INTEGRATION OF GLOBAL CLIMATE DATASETS WITH MESOSCALE MODELS THROUGH DATA ASSIMILATION FOR REGIONAL CLIMATE SERVICES

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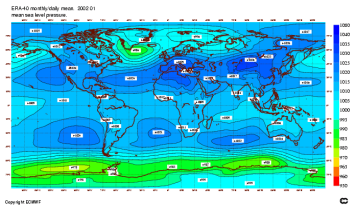
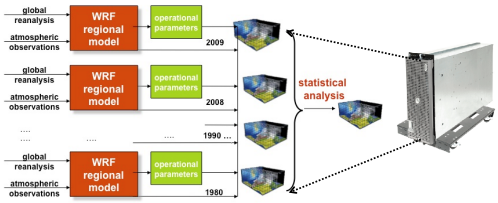
INTRODUCTION: The Climatology of Operational Parameters (**CLIMOPS**) is a new regional climate analysis toolkit issue from a US-French collaboration that aims at integrating 30 years of atmospheric and oceanic observations into fine scale gridded regional climate variables. The toolkit generates "on demand" large databases of gridded atmospheric parameters at high resolution, tailored to the specific needs for regional climate information of governmental and defense agencies.

CLIMOPS: The system takes advantage of the **zooming** and **relocation** capabilities of the embedded domains that is found in the community Weather Research and Forecast (**WRF**) model. The WRF regional model is applied to dynamically downscale **NNRP** and **ERA40** global reanalyses and to generate long records, up to **30 years**, of **hourly gridded data** over 200km^2 domains at **3km grid increment**. To insure accuracy, observational data from the NCAR ADP historical database are used in combination with **the Four-Dimensional Data Assimilation** (FDDA) techniques to constantly nudge the model analysis toward observations. The **WRF** atmospheric model is **coupled** to the community regional wave height model **WaveWatchIII** (WWIII). The combination of atmospheric and oceanic models allows the creation of **regional climate** information that is **consistent** both with **global atmospheric** and **oceanic circulation**, as well as local **observations**.

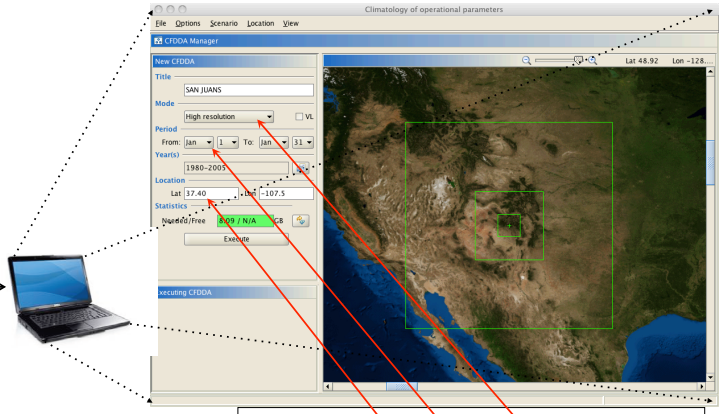


Input data are from NCEP/NCAR (NNRP) or ECMWF (ERA) reanalysis and Obs

FUNCTIONALITIES: The model grids can be **relocated** anywhere in the **world** by simple **point and click commands** through a **graphical interface** that was developed with input from users of both French and US agencies. Users can, with the same interface, **visualize**, **download** or **print** the physical and statistical information derived from the model-based **climatologies**. The system takes advantage of the high numerical efficiency of the **parallel** version of **WRF** and **WWIII** models and run autonomously on a multi-processor **workstation**, at a fractional cost of super-computers.



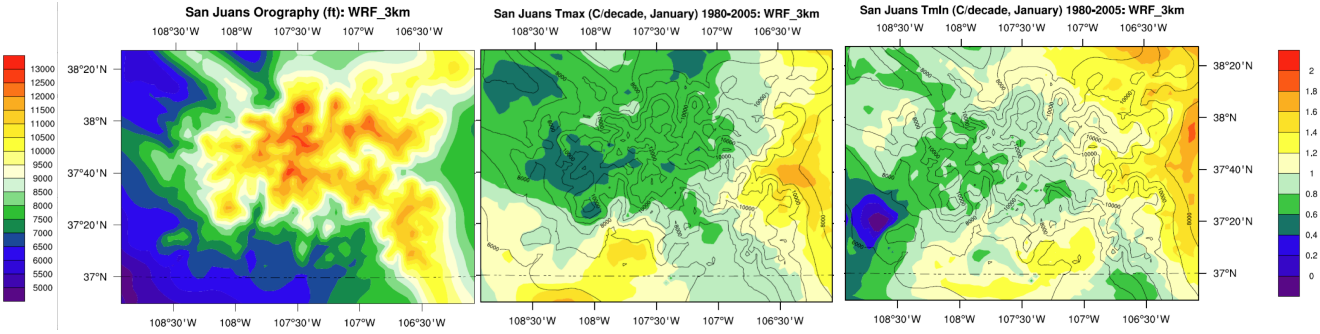
Downscaling by multi runs of WRF regional model with assimilation and post-processing



Selection of a) region; b) time period and c) resolution: 30km/30km/3.3km;

APPLICATIONS:

- ✓ One **CLIMOPS** system has been installed at the French hydrographic and oceanographic agency (SHOM). Its application and potential benefit for mission planning is under evaluation.
- ✓ **CLIMOPS** has been applied by NCAR to evaluate **climate trends** at high altitude in the **San Juan Mountains** in Colorado. Concerns that **climate change** is more **accelerated** at **higher elevation** cannot be ascertained because of the **lack** of long **observation records** at these altitudes and the **insufficient** representation of **orographic** effects of **global** climatologies (NNRP, ERA, etc.). **High-resolution hourly** atmospheric data have been produced by **CLIMOPS** for the months of **January** and **July 1980, 1985, 1990, 1995 , 2000** and **2005**. Trend analysis conducted at NOAA shows a **greater increase** of **minima** than **maxima** temperatures. **Increasing trends** of **moisture** (10%/decade) and **downwelling long wave** (2.5%/decade) is also more **pronounced** at **higher elevation**.



Orography in feet of the CLIMOPS WRF domain 3 (Δx = 3.3km) over the San Juan mountains, Colorado.

January temperature maxima trends, in C per decade, for the San Juan Mountains, Colorado, between 1980 and 2005 from the WRF model (Δx = 3.3km)

January temperature minima trends, in C per decade, for the San Juan Mountains, Colorado, between 1980 and 2005 from the WRF model (Δx = 3.3km)