Smart climatologies for preparation and planning of hazardous release

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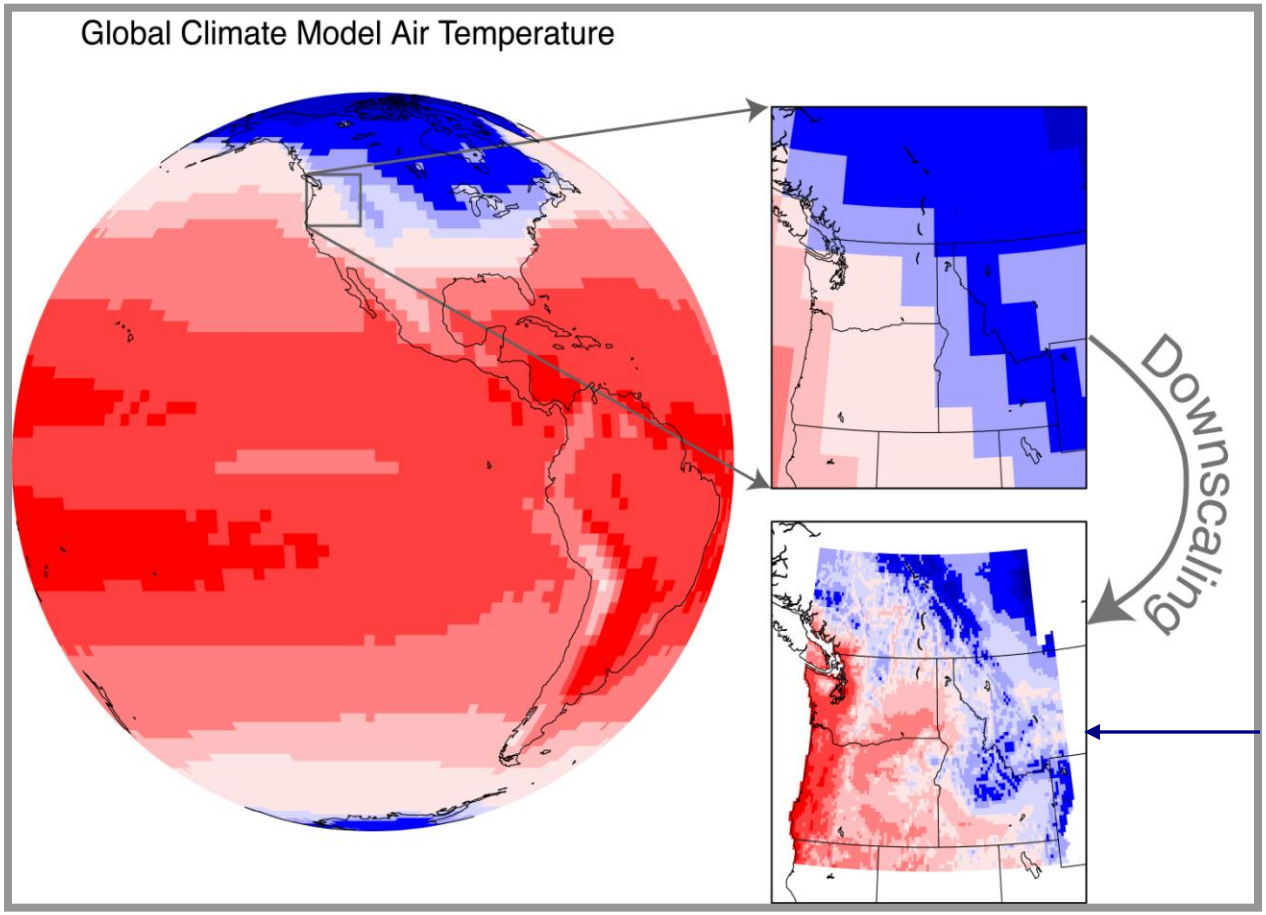
Model based climatologies

- ✓ Provide 4-dimensional fields and maps.
- ✓ Fill in when observations are missing.
- ✓ Global climatologies, public or proprietary, available: NCAR/NCAP Reanalysis Project, ERA 40, JMA, MERA, etc.
  - ➢ Too coarse resolution (0.5º to 2.5°, 6-hourly) for certain applications.

Dynamic downscaling

Global scale data mapped to local region while adding small scale variability

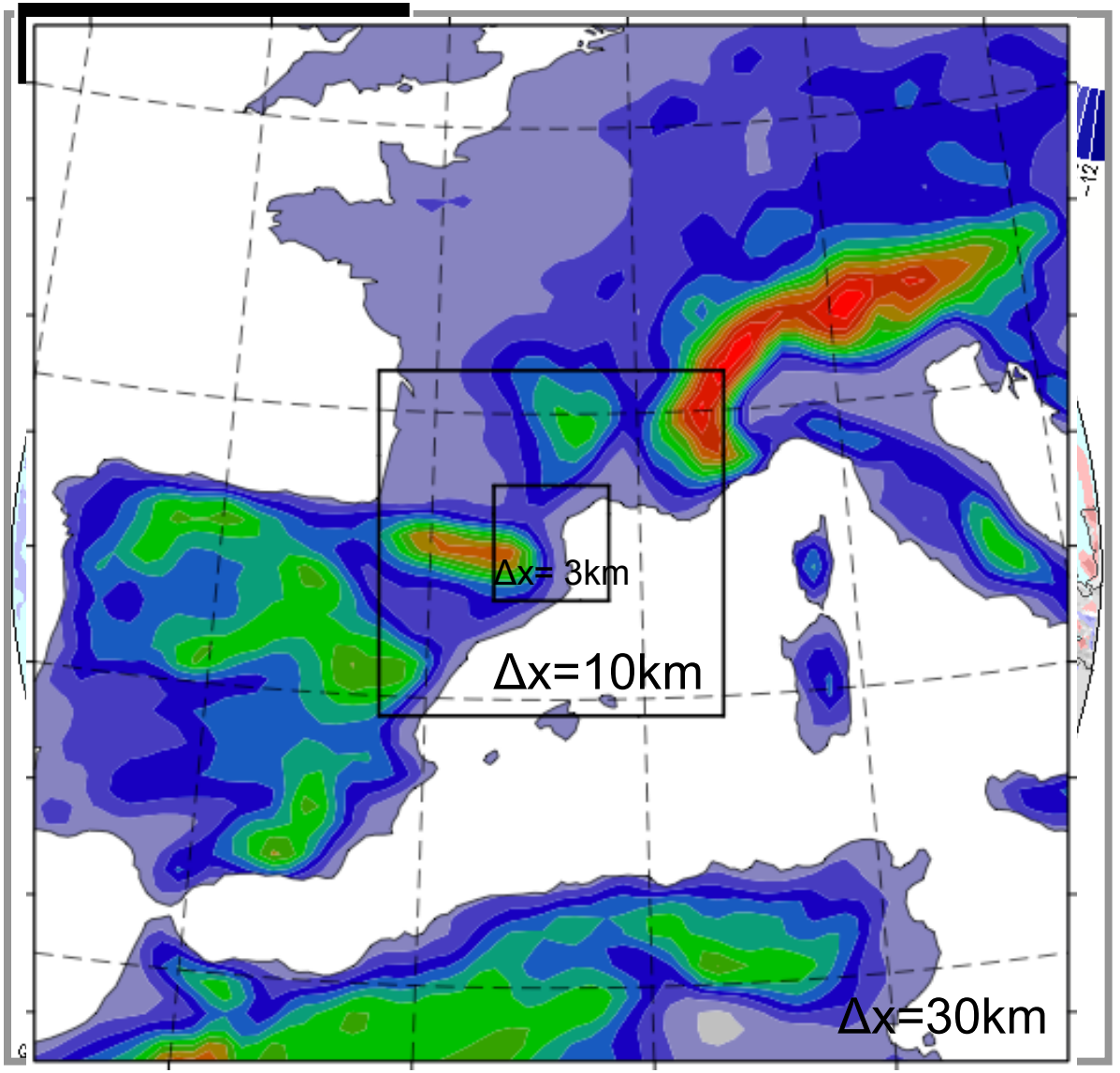


Courtesy Cliff Mass, Univ. Washington

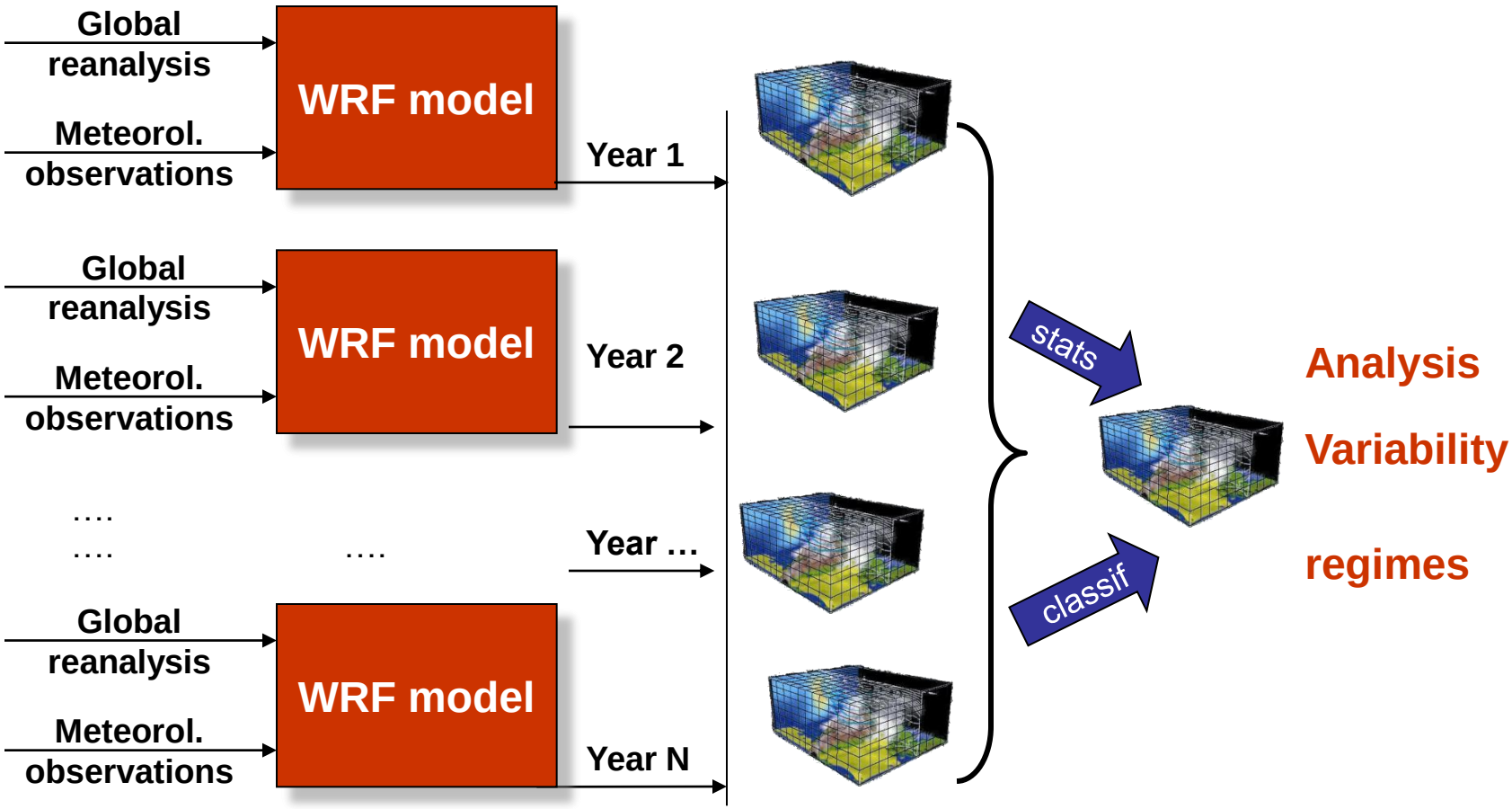
Dynamic Downscaling with Regional Models

NCAR

- Regional model "embedded" within a global model.
  - Global model constrains regional model.
  - Regional model defines small scale features.
  - Information only passed from global model to regional model.



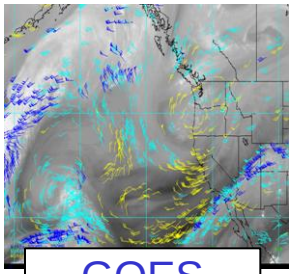
Regional Climatographies by Dynamical Downscaling

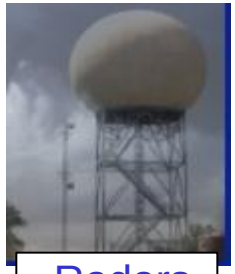


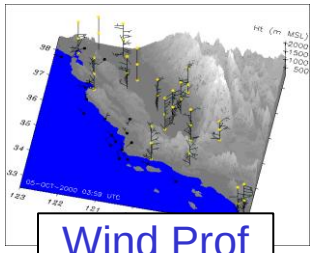
CFDDA - Continuous Data Assimilation

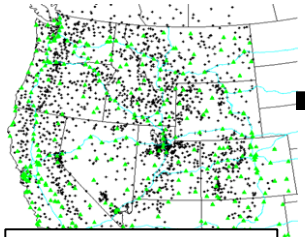
NCAR

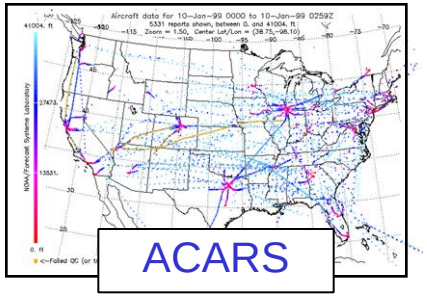

All WMO/GTS


GOES

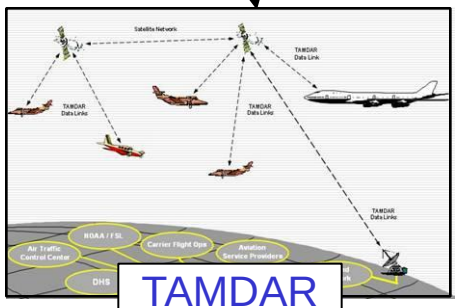

Radars


Wind Prof


MESONETs


ACARS

Etc.


TAMDAR

CFDDA

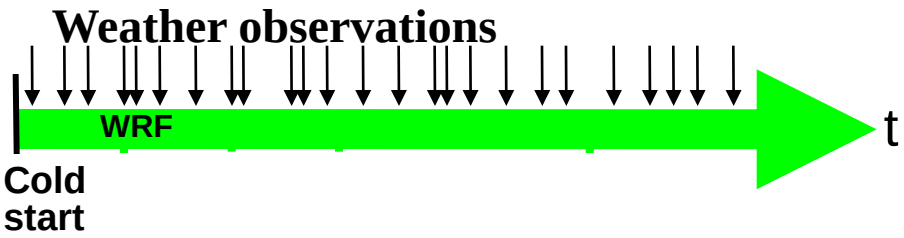
Regional-scale model, based on **WRF / MM5**

Modified WRF/MM5:

$Dx/Dt = \ldots + W\,(x_{obs} - x_{model})$

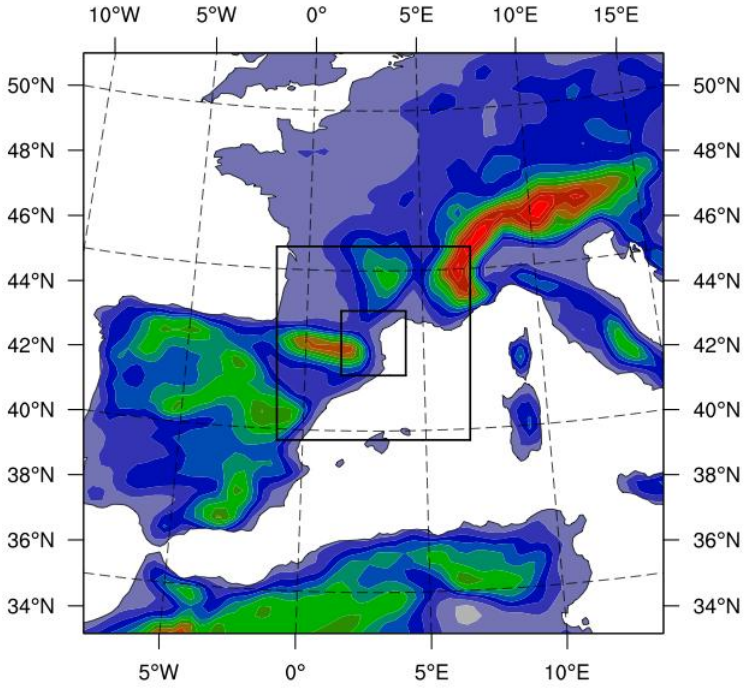
where x = T, U, V, Q, P1, P2 …

W is weight function



WRF Configuration

1 month x 20 years (1987-2006)



WRF 3.0.1.1, 3 domains: **30/10/3.3km**, **hourly output**

66x66x39 grid points**, first 5 levels: 2m, 6m, 10m, 18m, 36m**

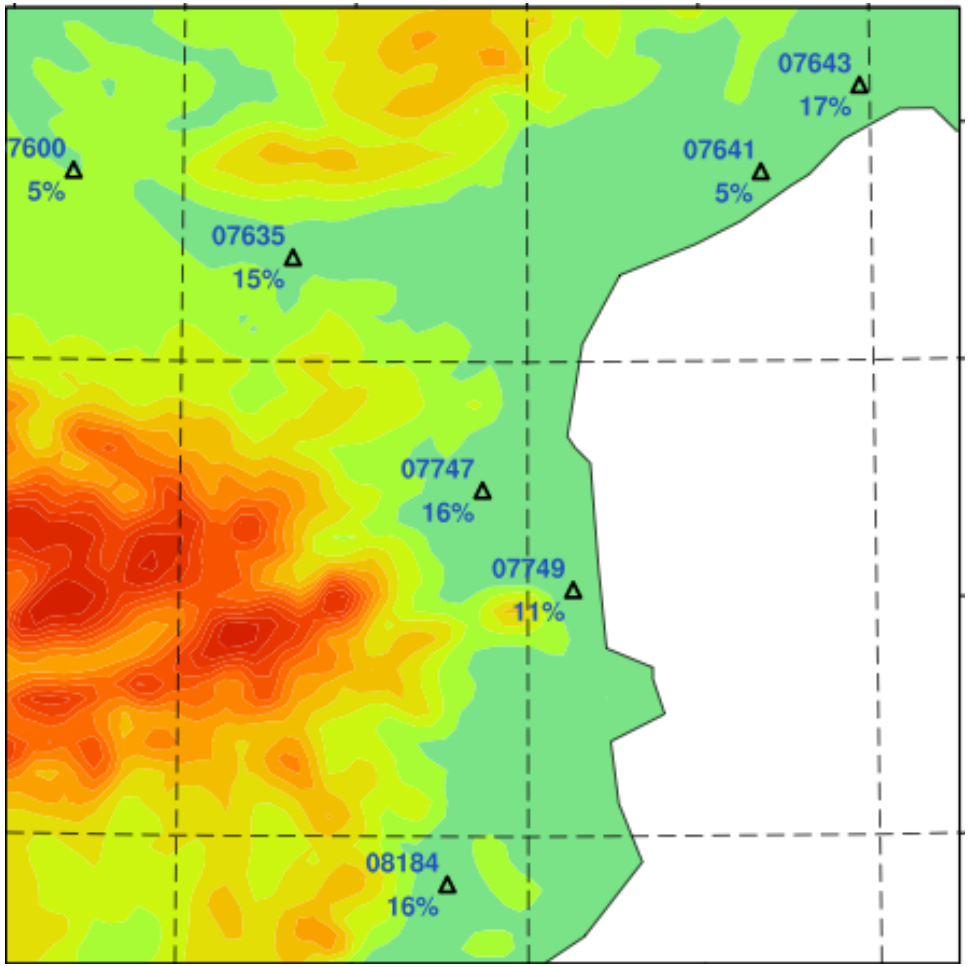
Physics: Lin et al., PBL: Yonsei University,

Kain Fritsh Cumulus parametrization (D1 & D2 only)

NOAH land surface, RRTM / Dudhia radiation,

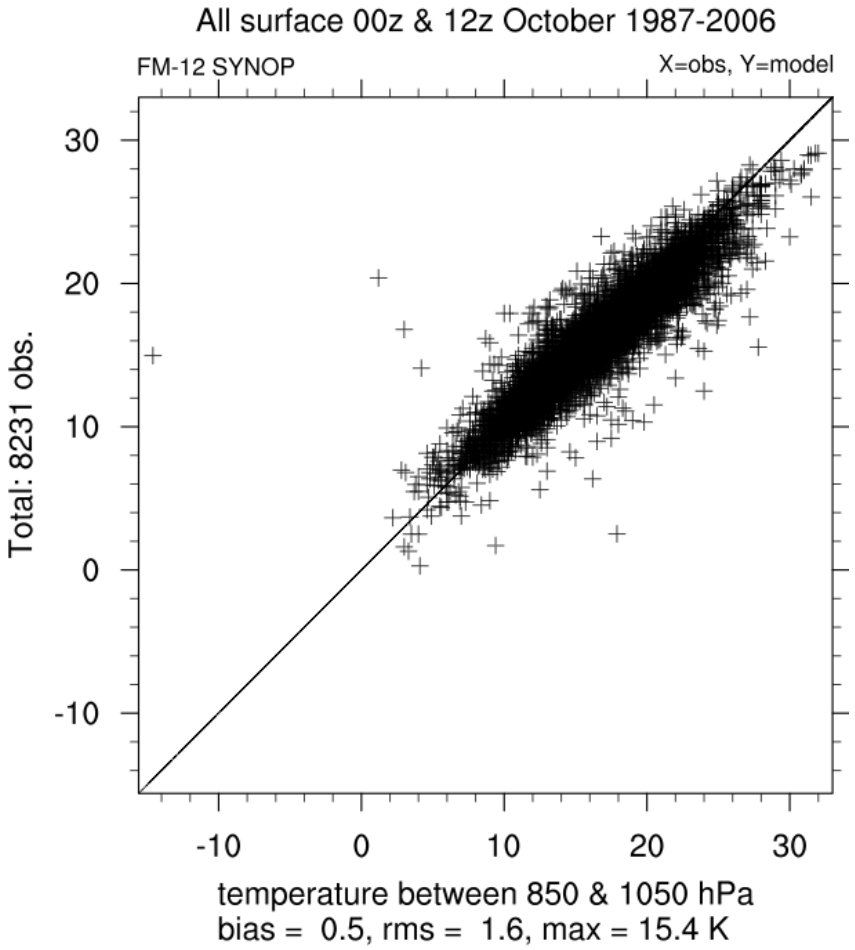
Simple diffusion, KM 2D Smagorinsky

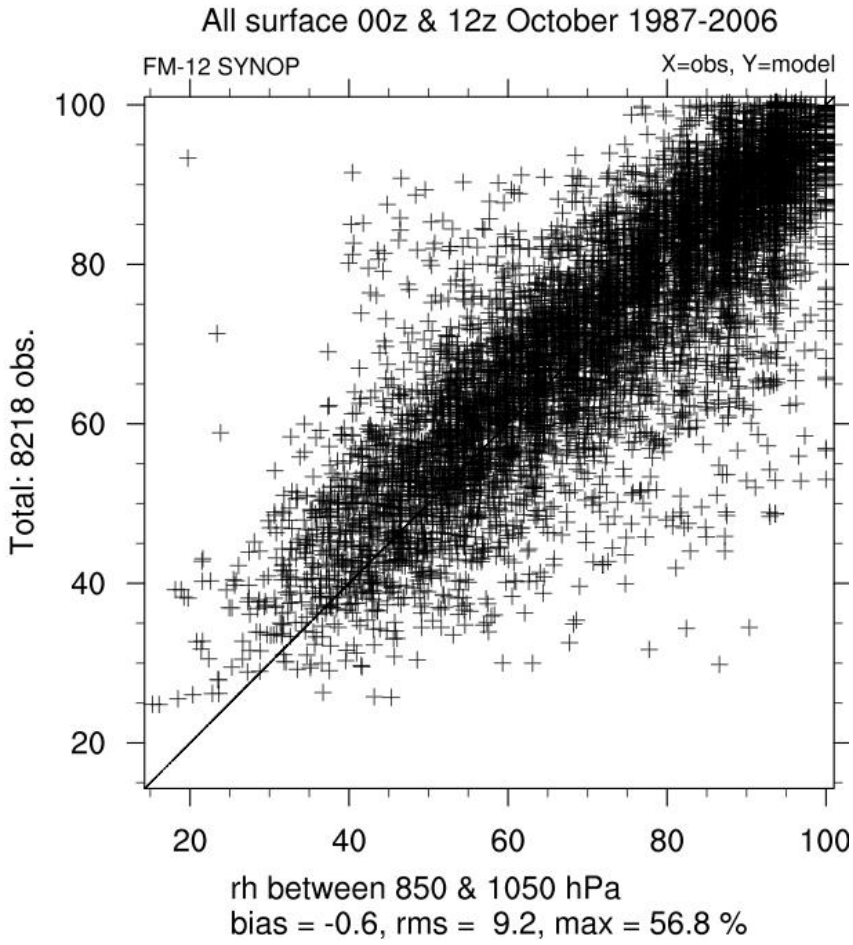
Surface stations coverage Domain 3 (3.3km)



Reporting surface stations at 12z in October 1987-2006 (5% quantile)

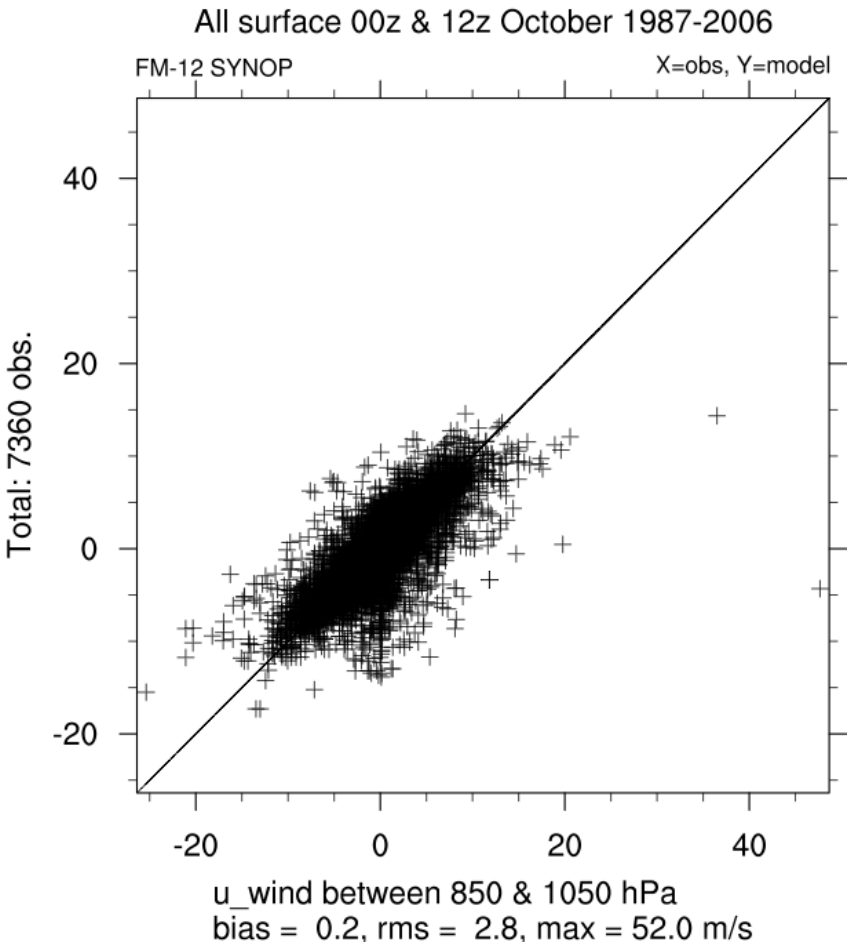
sfc mass analysis fit to obs

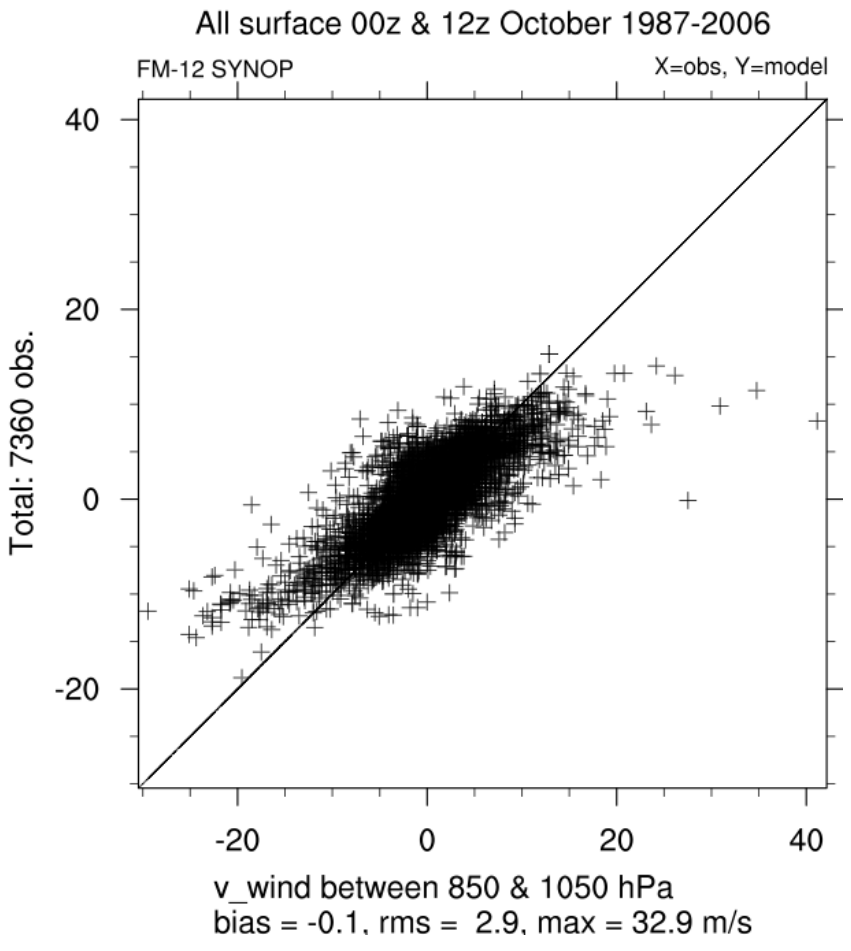




Surface Verification Domain 3 at 00z and 12z October 1987-2006
X = obs. Y = model, left = Temperature, right = Humidity

sfc wind analysis fit to obs



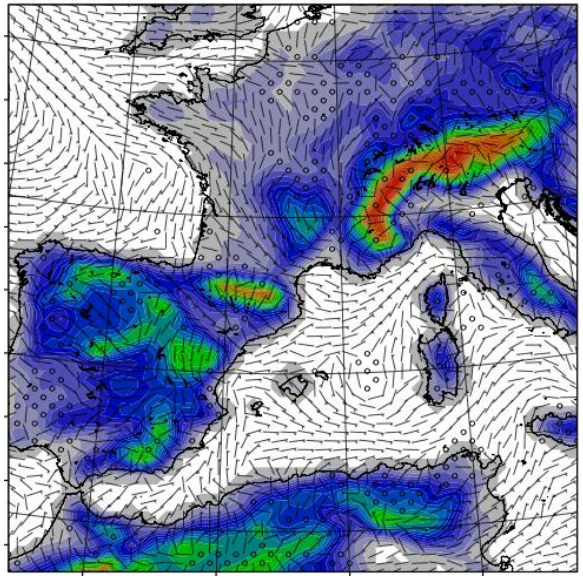


Surface Verification Domain 3 at 00z and 12z October 1987-2006
X = obs. Y = model, left = U-wind, right = V-wind

SOMs classification

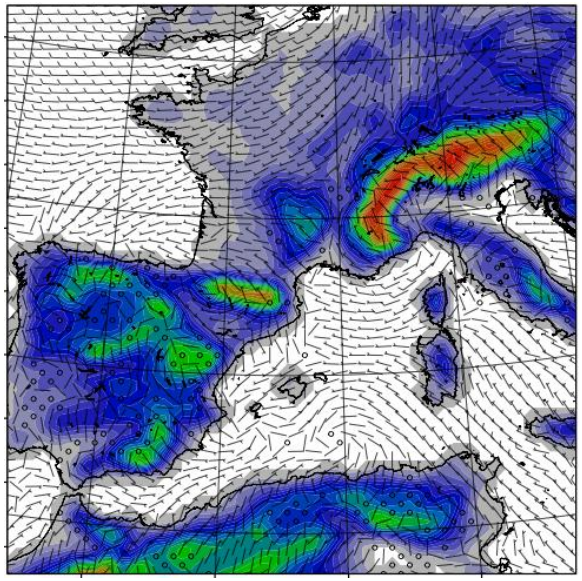
NCAR

46%



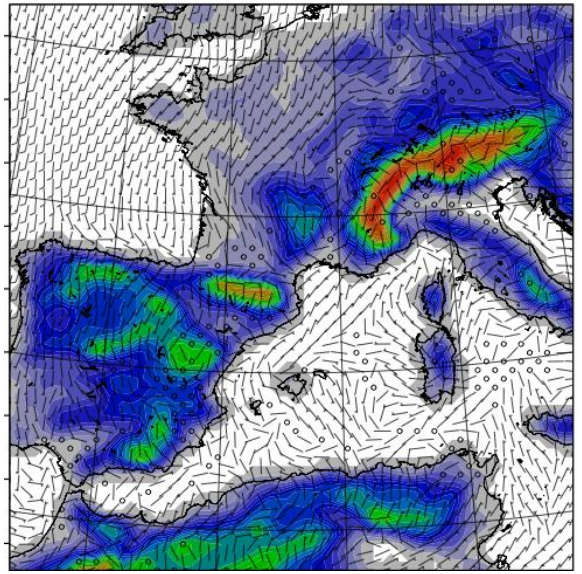
1994/10/15 12z

32%



1995/10/01 12z

22%



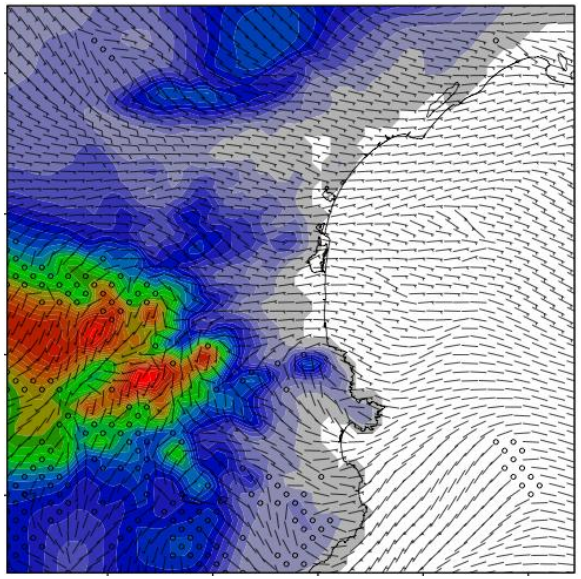
2001/10/14 12z

SOM analysis of large scale (domain 1) 10-meter wind. Most representative day and frequency of occurrence for the first 3 patterns over 20 years*31days*24 hourly = 14,880 WRF output files.

SOMs on Domain 3

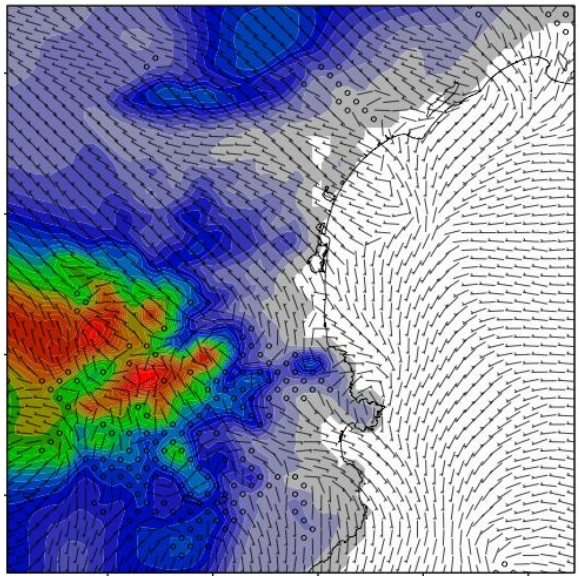
NCAR

46%



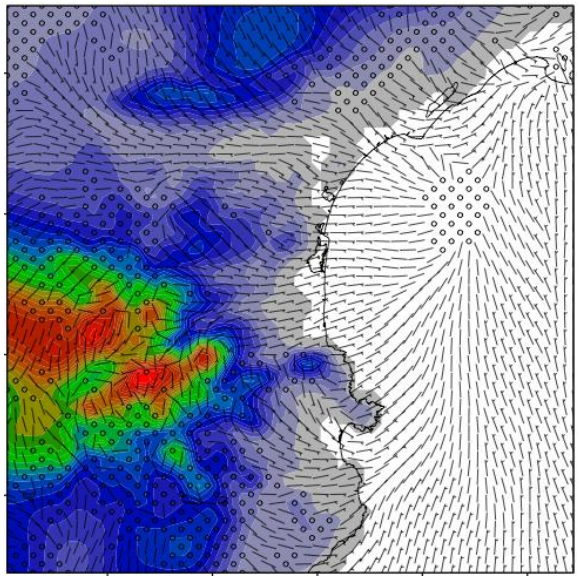
1994/10/15 12z

32%



1995/10/01 12z

22%



2001/10/14 12z

10-meter wind fine scale (3.3km) wind analysis for the three most representative days of the SOMs large scale classification.

Summary

- Regional model based climatologies offer both spatial and temporal resolution at reasonable accuracy.
- High computing cost (6000 CPU*Hours) and storage (600 Gb).
- SOMs classification can extract statistically representative days without averaging fields.

➢ Next step: T&D climatologies and classification.

T&D climatologies