A FRAMEWORK FOR THE DEVELOPMENT OF THE GLOBAL INTERACTIVE FORECAST SYSTEM (GIFS)

THORPEX GIFS-TIGGE WG

ICSC Meeting, Nov. 18-20 2008, Geneva, Switzerland

Acknowledgements:
THORPEX Colleagues
The development, evaluation and testing of a future GIFS will depend on results from all four components of THORPEX...

The THORPEX Interactive Grand Global Ensemble (TIGGE) will be developed as a resource to support this research.

TIGGE will provide a framework for international collaboration in the development of ensemble prediction systems (EPSs) and is also planned to provide the main prediction tool in the THORPEX Forecast Demonstration Projects...

Expected outcome:...
- A prototype future Global Interactive Forecasting System.”
GLOBAL INTERACTIVE FORECAST SYSTEM - GIFS

• “THORPEX research will inform and contribute to the design and development of a Global Interactive Forecasting System (GIFS) by coordinating and bringing together research activities carried out in the four major sub-programs…

• A future GIFS may include a
  – global observing system that
    • can be adjusted to meet the observational needs of the day;
  – data assimilation systems that
    • adapt to the varying data coverage and user requirements;
  – Numerical Weather Prediction methods, including ensemble forecast systems, that will be
    • configured interactively, i.e. by forecasters, to
      – provide the most critical and highest quality information
      – in response to varying user needs; and a
  – user interface, including applications procedures, that will
    • allow individual users to respond in the most efficient manner to expectations about future weather.

• Such efforts require cooperation on a global scale, which the THORPEX GIFS research will encourage and build on.” TIP
## TIP TIMELINE FOR TIGGE / GIFS DEVELOPMENT

<table>
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<tr>
<th>Projects</th>
<th>Goals</th>
<th>Time Scale (Years)</th>
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<td><strong>Global Interactive Forecasting System (GIFS)</strong></td>
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<td>Complete a prototype global multi-model ensemble system consisting of at least 3 models</td>
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<td>Provide access to TIGGE database for general THORPEX research (including predictability and societal and economic impacts)</td>
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EVOLUTION OF GIFS PLAN

• 2005 - THORPEX Implementation Plan (TIP)
  – Vision statement

• March 2007 Beijing WG meeting
  – First substantive discussion
  – Tasking of planning sub-group

• Oct. 2007 – Writing started
  – Telecon / email

• Mar 2008 Pretoria WG meeting
  – First draft of plan presented & discussed

• Jul 2008 – Revised draft

• Sep 2008 Geneva WG meeting
  – Draft accepted by WG (with modifications)

• Oct 2008 – Input requested from other THORPEX (& WWRP) WGs & RCs

• Nov 2008 Geneva ICCS meeting
  – Revised GIFS Plan presented for approval

• May 2009 THORPEX Science Symposium
  – First face-to-face meeting of two GIFS Focus Groups
  – Detailed technical planning
GIFS DOCUMENT

• Framework for detailed planning and development

• Builds on TIGGE achievements

• Nine pages main text (incl. summary)
  – High level outline – May not need frequent updates

• 34 pages Appendices (10)
  – May be changed/updated
  – New Appendices can be added describing detailed plans
    • Two added since Sept. Workshop
    • TIGGE-LAM to be added later

• WG requests publication as THORPEX WMO document

• Basis for BAMS-type publication with selected Appendices
LIST OF APPENDICES

- GIFS high impact event example (1)
- New technical aspects (5)
- Multi-center ensemble forecasting (9)
- Verification of ensemble forecasts (2)
- GIFS participants & contributions (3)
- IWTC-6 major recommendations on ensemble forecasting (1)
- Tropical Cyclone data format – CXML (3)
- Timeline for GIFS developments (2)
- Charge for focus groups (4)
- Regional sub-groups for product development (1)
OBJECTIVES OF GIFS

**GIFS PRODUCTS**
- Produce internationally coordinated advance warnings and forecasts
  - For high impact weather events
    - To mitigate loss of life and property
    - To contribute to the welfare of all WMO nations
      - With a particular emphasis on least developed and developing countries
- Apply ensemble prediction systems for
  - Assessing and mitigating weather and climate related risks by
    - Quantifying forecast uncertainty

**END-TO-END GIFS**
- Provide guidance on & coordinate use of
  - Observational
  - Numerical data assimilation
  - Forecasting
  - User application resources
    - To ensure the highest quality guidance for high impact weather events
EXPECTED BENEFITS

• Significant improvements in range and quality of services
  – Leading to savings in costs, property, and lives
    • Public safety
    • Health
    • Water resources

• Achieved by
  – Scientifically sound combination of information from
    • Existing NWP forecast providers
  – Global leveraging of NWP activities that are
    • Currently
      – Not yet well coordinated
      – Carried out independently by national and regional forecast centers
RESOURCES

• GIFS involves a wide range of activities
  – Development & operational maintenance of
    • Data access
    • Product generation & delivery
    • Adaptive NWP procedures

• GIFS will be built by volunteer contributions
  – GIFS will leverage existing infrastructure by
    • Coordinating and augmenting ongoing activities at
      – Established NWP centers and other organizations
    – Significant additional investments still necessary
      • To realize full benefits of GIFS from
        – National Hydro-Meteorological Services (NHMS)
        – Other organizations

• Investment in GIFS by NHMSs will need to be justified by
  – Ability to deliver improved services that in turn
    • Lead to socioeconomic benefits for all nations involved
STAGES OF DEVELOPMENT

TIGGE Development (2005-2007)

• TIGGE Implementation (2008-)

GIFS Development (2007-)

• GIFS Prototypes (2008-)

• GIFS Products Phase Implementation (2012-)

• GIFS End-to-End Phase Implementation (2014-)
TIGGE – CLOSE TO COMPLETION

• Definition
  – Archive of operational ensemble forecast data
    • 73 variables from 10 NWP centers
    • Maintained through GIFS

• Three archive centers
  – CMA, ECMWF, NCAR
  – Common data sets served to geographically distributed user groups
  – Redundant data allows centers to back up each other

• Ten NWP providing centers
  – BOM, CMA, CPTEC, ECMWF, Meteo France, JMA, KMA, MSC, NCEP, UKMO

• Data access
  – Further improvements possible in TIGGE – eg, time series
  – 48-hr delay for research applications by agreement
    • Delay waived for demonstration / field campaigns
  – 36 hr delay due to telecommunication constraints otherwise => GIFS
    • Due to shipping large amounts of data to archive centers
  – Web interface unique to each archive center => GIFS
Ensemble Forecast Time Series
at a fixed location

Forecast Time --->

Courtesy of B. Doty
GIFS – CONCEPT OF OPERATIONS FOR PRODUCTS

• **Ensemble data access**
  – *Real time*, directly from ensemble producing centers
    • For product generating centers
    • Flexible processing methods to handle missing data

• **Product generation**
  – Distributed & coordinated among ensemble producing centers and RSMC (DCPCs)
    • Major challenge – control change process, etc

• **Product distribution**
  – *Common web interface* using WIS concepts (GISCs)
    • Ensemble data
      – Real time
      – Archived
    • Probabilistic forecast products
      – Predesigned
      – On demand

• **User applications**
  – External support critical – GIFS-TIGGE WG has no expertise or resources
    • RCs, SERA, CBS, SWFDPs, etc
September 10th 2008 at 00Z

Courtesy of R. Swinbank
SCIENCE QUESTIONS

• Added value of multi-center ensemble approach? – PDP, SERA
  – Thorough evaluation, with cost – benefit analysis
  – Theoretically, as good or better than best ensemble
    • More gain when component systems have comparable skill?
      – NAEFS experience

• Best ways of combining ensembles from multiple centers? – PDP

• Best statistical correction methods? – PDP
  – Plethora of methods

• Product design – SERA, Regional Committees, SWFDPs
  – Dynamical set of user specific products

• Best training practices – CBS ET-EPS, SERA, SWFDPs
Brier skill scores for a) mean sea level pressure greater than the climatological mean, b) 2m temperature greater than the climatological mean, c) 2m temperature greater than 90th percentile. They grey lines show the bias-corrected single-model ensembles (ECMWF, Met Office and NCEP) and the black lines show three different multi-model ensembles: simple combination (dotted), weighted (dashed), weighted and variance adjusted (solid). The data are globally averaged over 120 days ending 29 April 2008.
TECHNICAL ASPECTS

• Data exchange
  – Policy, access, distribution, distribution, archive
  – Common web interface

• Product generation
  – Shared data processing
  – Shared software tools
    • Contribution to development of / operational use of
  – Pre-designed / on-demand
  – Common web interface
  – Link meso-scale (LAM-ensemble) & seasonal (TFSP) prediction

• Statistical corrections
  – Hind-cast sample
  – Observationally based fine-scale analysis for downscaling & verification

• Adaptive procedures
  – High impact event selection
  – Equitable use of resources
  – User driven processes
FOCUS GROUPS

• Charge
  – Develop detailed technical plans
  – Contribute to operational implementation of plans

• Organization
  – Report to GIFS-TIGGE WG

• Membership
  – GIFS-TIGGE WG members, colleagues, interested external experts

• Critical links
  – SIMDAT, GO-ESSP, NOMADS, CHPS, RISA, GRADS, etc

• 3 Topics, 2 groups
  – #1 Access to & distribution of real-time & archived ensemble data
  – #2 Ensemble-based product & service generation for high impact events
  – Joint - Common web interface for data and product distribution
GIFS PARTNERS - OPERATIONS

• Global NWP Centers
  – Global ensemble forecasts
  – Statistical correction of their ensemble
  – Product generation (combine ensembles from multiple centers, etc)

• Regional Specialized Meteorological Centers (RSMCs)
  – Coordination / resource organization for high impact event related activities in region
  – Observationally based hires analysis
  – Collection of relevant forecast data
  – Feedback to Global Centers on utility of their data/products
  – LAM ensemble integrations
  – Preparation of special products
  – Training

• National HydroMet Services (NHMSs)
  – Collect observations
  – Set & communicate forecast product and service requirements
  – Interpret climate & meteorological guidance
  – Special product generation & user outreach
GIFS PARTNERS & LINKS – DEVELOPMENT

- THORPEX DAOS WG research on
  - Adaptive observations
  - Adaptive DA techniques

- THORPEX PDP WG research on
  - Ensemble generation
  - Statistical correction of ensembles
  - Adaptive methods

- THORPEX Regional Committees – Regional focus on
  - Product design / requirements
  - Operational configuration
  - Training

- WWRP Nowcasting WG
  - Statistical downscaling of ensemble forecasts

- WWRP Mesoscale WG
  - Seamless prediction from hours to weeks

- WWRP WGSIP/CHFP (formerly TFSP)
  - Seamless prediction from days to seasons
• WGNE Verification Subgroup
  – Verification of TIGGE forecasts

• WWRP SERA WG
  – Measuring value added by and cost of GIFS – for forecasters and others
  – Training
  – Equitable use of adaptively allocatable forecast resources

• CBS ET-EPS
  – Training for new GIFS products

• HEPEX
  – Hydrologic user applications

• CBS
  – Operational systems and requirements

• North American Ensemble Forecast System (NAEFS)
  – Experience with fast operational implementation of multi-center ensemble system
PATH TO OPERATIONS

• Build on success of Southern Africa SWFDP
  – CBS project to expand from 5 to 16 countries

• Capacity building
  – Empower regions to tackle their unique forecast problems
  – Special consideration to IT & other limiting factors

• CBS links critical
  – Consider operational systems and requirements
    • CBS interest
      – What is possible today
    • GIFS interest
      – What is possible tomorrow
        » Transition TOHRPEX research into operations
CONSIDERATIONS FOR GIFS DEVELOPMENT

• **Producing centers**
  – Vested interest in their own region

• **RSMCs**
  – Vested interest in their region
    • Best knows special needs of their region
  – Existing links with some producing centers based on their region / service area

• Select **regions that could most benefit** from GIFS development
  – Southern Africa (existing SWFDP) – UKMO, NCEP?
  – South America (future SWPD) – CPTEC, NAEFS?
    • Great opportunity for 2-way interaction
  – Southeast Asia – KMA?
  – Southern Pacific – BOM?
Concurrent development in 4 regions

- **Form separate subgroups** in 4 regions from
  - 10 Global Centers and RSMC(s) in each region
  - Consider same ensemble data from 10 Global centers
    - Inter-comparability
  - Develop products specifically tailored for each region
  - Periodically exchange experience to cross-fertilize efforts

- **Grant real time data access** to GIFS partners to
  - Global ensemble data
  - Products for
    - Testing operational data feed
    - Engaging forecasters and other experts at global centers & regions
      - Engage Global Centers in product development
      - Provide regular feedback from RSMCs on product design/quality
      - Contribute to forecaster training

- Ensures **fast and high quality product development** for all 4 regions
  - Best use of regional data sources
  - Best service for special product needs
DATA POLICY

• **Current data policy**
  – Varies widely across NWP ensemble / product generating centers
    • Some make all ensemble data and derived products publicly available without restrictions
      – Continued free access during GIFS
    • Others limit set of freely distributed information

• **GIFS participants may need to ease current restrictions**
  – Development phase of GIFS
    • Grant real time data access to trusted GIFS partners
      – No redistribution of data / products
  – Testing and implementation phase of GIFS
    • Open up distribution of derived products to a wider user community
  – For high impact events
    • Further relax restrictions on product distribution
PROTOTYPES FOR GIFS

- **Tropical cyclone forecasting** – CXML data from multiple centers
  - Focus group involvement
  - Common web interface for CXML data
    - Access
    - Display
    - Combination / product generation

- **Probabilistic precipitation forecasting**
  - Subgroups to address special product needs in each region
    - Regional observationally based analysis
  - Real time data/product exchange among participants requested
  - Product development / testing in parallel with
    - Focus group technical developments

- **Probabilistic 10m winds, 2m temperature** next
PROTOTYPE GIFS DEVELOPMENTS – TROPICAL CYCLONES

- Nov 2006 San Jose WWRP IWTC-6 Major Recommendations
  - Distribute ensemble TC data from all NWP centers in common format
  - Explore use of ensemble data for estimating forecast uncertainty

- March 2007 Beijing WG meeting
  - Decision to respond to IWTC recommendations
  - Beth Ebert tasked to study background and possible response

- Fall 2007 – CXML format developed for exchange of cyclone data
  - BOM, NCEP, UK Met Office & other contributors
  - Track, intensity, phase
  - GIFS-TIGGE WG agrees to promote use of new format

- Winter 2007/08 – CXML format vetted with TC community
  - Community approves new format and distribution plan

- Mar 2008 Hawaii T-PARC meeting
  - T-PARC community requests real time access to GIFS TC data in CXML format

- Spring/Summer 2008
  - 7 of 10 Ensemble providing centers implement tracking algorithms

- 1 Aug 2008 – Summer T-PARC starts
  - 7 of 10 providing centers provide real time access to CXML TC data for T-PARC use
TIGGE Forecasts of Hurricane Ike
valid: 12z 9 Sep - 00z 13 Sep

Courtesy of B. Doty
From Bias correction (NCEP, CMC)
Dual-resolution (NCEP only)
Down-scaling (NCEP, CMC)
Combination of NCEP and CMC

NAEFS final products

NCEP/GEFS raw forecast

8+ days gain
GIFS – CONCEPT OF END-TO-END PHASE

• Maximize utility of forecasts of high impact events
  – User needs influence entire forecast process
  – Genuine GEOSS project

• Adaptive use of entire forecast process
  – Observations
    • Adaptive collection & processing
  – Data Assimilation
    • Case dependent covariances
  – Ensemble forecast
    • Enhanced resolution (e.g., LAM ensemble for heavy precip cases)
  – User applications
    • On demand product generation

• Issues
  – Demonstrate benefit of procedures first
    • Least developed, to be tested/implemented last
  – Equitable use of adaptively configurable resources? - SERA
Predicted data impact

Observed data impact

Forecast improvement / degradation
DISCUSSION TOPICS

• Application areas
  – 4 regions
  – Food, health, other general downstream applications

• Prototypes

• Focus groups

• Data exchange policy

• THORPEX Publication
GIFS = GLOBAL “if”s
plan (pl  n)  
n.  
1. A scheme, program, or method worked out beforehand for the accomplishment of an objective: a plan of attack.  
2. A proposed or tentative project or course of action: had no plans for the evening.  
3. A systematic arrangement of elements or important parts; a configuration or outline: a seating plan; the plan of a story.  
4. A drawing or diagram made to scale showing the structure or arrangement of something.  
5. In perspective rendering, one of several imaginary planes perpendicular to the line of vision between the viewer and the object being depicted.  
6. A program or policy stipulating a service or benefit: a pension plan.
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• TIGGE Development (2005-2007)
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• GIFS Development (2007-)
• GIFS Prototypes (2008-)
• GIFS Products Phase Implementation (2013-)
• GIFS End-to-End Phase Implementation (2013-)
• **Definition of GIFS**
  – Internationally coordinated system for high impact event prediction
    • Emphasis on needs of least developed and developing nations

• **Phases of GIFS**
    • Archive to support THORPEX research
      – Running as of Spring 2008
    • Develop real time data access & product generation infrastructure
      – Planning phase
        » Prototyping with Tropical Cyclone related product
  – **GIFS Products (2013-)**
    • Real time product generation based on multi-center ensemble
      – Component of WMO Information System (WIS)
  – **End-to-End GIFS (2013-)**
    • Adaptive use of observing, DA, ensemble, and application resources
      – To optimize forecasts for high impact events

• **Delivery mechanism for WWRP / THORPEX research**
  – Built on THORPEX / WWRP research achievements
    • Input from four international THORPEX research WGs
    • Link with WWRP now-casting - short-range research / demonstration activities
    • Link with WCRP Task Force for Seasonal Prediction (TFSP)
  – Transition to operations coordinated internationally
PURPOSE OF TIGGE – LINK WITH GIFS

• “The development, evaluation and testing of a future GIFS will depend on results from all four components of THORPEX…

• The THORPEX Interactive Grand Global Ensemble (TIGGE) will be developed as a resource to support this research.

• TIGGE will provide a framework for international collaboration in the development of ensemble prediction systems (EPSs) and is
  – also planned to provide the main prediction tool in the THORPEX Forecast Demonstration Projects…

• Expected outcome:…
  – A prototype future Global Interactive Forecasting System.”
GLOBAL INTERACTIVE FORECAST SYSTEM - GIFS

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    • allow individual users to respond in the most efficient manner to expectations about future weather.

• Such efforts require cooperation on a global scale, which the THORPEX GIFS research will encourage and build on.” TIP
**TIGGE PHASE-1**

**Definition**
- Archive of operational ensemble forecast data
  - 73 variables from 10 NWP centers

**Three archive centers**
- CMA, ECMWF, NCAR
- Common data sets served to geographically distributed user groups
- Redundant data allows centers to back up each other

**Ten NWP providing centers**
- BOM, CMA, CPTEC, ECMWF, MeteoFrance, JMA, KMA, MSC, NCEP, UKMO

**Data access**
- 48-hr delay for research applications by agreement
  - Delay waived for demonstration / field campaigns
- 36 hr delay due to telecommunication constraints otherwise - *PHASE-2*
  - Due to shipping large amounts of data to archive centers
- Web interface unique to each archive center – *PHASE-2*
TIGGE VARIABLES

• **Surface fields** (25)
  – Archive of operational ensemble forecast data
    • 73 variables from 10 NWP centers

• **Upper air fields** (45)
  – u, v, t, geop height, humidity at
    • 1000, 925, 850, 700, 500, 300, 250, 200, 50 hPa

• **Isentropic Level** (1)
  – PV at 320K

• **Potential Vorticity Level** (2)
  – Temperature and wind at 2 PVU

• Total volume
  – 300 Gbytes/day
  – Further details at http://tigge.ecmwf.int
TIGGE DATA FLOW

TIGGE PHASE-2 OPENED IN SPRING 2008

Courtesy of S. Worley
### TIGGE DATA PROVIDERS

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*May 1, 2008*
DATA PORTALS

• **Location**
  – NCAR [http://tigge.ucar.edu](http://tigge.ucar.edu)

• **Functions**
  – Register, search, discover, select, check volume, download

• **Data selection criteria**
  – Initial date/time
  – Forecast lead time
  – Spatial sub-domain
  – Data provider
  – Atmospheric variable / level

• **Options** – at NCAR
  – Output format (GRIB, netcdf)
  – Native or regular lat/lon grid
Ensemble Forecast Time Series
at a fixed location

Forecast Time --->

Courtesy of B. Doty
TIGGE Forecasts of Hurricane Ike
valid: 12z 9 Sep - 00z 13 Sep

init: 00z 8 Sep
init: 12z 8 Sep
init: 00z 9 Sep
init: 12z 9 Sep

Courtesy of B. Doty
As of March 2008, there are around 100 registered users, of which a third are active. The following graph shows the country of origin of the registered users (excluding ECMWF internal users):

The following graph shows the growth of active users since the service started. From December 2006 to March 2007, the service was only available inside ECMWF. It was opened to the external users in April 2007:

Courtesy of B. Raoult
Brier skill scores for a) mean sea level pressure greater than the climatological mean, b) 2m temperature greater than the climatological mean, c) 2m temperature greater than 90th percentile. They grey lines show the bias-corrected single-model ensembles (ECMWF, Met Office and NCEP) and the black lines show three difference multi-model ensembles: simple combination (dotted), weighted (dashed), weighted and variance adjusted (solid). The data are globally averaged over 120 days ending 29 April 2008.
TIGGE USER GROUP (TUG) FORUM - NCAR

• Definition
  – Community-wide email service and web interface
    • Share questions, solutions, and ideas

• Functions
  – Supports all TIGGE archive issues
    • Web links will be added from all TIGGE archive centers
    • Enrollment by all interested parties encouraged
      – Spread the word
        » EOS article on TIGGE Archives has been accepted, publication soon
    • More web links to be added with
      – New Phase-2 & prototype GIFS implementations
      – Other related THORPEX projects

• Service provider
  – UNIDATA - Complimentary by UCAR Program Office – NCAR collab.

• Questions
  – Contact Steven Worley and Doug Shuster, NCAR
STAGES OF TIGGE-GIFS

• **TIGGE**
  – Phase-1 (2005-2007) - Completed
    • Ensemble data archives at 3 centers
      – 100+ and growing number of users
      – Need to broaden user base

    • Develop infrastructure for
      – Real time data access directly from producing centers
      – Derived product generation
      – Common web interface for data/product access

• **GIFS**
  – GIFS Products (2013-)
    • Real time product generation

  – End-to-End GIFS (2013-)
    • Adaptive use of observing, DA, NWP/ensemble, and application systems
EVOLUTION OF GIFS PLANNING DOCUMENT

• Sept 08 (THORPEX Workshop, Geneva)
  – GIFS Plan accepted by GIFS-TIGGE WG
  – Two focus groups form

• Oct 08
  – Input from THORPEX WGs and WWRP

• Nov 08 (ICSC meeting, Geneva)
  – ICSC input / approval

• Mar 09 (THORPEX Symposium, Monterey)
  – TIGGE User Workshop
  – Focus group meetings

• Open issue
  – Maintain centralized archive and/or introduce distributed archiving?
    • Combination of two approaches may be realistic
      – Some producing centers may archive their own data
TIGGE PHASE-2 / GIFS DEVELOPMENTS

• **TIGGE Phase-2** - Developments for GIFS
  – Complex tasks
    • Real time data access
    • Multicenter product generation
    • Common web interface for data/product access

• **GIFS Products** – For operations
  – Major challenges for international
    • Data sharing – policy issues
    • Coordination of derived product generation
  – **Prototypes**
    • Tropical cyclone related data
      – Small amount of data – new CXML format
      – Highest impact/priority – *T-PARC support, Aug 08 – Mar 09*
      – Link with WWRP/TC program
    • Precipitation

• **End-to-End GIFS** - Conceptual planning
  – Coordinated use of additional major resources
  – New challenges
    • Selection of high impact events
    • Equitable use of resources
September 10th 2008 at 00Z

Courtesy of R. Swinbank
Continuous Ranked Probability Score (CRPS) for 2m temperature forecasts verified against the 5x5 km observationally based RTMA analysis over the continental US. Red line (with open circles) represents 20-member raw NCEP ensemble; blue (open square) and green (full circle) lines represent bias corrected and downscaled CMC and NCEP 20-member ensembles respectively (the latter combined with information from a higher resolution control forecast); black line (plus sign) represent 40-member combined bias corrected and downscaled CMC and NCEP ensembles (NAEFS).
The interfacing of global ensemble prediction systems with LAM ensembles is of particular importance considering the emphasis of THORPEX on high-impact weather.
Main Issues

Scientific Issues & Scientific Coordination

- LAM EPS output archiving
- Coupling LAM-EPS and GLOBAL EPS systems
- Archiving of ICs and BCs
- Relocatable Systems

LAM component of GIFS TIGGE prototype

Courtesy of T. Paccagnella
A TIGGE LAM Panel was established.

The Panel is working mainly by e-mail.

Two “small” meetings up to now:

- **4th of October 2007 San Lorenzo de El Escorial – Spain**
  - LAM EPS output archiving
  - Coupling LAM-EPS and **GLOBAL EPS systems**
  - Archiving of ICs and BCs
  - Relocatable Systems

- **4 Sept. 2008 hosted by ECMWF**
  - TIGGE LAM archiving - Phase 1

*Courtesy of T. Paccagnella*
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<th>Region</th>
<th>System</th>
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*Courtesy of T. Paccagnella*
1st plenary TIGGE LAM meeting

The first TIGGE LAM meeting will be organized in January 2009. General announcement after this WG meeting.

Part of this meeting will be devoted to discuss methodologies to improve cooperation and exchanges with the Thorpex Regional Committees and with the other WMO Working Groups and Expert Teams.

Courtesy of T. Paccagnella
TIGGE-GIFS LINKS

- **GIFS offers**
  - Operational outlet for THORPEX & WWRP research and development
  - Centerpiece of new seamless product suite
  - Interface with
    - CBS operations &
    - WIS IT developments
    - GIFS important contributor

- **GIFS receives**
  - THORPEX & WWRP WGs
    - Major input for design of GIFS
      - PDP, SERA - GIFS Products
      - OS, DA, SERA - End-to-End GIFS
  - WWRP
    - Link with now-casting & short-range forecasting
    - Verification group
  - WCRP
    - CHFP (Coupled Historical Forecast Project) – joint developments for intra-seasonal time scales?
      - Products for time means
      - Seamless forecast suite from days to seasons
      - Use of netcdf format
  - New WMO Information System emphasized
    - GIFS should be important contributor to WIS
  - GEOSS
    - Coordination on broader scales
    - Potential funding source for meetings etc
BACKGROUND
**Our Project: Activities on Multiple Fronts**

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<th>Issue: Approach</th>
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- **Misinterpretation:** Field-testing of communication effectiveness for all products as SOP
- **Connecting Information:** Consistent linking of forecasts, recent observations, historical record
- **Forecast Quality:** Customized forecast verification
- **Unique Needs for Products:** Dynamic, customizable products
- **Easy Access:** Information management portfolio
- **Connecting Information:** Newsletter/report generation
2. Many product formats for diverse users

NWS Local
3-month Temperature Outlook

User-selected product formats

http://www.weather.gov/climate/l3mto.php
Initially for NWS CPC climate forecasts
Now L3MTO station forecasts, Alaska

Six elements in our webtool:
• Forecast Interpretation – Tutorials
• Exploring Forecast Progression
• Historical Context
• Forecast Performance
• Use in Decision Making
• Details: Forecast Techniques, Research

NWS Climate Services Division:
Climate Focal Points at every WFO


Historic Conditions
Precipitation / NorthEast Arizona (97)
This plot shows 3 month (seasonal) Precipitation for the
last 24 Months compared to the historic tercile categories

Analogs: Examples of Possible Futures
Precipitation / NorthEast Arizona (97)
Probabilities for the future 12 Months are shown in this
subset using each 3 month (seasonal) period from the
past 40 years, 1961-2000.

http://fet.hwr.arizona.edu
/ForecastEvaluationTool/
TIGGE CONCEPT

- Create an archive of global ensemble forecasts and make it widely accessible to the operational and research meteorological community, in near-real time.

- Data archived in priority: operational ensemble forecasts from the ten global operational forecasting centres.

- Initially, the archives are centralized and fully duplicated at three archive centres serving various parts of the world and acting as mutual back-up (Phase 1).

- Later, the archives may become distributed at a number of centres, may avoid duplication, while maintaining a single access portal for users (Phase 2).
Archive Structure and Content

Organization of TIGGE Parameters: Four types of fields

- (SL) Single Level
  - includes a large number of surface fields
- (PL) Pressure Level – u, v, t, geopotential height, humidity
  - 1000, 925, 850, 700, 500, 300, 250, 200, 50 hPa
- (IL) Isentropic Level
  - PV at 320K
- (PV) Potential Vorticity Level
  - Temperature and wind at 2 PVU

- TOTAL VOLUME IS ABOUT 300 Gbytes/day

➤ Full description of requested fields is available at http://tigge.ecmwf.int
Current Data Portal Functions

NCAR  http://tigge.ucar.edu
ECMWF  http://tigge-portal.ecmwf.int/
CMA      http://wisportal.cma.gov.cn/tigge/

- Registration
- Search, discover, and download files
- Select data by
  - Initial date/time and forecast lead time
  - Spatial sub-domain
  - Data provider
  - Atmospheric variable / level
  - Output format (GRIB, netcdf) – at NCAR
- Check volume and download data
- By agreement, access is open 48h after forecast start time
- Quicker (~36-hr delay) access is possible for demo projects
UPDATE ON PHASE-1 - NCAR

• Recent Improvements
  – New hardware for data ingest and publication functions
  – New user subsetting features
    • Spatial subsetting
    • Regridding across multiple model native grids to uniform latitude x longitude grids
    • Output format selection, GRIB2 or netCDF

• Plans for inclusion of additional NCEP data
  – Addition of 11 missing variables processed by NCDC
    • New data to be sent to other archive centers (ECMWF, CMA)
    • Last 3 variables to be added by end of 2008
      – Sunshine duration
      – Wilting point
      – Field capacity