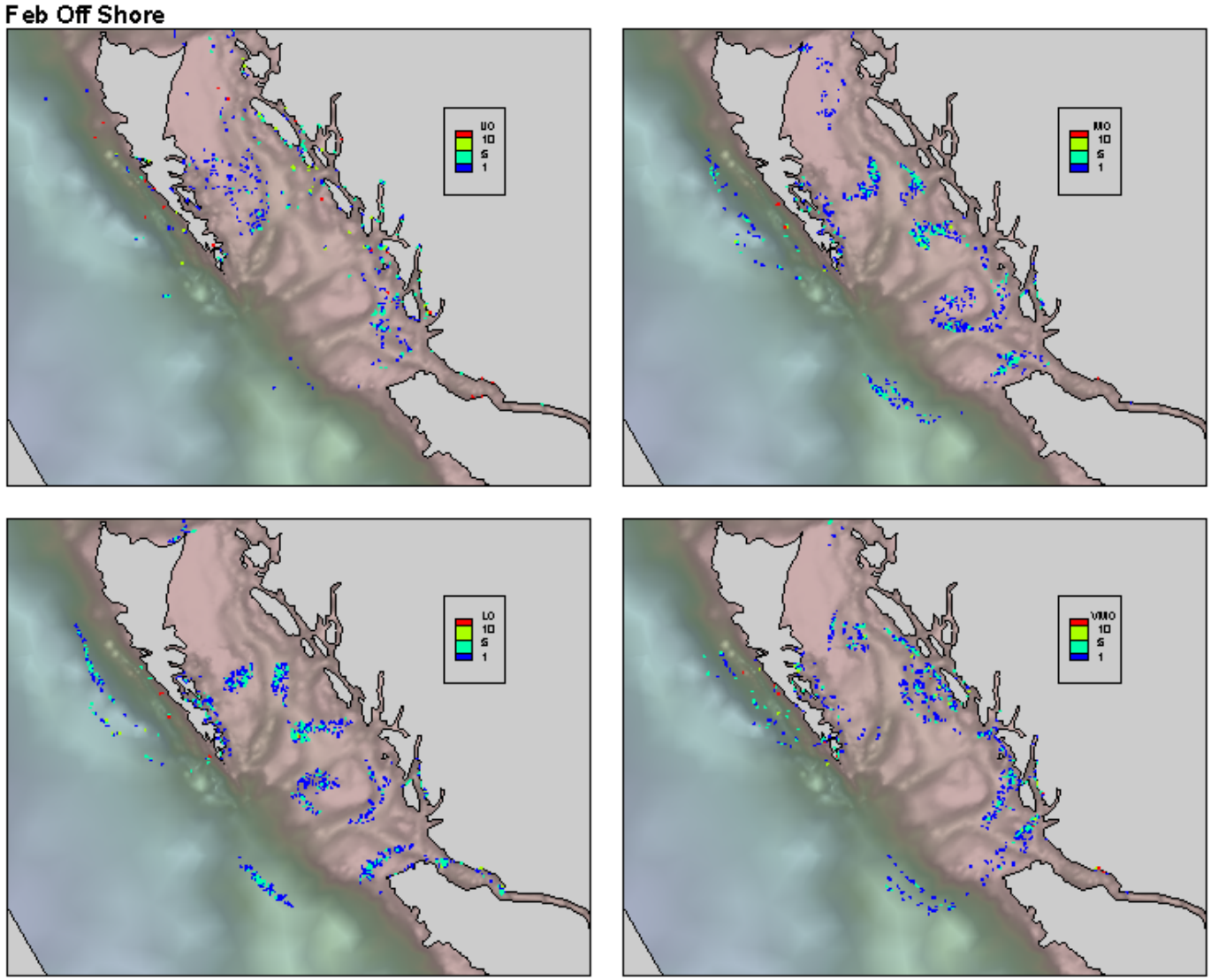

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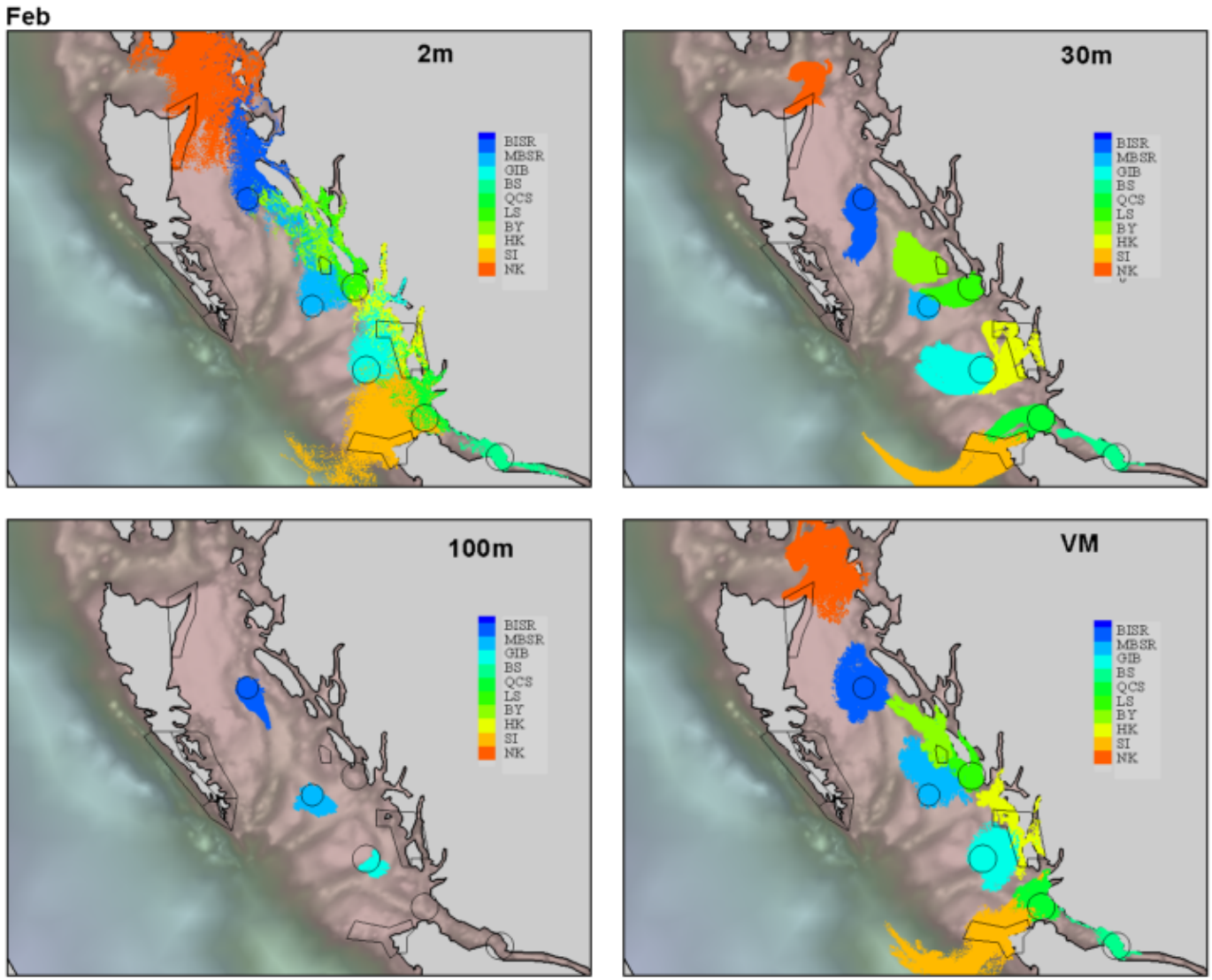
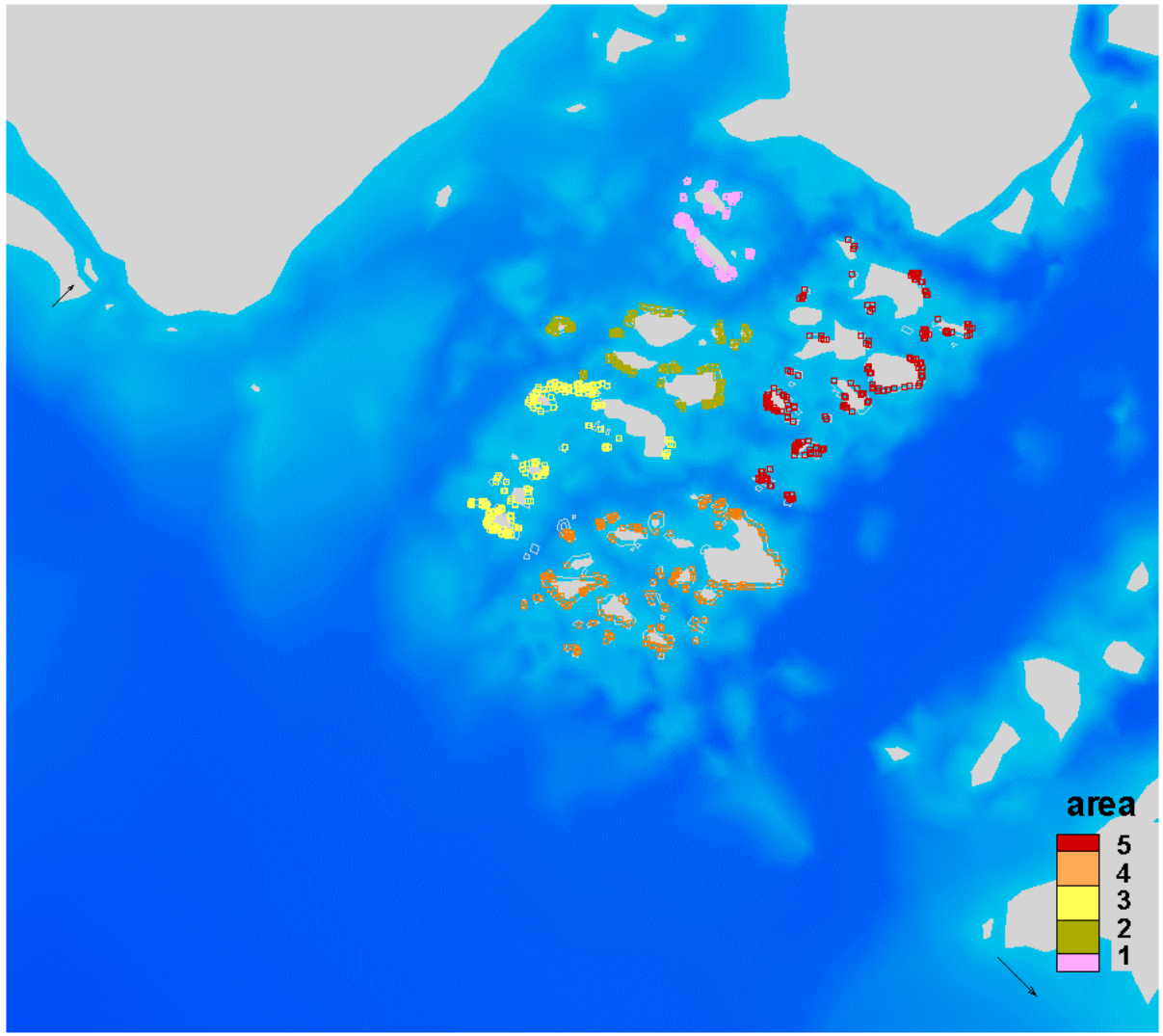
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