



Atmospheric Modeling in Cook Inlet and Prince William Sound (and Gulf of Alaska)

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What we do (on the modeling front) ...

We run the Weather Research and Forecasting (WRF) model* twice a day (0000 and 1200 UTC) to produce 48-hour forecasts for southcentral Alaska and the N. Gulf of Alaska.

- We write out results hourly, depicting the simulated three-dimensional atmosphere, frozen at an instant in time. Thus, each forecast results in 49 instantaneous 3-d views of the simulated atmosphere.

*WRF is a *numerical approximation* of the *physical approximation* of how we think the atmosphere works

SO..., How does this numerical approximation work?

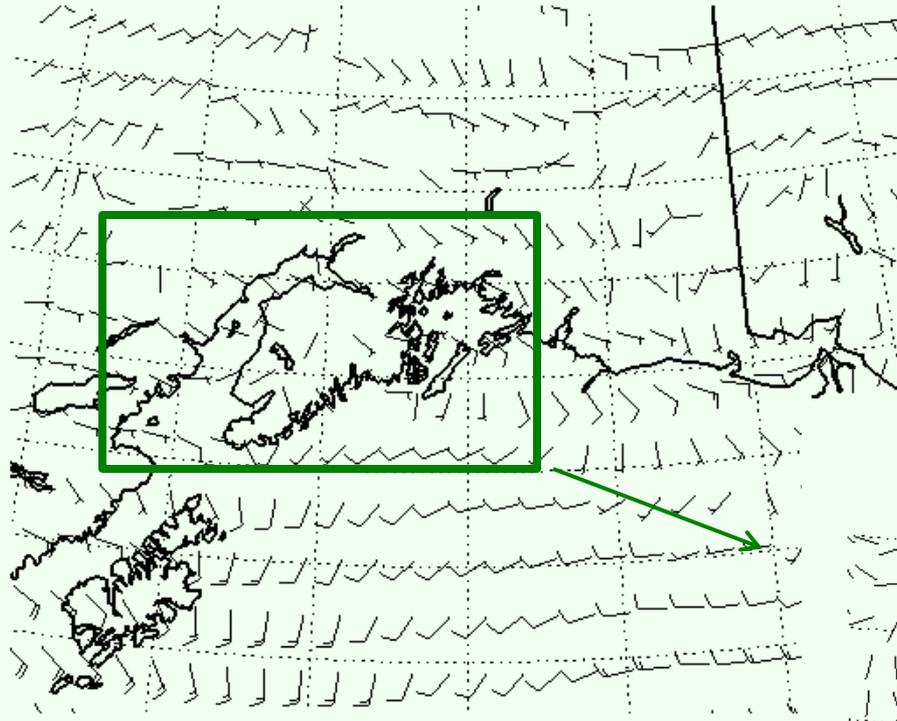
- **The WRF equations are solved for each time step on each point of a 3-d grid.**
- **Our version uses nested horizontal grids**
 - **12 km x 12 km outer grid (coarse grid)**
 - **4 km x 4 km smaller, nested inner grid (fine grid)**
 - **Vertical coordinate is pressure.**
- **The model integrates first on coarse grid, then on fine grid, repeating this process each time step till completion time.**

How does this differ from what the NWS/NCEP does?

- The PWS-WRF is run on a finer grid (4-km) and uses a different physics core (ARW) than the NAM—the NWS’s WRF variant.
- Indeed, PWS-WRF uses the NAM for ICs and BCs.
- Neither WRF variant is “better”, they are different tools for slightly different jobs.

Coarse Grid: 12km x 12km

accum precip(mm,shaded) 10m winds(kt)

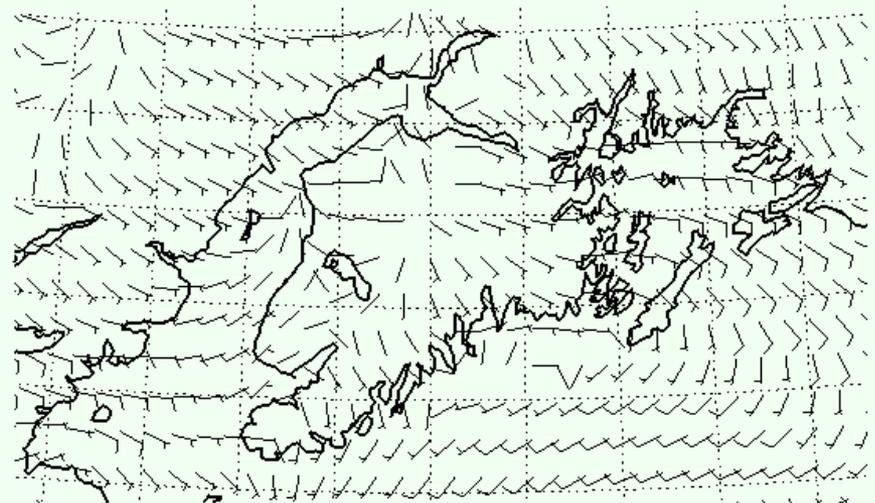


valid 03/25/10 00Z (Mar/24/2010 03pm local)

Coarse grid covers much of southern mainland AK and the N Gulf of Alaska.

This provides the lateral boundary conditions for the Fine grid (4km x 4km $\Delta x, y$)

accum precip(mm,shaded) 10m winds(kt)

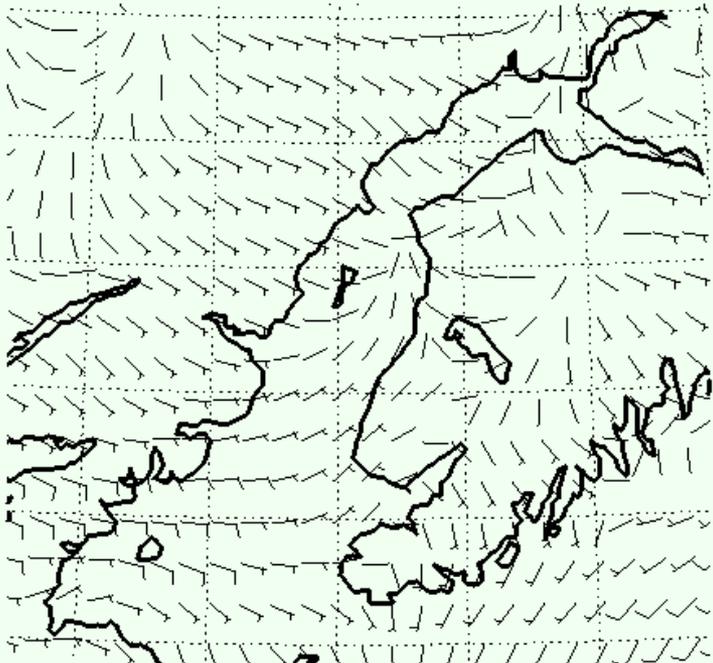


valid 03/25/10 00Z (Mar/24/2010 03pm local) 00 hr

For display purposes, we decompose the fine grid into 2 domains.

Decomposed fine grid can show more detail in each sub-domain

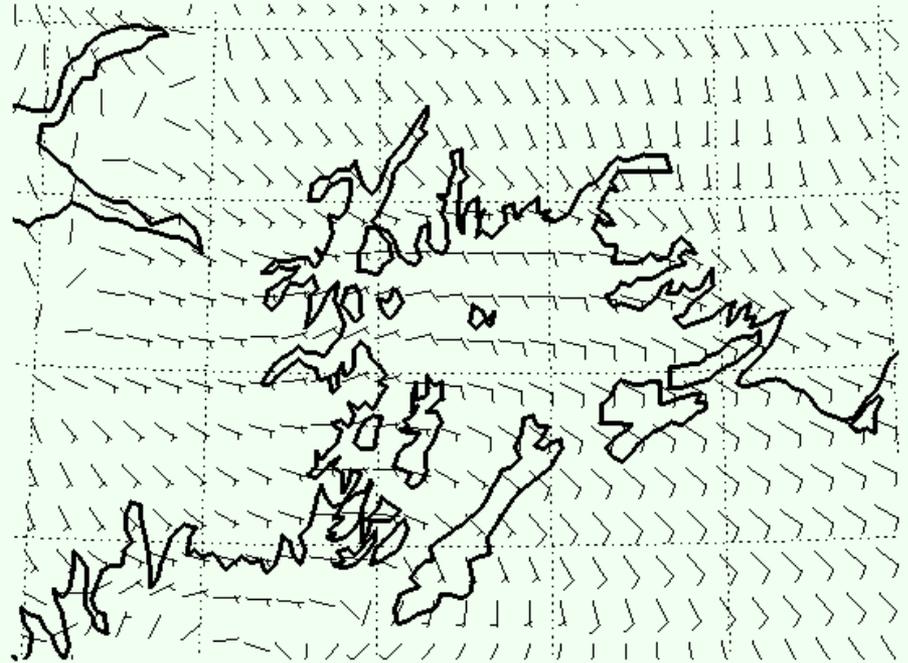
accum precip(mm,shaded) 10m winds(kt)



valid 03/25/10 00Z (Mar/24/2010 03pm local) 00 hr

Cook Inlet

accum precip(mm,shaded) 10m winds(kt)



valid 03/25/10 00Z (Mar/24/2010 03pm local) 00 hr

Prince William Sound

Some Points to Note:

- Even though the sub-domains CI and PWS exist for analysis and display purposes, *they are really both parts of the fine grid.*
- The model runs over land as well as water (terrain-following coordinate system), so the entire rectangular area within the grid boundaries is covered by the computational grid.
- WRF has a complete surface package (soil moisture, snow cover, ET, etc.), full multi-stream radiation model, and complete cloud microphysics.

What does this version of WRF predict?

Predicted 3-d variables:

horizontal and vertical winds
temperature
geopotential height (pressure-like variable)
mixing ratios of cloud ϕ variables:
rain
cloud droplets
hail
graupel
snow species
radiative fluxes

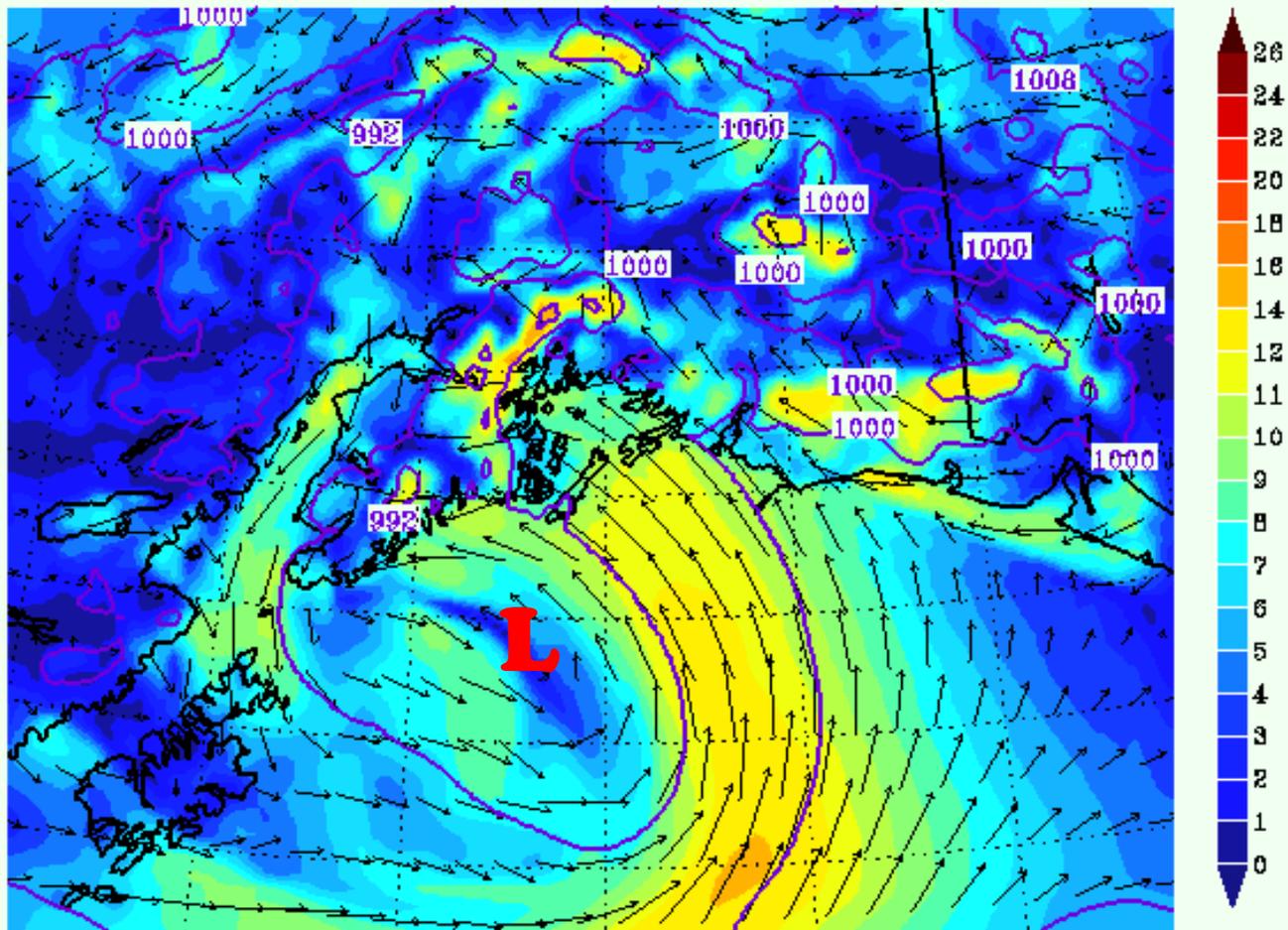
+
others

Predicted 2-d variables:

accumulated precipitation
surface air temperature
surface pressure
skin temperature
surface radiation (long & short wave)
albedo
+
others

Some Examples:

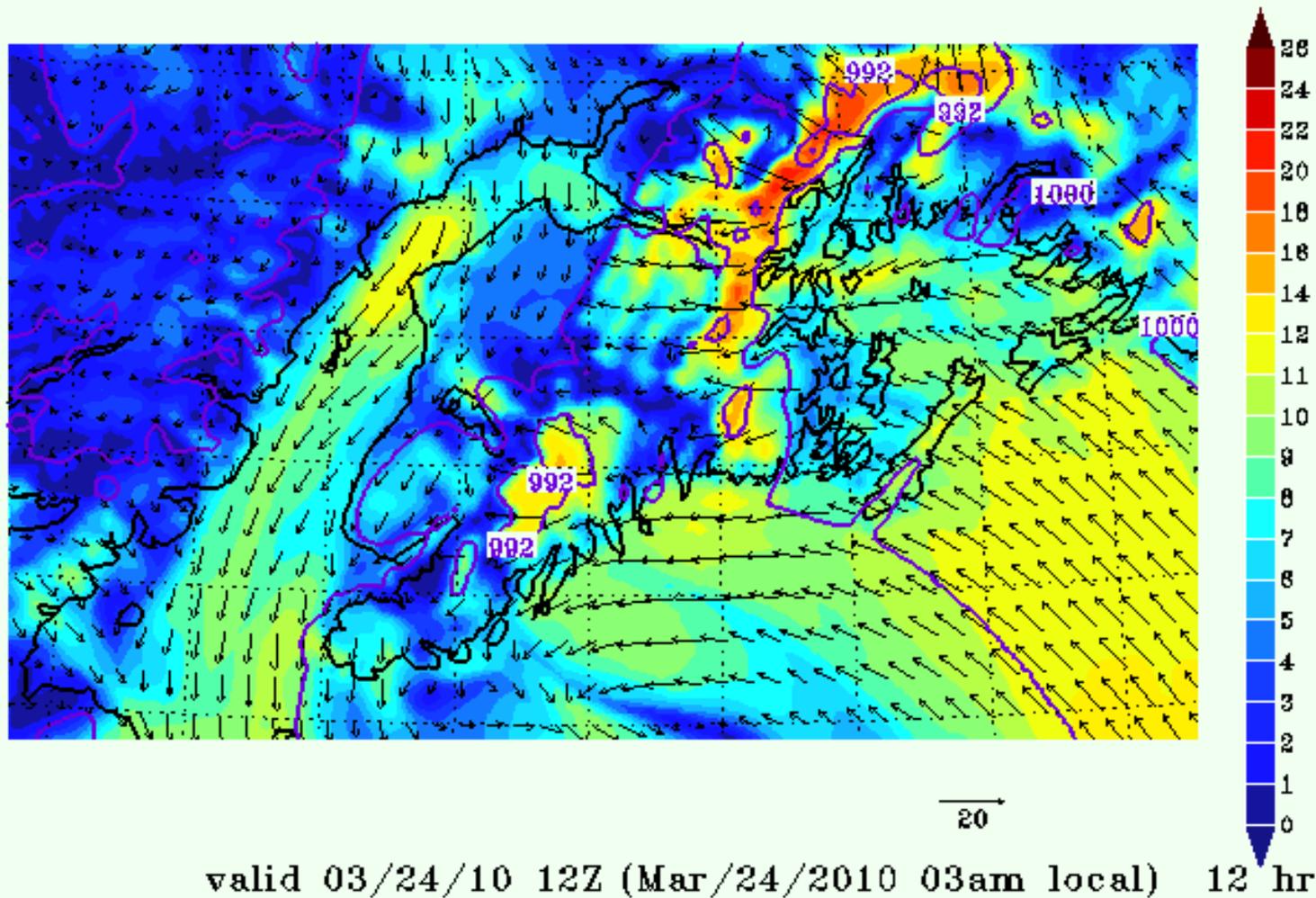
10m wind (m/s,shaded) sea level press.(mb,contour)



valid 03/24/10 12Z (Mar/24/2010 03am local) 12 hr

Coarse Grid

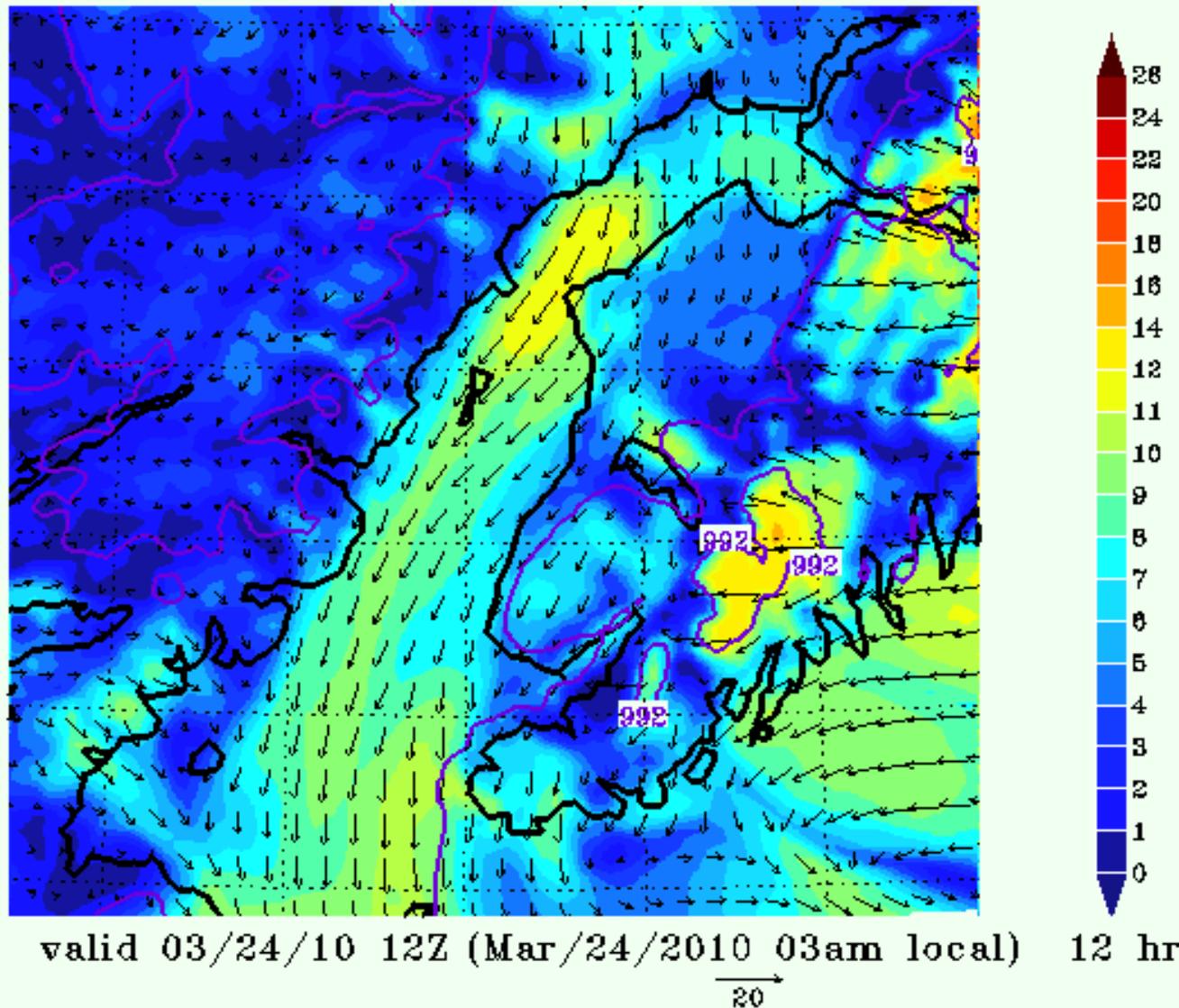
10m wind (m/s,shaded) sea level press.(mb,contour)



Full fine grid

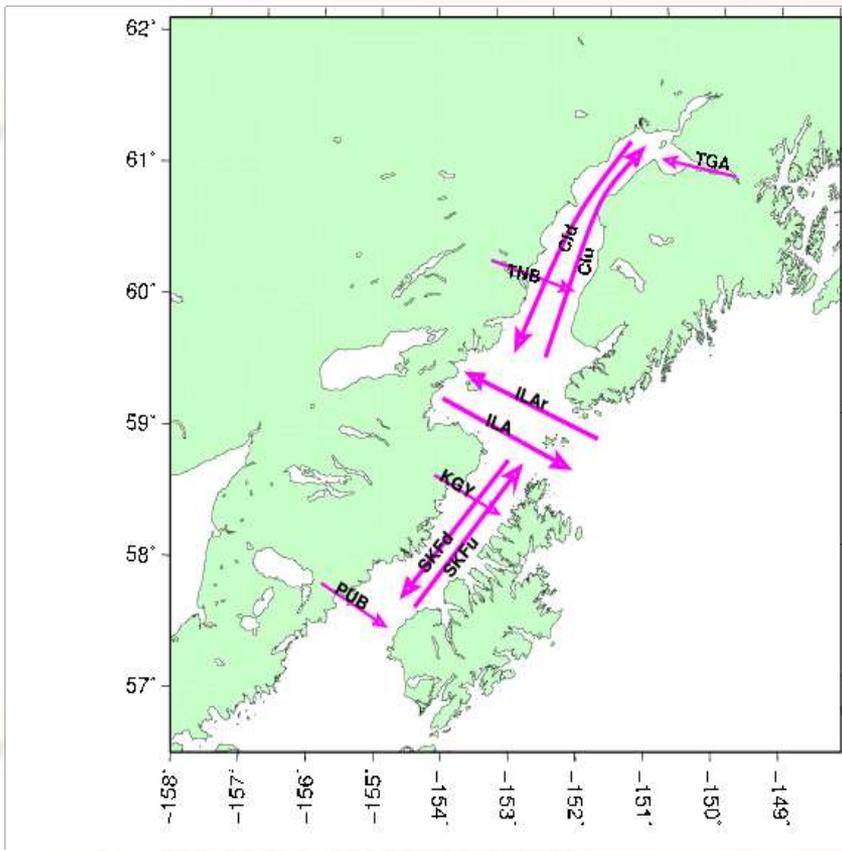
Alaska

10m wind (m/s,shaded) sea level press.(mb,contour)



Fine Grid, Cook Inlet

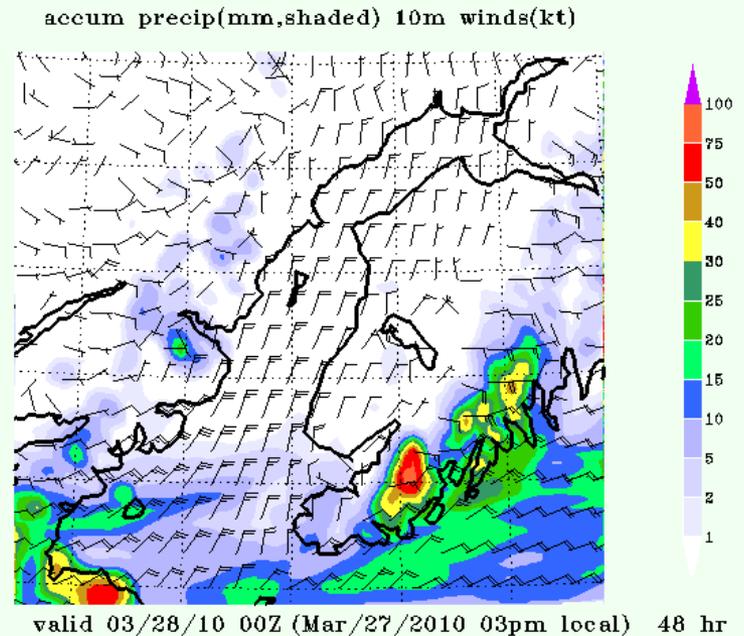
Alaska



Under CMI-supported work (2003-2006), the AEFf identified several high-wind (jet) regimes in Cook Inlet.

The previous example was a marginal “Cld” or Cook Inlet down-channel event

Another useful product is the accumulated precipitation (2-d). To right is 48-hr accumulated precipitation from WRF for CI region (different timeframe).



Forecast
Alaska

An aerial photograph of a mountain range, likely the Sierra Nevada, showing rugged peaks and valleys. The image has a blue tint. The text is overlaid on the upper portion of the image.

Future work will be considered in group discussion

That's All, Folks