# 3A.4 TABULAR PRODUCT EVOLUTION USING EXTENSIBLE MARKUP LANGUAGE

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## 1. INTRODUCTION

The Selected Cities Weather Summary and Forecasts (SCS) and Travelers Forecast Table (TAV) are tabular products first issued by NOAA's National Weather Service (NWS) in 1972 to support NWS users and partners worldwide. These products give observed and forecast weather information for US cities in a terse, tabular format. SCS and TAV data can be found in a wide range of media outlets worldwide. The products were initially issued by the National Public Service Unit (NPSU) in Kansas City. However, in 1992 the National Oceanic and Atmospheric Administration (NOAA) NWS National Centers for Environmental Prediction (NCEP) took over production when the NPSU was discontinued.

The Coded Cities Forecast (CCF) products play a key role in the production of the legacy SCS and TAV text products. A description of the current tabular products (SCS, TAV, and CCF) can be found in two separate NWS instructions. NWS instruction 10-504, "National Public Weather Forecast Products Specification," describes the generation of the SCS and the TAV as:

> *"NCEP's Hydrometeorological Prediction Center (HPC) issues the Selected Cities Forecast to provide observed maximum and minimum temperatures, observed precipitation, and forecast weather and temperatures for 162 cities in the United States, Puerto Rico and the U.S. Virgin Islands. This product is heavily used by the print media and supports the public weather program."*
>
> *"HPC issues the Travelers Forecast to provide the forecast weather and temperatures for several dozen cities in the United States and Puerto Rico."*

NWS Instruction 10-503, "WFO Public Weather Forecast Products Specification," describes the generation of the CCF as:

> *"WFOs issue CCFs for both internal and external uses. CCFs are abbreviated forecasts for particular cities/locations within a WFO's area of responsibility. CCFs serve as input for the Selected Cities Weather Summary and Forecasts and Travelers' Forecasts. The private sector uses the CCF to compare with their forecasts for specific cities/locations."*

Recently, the National Digital Forecast Database (NDFD) became operational. It currently contains a seamless mosaic of digital forecasts prepared by NWS Weather Forecast Offices (WFO) consisting of various weather elements such as sky cover, wind, and maximum temperature. These digital forecasts can be used by NWS users and partners in the creation of text, graphical, gridded, and image products. One service of the NDFD that is enjoying considerable success is a World Wide Web service that provides access to all NDFD weather elements in eXtensible Markup Language (XML). These elements include maximum, minimum, 3-hourly, and dew point temperatures; probability of precipitation (PoP); precipitation amount; sky

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cover; wind direction and speed; weather; and wave height).

As the cornerstone of the transition to NWS Digital Services, the NDFD offers an unprecedented opportunity for the NWS to automate and modernize a number of tabular products including the current SCS/TAV/CCF product suite. First, WFO grids are now centrally located on the NDFD Central Server System (CSS). These grids, along with observations, provide the key elements needed to produce the legacy tabular products (SCS/TAV/CCF). Because WFO forecasters are constantly updating the NDFD, products generated from NDFD are remarkably reliable, and contain the most current forecast data. Second, updating the format for the future product suite by leveraging NDFD's XML schema would also address one of NOAA's Strategic Mission goals of serving "society's needs for weather and water information". See Glahn and Ruth (2003) for more details about NDFD and its products.

This paper focuses on steps to modernize and streamline the current tabular product suite (SCS/TAV/CCF) by introducing four new XML products. These four new XML products will have a decided advantage over their current legacy tabular counterparts. In general, XML allows NWS users and partners the flexibility to capture some or all of the data being delivered in the product. Additional cities, weather elements or time projections all can be handled gracefully by the NWS and our users and partners without major software redevelopment efforts. These products will be generated early in 2007. These enhanced products are expected to replace the legacy SCS/TAV/CCF tabular products as users transition to the new XML product suite.

## 2. Current Tabular Product Suite and Procedures

Figure 1 shows the current process for generating the SCS, TAV, and CCF products. Individual WFOs use product generation software to create 124 CCF products. These products are transmitted via the NWS Family of Services (FOS) and delivered to NWS users and partners as well as to NCEP's Central Operations (NCO). NCO uses the CCFs and an archive of surface observations to create draft versions of the SCS and TAV products. HPC forecasters then manually quality control (QC) the SCS and TAV draft products before issuing them. HPC's manual QC steps frequently include finding and fixing missing data as well as removing spurious precipitation observations. More information about the SCS/TAV text products including the current products can be found at http://www.hpc.ncep.noaa.gov/discussions/selcit.shtml.

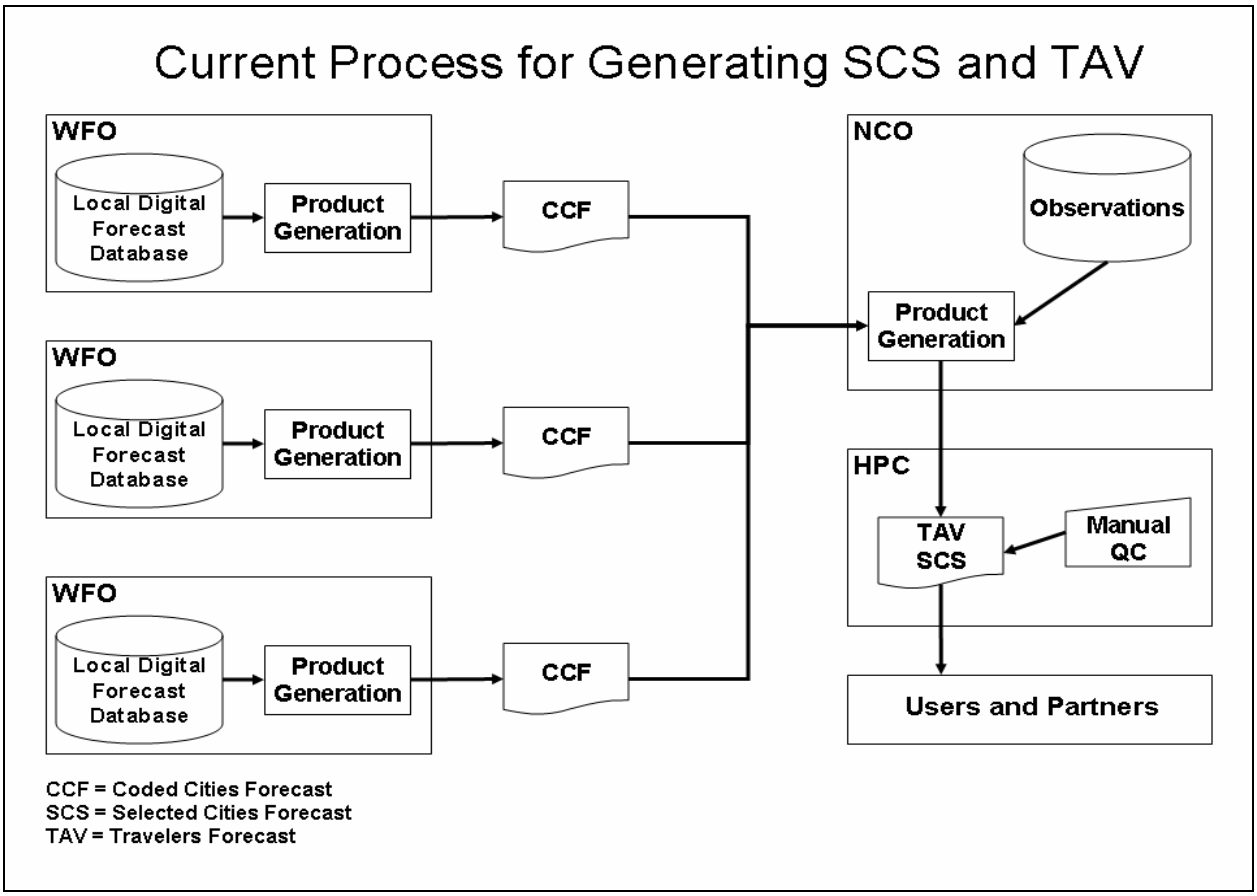


Figure 1: Current process for generating SCS and TAV.

### 2.1 *Current SCS Product*

The SCS is a four-part tabular array of observed maximum and minimum temperature and total precipitation for a 24-h period, as well as an abbreviated forecast for the next 2 days. It is issued by 0100 Coordinated Universal Time (UTC) and 1300 UTC each day and is based on data contained in the CCF. The four parts consist of alphabetized city names. The final section of part four also lists the so-called "National High/Low Temperature" in the continental United States (CONUS). There are a number of criteria that must be satisfied before a city can be considered as the national high or low temperatures for the day. These criteria include but are not limited to constraints on elevation and population. Some exceptions apply for particular notable locations (e.g., Death Valley).

Figure 2 represents a portion of a sample SCS product. In this example, Abilene, Texas, had a high and low temperature of 53 and 33 degrees Fahrenheit, respectively, yesterday with no precipitation. The forecast for tomorrow calls for partly cloudy skies with a forecast high temperature of 75 degrees Fahrenheit and a forecast low temperature of 51 degrees Fahrenheit. The forecast for the following day is for partly cloudy skies with a forecast high temperature of 82 degrees Fahrenheit and a forecast low temperature of 40 degrees Fahrenheit.

SELECTED CITIES WEATHER SUMMARY AND FORECASTS
NWS HYDROMETEOROLOGICAL PREDICTION CENTER
CAMP SPRINGS MD
736 AM EST FRI DEC 02 2005

TEMPERATURES INDICATE DAYTIME HIGH...NIGHTTIME LOW
B INDICATES TEMPERATURES BELOW ZERO
PRECIPITATION FOR 24 HOURS ENDING AT 7 AM EST

| | | | FORECAST | | FORECAST | |
|---|---|---|---|---|---|---|
| | THU...DEC 01 | | FRI....DEC 02 | | SAT....DEC 03 | |
| CITY | HI/LO | PCPN | WEA | HI/LO | WEA | HI/LO |
| **ABILENE TX** | **53 33** | | **PTCLDY** | **75/51** | **PTCLDY** | **82/40** |
| AKRON CANTON | 33 23 | .11 | CLOUDY | 30/17 | MOCLDY | 31/25 |
| ALBANY NY | 44 33 | | SNOSHW | 39/24 | PTCLDY | 36/23 |
| ALBUQUERQUE | 58 38 | | PTCLDY | 63/41 | MOCLDY | 58/34 |
| ALLENTOWN | 44 35 | | FLRRYS | 40/22 | PTCLDY | 38/28 |
| AMARILLO | 45 29 | | PTCLDY | 72/37 | PTCLDY | 51/25 |
| ANCHORAGE | 13 05 | .01 | VRYCLD | 19/09 | VRYCLD | 15/11 |
| ASHEVILLE | 52 29 | | SUNNY | 45/25 | FZRAIN | 46/39 |
| ATLANTA | 54 30 | | SUNNY | 50/35 | MOCLDY | 51/51 |
| ATLANTIC CITY | 47 35 | | PTCLDY | 47/26 | PTCLDY | 42/33 |
| AUSTIN | 64 33 | | PTCLDY | 66/54 | PTCLDY | 84/54 |

Figure 2: Sample of a typical SCS Text Product

### 2.2 *Current TAV Product*

The TAV product is a three part tabular array of one word forecasts for selected cities arranged in alphabetical order. These one word forecasts are based on Character of the Day (CoD) codes currently based on the CCF code definitions. These definitions are defined in the left hand column of Table 1.

The TAV forecasts are based on data contained in the CCF. The TAV products are transmitted one hour prior to the SCS issuance times. The TAV represents a subset of the SCS product. While it does not include observations, this product was developed to serve the needs of the media, who need forecast information quicker then the SCS issuance times.

### 2.3 *Current CCF Product*

The CCF is an abbreviated seven-day forecast for particular cities that fall within a WFO's area of responsibility. The CCF serves as input for generating the SCS and TAV products. CCF products are transmitted by WFOs twice daily from approximately 0700 to 1000 UTC and 1900 to 2200 UTC. CCFs for each city are two lines in length. The first line refers to days one and two of the seven-day forecast. The second line of the CCF refers to days three through seven. The format for the first line of the 1000 UTC CCF product is as follows:

**LLL $F_1F_2$ max/min max/min max $NNP_1P_2P_3$**

where, LLL is the 3-letter station id, $F_1$ and $F_2$ are single letters that represent one-word forecasts, and the $NNP_1P_2P_3$ is a 5-digit grouping consisting of the forecaster's assigned number (NN), and 12-h POP numbers for the three 12-h periods. For information concerning all aspects of the CCF and the representative values for each variable, please refer to Section 4, NWSI 10-503: http://www.weather.gov/directives/sym/pd1005003curr.pdf.

Figure 3 represents a portion of a sample 1000 UTC CCF product. The first line of this sample CCF is for Baltimore (BWI). The forecast calls for windy (N) weather today and mostly cloudy (E) weather tomorrow. The forecast high temperature for today is 60 degrees Fahrenheit, while the forecast low temperature for tonight is 34 degrees Fahrenheit. The forecast high temperature for tomorrow is 53 degrees Fahrenheit and the forecast low temperature for tomorrow night is 37 degrees Fahrenheit. The forecast high temperature for the following day is 63 degrees Fahrenheit. The forecaster's assigned number is 23. The forecast probability of precipitation (POP) today is 30 percent. The forecast POP for tonight the POP is 30 percent, and for tomorrow the POP is 20 percent. The second line of the CCF for BWI contains similar information for days 3 through 7.

FPUS41 KLWX 040815
CCFLWX
**BWI NE 060/034 053/037 063 23332**
**UEEUU 046/066 049/057 037/054 037/061 -134421111**
DCA NB 059/039 055/038 064 23332
UEEUU 047/070 050/059 038/056 038/063 -134421111
MRB NE 058/033 051/029 064 23442
UEEUU 042/065 050/056 033/053 033/060 1235521111
IAD NB 059/033 055/027 063 23332
UEEUU 043/069 048/058 034/055 034/062 -134421111
CHO UB 062/035 057/032 065 23222
UBEUU 045/071 051/060 036/057 036/064 -134421111
HGR NE 053/032 050/033 061 23552
UEEUB 042/064 050/055 033/052 033/059 1235521111

Figure 3: Sample CCF Product

## 3. Future Product Suite and Procedures

There are three basic goals for implementing The Tabular Product Evolution in XML (TPEX) plan. The first is to modernize and improve upon the current tabular product suite. The second is to streamline and automate the generation of the future products. The third is

to maximize the role of the NDFD in the generation of the future product suite.

To meet these objectives, four new XML products have been designed. Two Forecasts in XML (FoX) products, one Observations in XML (ObX), and a Temperature Extremes in XML (TEX) will be generated. These products can be used to generate the legacy SCS text product using eXtensible Stylesheet Language Transformation (XSLT) style sheets. In time, we expect users and partners to migrate away from the legacy text products to the new XML products.

The format used for generating the new XML products will be a Digital Weather Markup Language (DWML)-based version of XML. The DWML is used to share weather data. The specifications were written with enough flexibility however to accommodate other environmental science applications. DWML consists of three main parts: a header section containing a description of the product, a temporal definition section, and the forecast data section. For a complete description of DWML see http://www.weather.gov/mdl/XML/Design/MDL_XML_Design.htm.

On inspection, there are similarities between XML and HyperText Markup Language (HTML). However, XML is used to describe the data, whereas HTML is used to describe the format or to display the data.

### 3.1 *FoX Products*

The two FoX products (FOX3 and FOX7) will be generated hourly from the NDFD CSS, and contain forecasts of weather and high/low temperatures for a select number of cities. The first FoX product (FOX3) will contain forecasts for days 1 through 3. The FOX3 product will provide all the forecast data for the same stations and times as in the current SCS and TAV products. The second FoX product (FOX7) will contain forecasts for days 1 through 7. The FOX7 product provides considerably more information than the legacy three day SCS/TAV products, and could be used as a tool for advanced planning that is not available within the current text product suite (SCS and TAV).

The FoX products have several improvements over their legacy tabular counterparts (SCS/TAV/CCF). First, the FoX products will be issued hourly. This increased frequency of issuance will allow for better forecasts as synoptic weather conditions change throughout the course of a given day. Second, there will be improvements to the CoD parameter. The first improvement will be to add character of the night values. The second improvement is to assign a more precise set of weather definitions to CoD. The point-and-click codes will be used as opposed to the old CCF CoD codes, as they contain both daytime and nighttime values, whereas the CCF codes used in the current legacy product suite only have daytime weather values.

Table 1 provides a mapping of the old CCF CoD codes with the new point-and-click codes. With each point-and-click CoD code, the NWS maintains an associated icon representation for the weather condition.

| CCF Code Definition | Point and Click Code |
|---|---|
| A (Fair) | Sunny or Clear |
| B (Partly Cloudy) | Partly Cloudy |
| C (Cloudy) | Cloudy |
| D (Dust) | Blowing Dust |
| E (Mostly Cloudy) | Mostly Cloudy |
| F (Fog) | Fog |
| G (Very Hot/Humid) | Hot |
| H (Haze) | Haze |
| I (Very Cold) | Cold |
| J (Snow Showers) | Snow Showers |
| K (Smoke) | Smoke |
| L (Drizzle) | Drizzle |
| M (Snow Flurries) | Flurries |
| N (Windy) | Windy or Breezy |
| O (Mixed Precipitation) | Rain/Snow |
| P (Blizzard) | Heavy Snow |
| Q (Blowing Snow) | Blowing Snow |
| R (Rain) | Rain |
| S (Snow) | Snow |
| T (Thunderstorms) | Thunderstorms |
| U (Sunny) | Sunny |
| V (Clear) | Clear |
| W (Rain Showers) | Rain Showers |
| X (Sleet) | Sleet |
| Y (Freezing Rain) | Freezing Rain |
| Z (Freezing Drizzle) | Freezing Drizzle |

Table 1: Mapping the CCF CoD codes to the point-and-click codes

### 3.2 *ObX and TEX Products*

The ObX product will be generated and issued hourly by the NCEP NCO. ObX will contain observed maximum/minimum temperatures and observed precipitation for the same cities as in the legacy SCS text product. At the appropriate times of day, the ObX will also contain high and low temperatures "so far today/tonight" in addition to the high and low temperatures for the most recent complete day/night periods. This is one improvement over the observational information contained in the current tabular product suite. In addition, ObX will be issued hourly, providing more accurate values for maximum and minimum temperature than the current SCS product. For many western cities, overnight low and daytime high temperatures reported in the legacy text SCS are not credible since the issuance times are frequently before the temperature has reached its maximum/minimum value. Hourly issuance of the ObX product and the addition of the high/low so far today weather elements will solve this problem.

The following observing period definitions have been created for the ObX product. For maximum and minimum temperatures, the periods have been defined as 7:00 a.m. to 7:00 p.m. and 7:00 p.m. to 8:00 a.m. Local Standard Time (LST) respectively. Precipitation observations are defined as the last four 6-h synoptic times (cumulative). Maximum Temperature "so far today" is defined as the period between 7:00 a.m. to the current hour (not to exceed 6:59 p.m.). Minimum Temperature "so far tonight" is defined as the period between 7:00

p.m. to the current hour (not to exceed 7:59 a.m. the following day).

The TEX product will be generated and issued four times each day at the standard synoptic times (0000, 0600, 1200, 1800 UTC) by the HPC. It will contain the so-called National High/Low Temperatures observed in the CONUS, using the same criteria currently used in the SCS. Due to the flexibility of XML, the TEX could be readily expanded to include extreme values for Outside CONUS (OCONUS) areas as well (e. g., Alaska high and low).

### 3.3 *SCS Text Product*

Once the FOX3, ObX, and TEX products are available, new techniques will be available for producing the legacy SCS product. The new procedures are fully automated. The automated SCS product will contain the same data in the same format for the same stations and times as the current product. All forecasts will come from NDFD rather than CCF. The resulting text product will be generated using XSLT style sheets. More information about XSLT can be found in section 4.4.

## 4. Future Product Suite Methodology

The TPEX plan in Figure 4 shows the proposed process for generating the new XML and SCS products. FOX3, FOX7 and SCS will be generated on the NDFD CSS, the TEX product will be produced by the NWS's HPC and the ObX product will be produced by the NCO. The NWS Telecommunications Gateway (TG) will route products between NWS centers and our users and partners. NWS users and partners will be able to receive all these products via the NWS FOS methods.

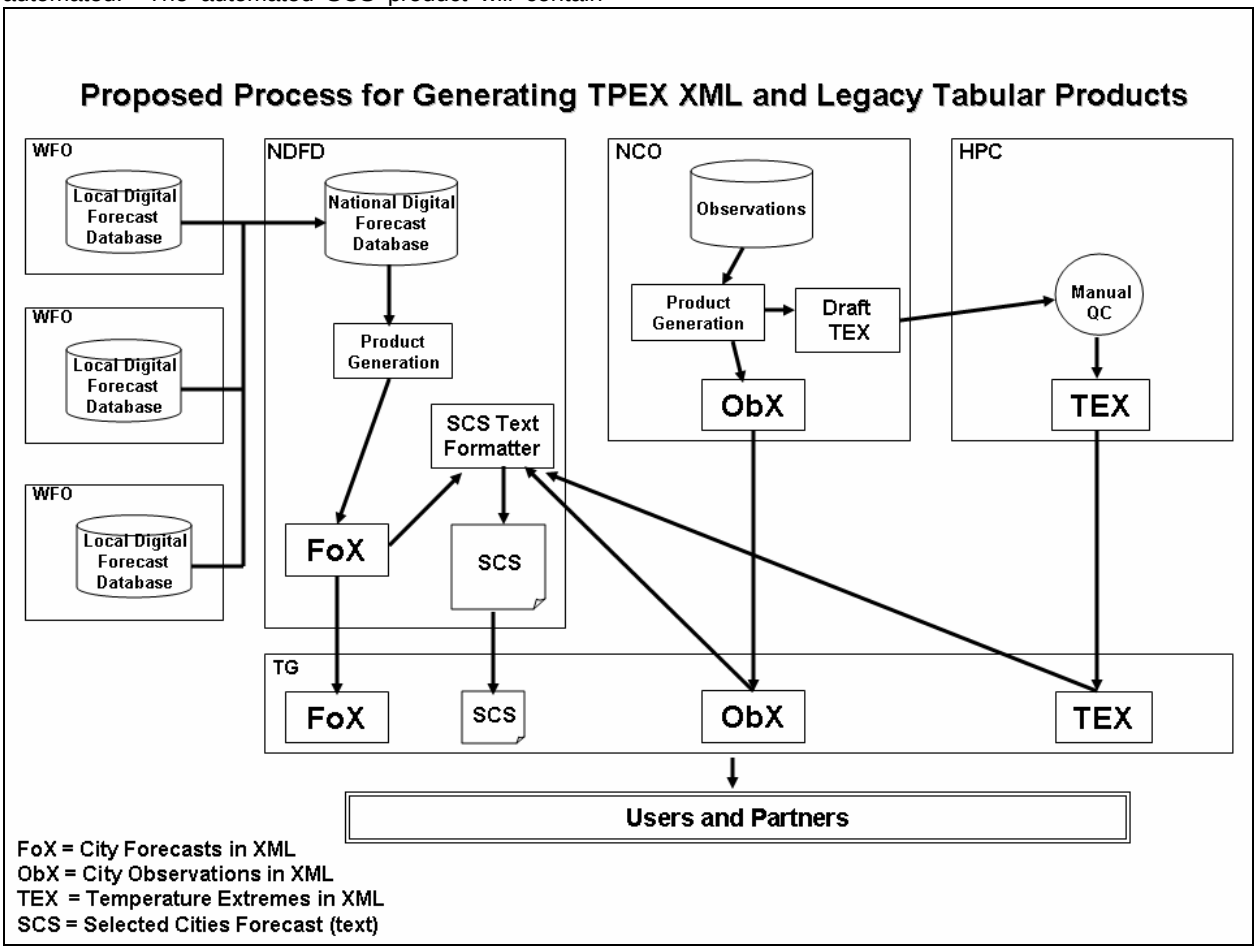

Figure 4: TPEX process for generating new XML and Legacy SCS Products.

### 4.1 *FoX Products*

The methodology for generating the FoX products is a three step process. Grids are processed at the NDFD CSS as they arrive from WFOs, grids are summarized and geodata are assessed, and products are generated according to a time schedule.

#### *4.1.1 Grid Arrival and Processing*

As each of the WFOs send their grid information to the NDFD CSS, NDFD software records metadata associated with each grid into relational database tables. These tables contain information about the weather elements contained in the grids, their WFO of origin,

valid date/time, grid arrival time, and the grid characteristics (grid size and spatial resolution).

#### *4.1.2 Grid Summarization and Categorization of Geodata*

Point data for the Digital Forecast Matrices (DFMs) are queried from each grid. DFMs describe the evolution in time of a set of weather elements at a geographic point. The weather elements are also summarized over a 12-h time period to yield the CoD.

When creating the station DFMs, the grid point closest to a station's latitude/longitude is used. A land-sea mask is applied to ensure that only land values are used. In addition, each DFM contains information about the originating WFO, the station ID, the valid date/time, the element names, and the actual data.

#### *4.1.3 Product Generation*

The FoX generation application creates the header and temporal definition sections using pre-defined configuration data and the current date and time. The application then extracts the appropriate weather information from the station DFMs and completes the formatting of the FoX.

Figure 5 represents a portion of a sample FOX7 product. In this example, maximum and minimum temperature forecasts for Philadelphia are encoded in XML. Taking maximum temperature as an example, Figure 5 shows Philadelphia is forecast to have a maximum temperature of 76 degrees Fahrenheit (day 1), 86 (day 2), 85 (day 3), 83 (day 4), 82 (day 5), 82 (day 6) and 82 (day 7).

```
<parameters applicable-location="Philadelphia">
    <temperature type="maximum"
      units="Fahrenheit" time-layout="k-p12h-n7-1">
      <name>Maximum Temperature</name>
      <value>76</value>
      <value>86</value>
      <value>85</value>
      <value>83</value>
      <value>82</value>
      <value>82</value>
      <value>82</value>
    </temperature>
    <temperature type="minimum" units="Fahrenheit"
      time-layout="k-p13h-n7-2">
      <name>Minimum Temperature</name>
      <value>64</value>
      <value>62</value>
      <value>61</value>
      <value>61</value>
      <value>60</value>
      <value>58</value>
      <value xsi:nil="true"/>
    </temperature>
  </parameters>
```

Figure 5: Portion of a sample FOX7 Product

### 4.2 *ObX Product*

The methodology for generating the ObX product is to screen hourly observations via automated procedures. Only the subset of stations transmitting Meteorological Aerodrome Report (METAR) data currently used in the SCS text product is kept. Second, automated procedures are used to quality control the integrity of the remaining data.

Quality control checks for the ObX products attempt to correct data problems that can be readily recognized. Temperature values that are too cold or too hot are replaced with missing values. Six-hour accumulated precipitation values of 0.01 inches are considered suspect. If precipitation is reported in the observations during that 6-h period, then the accumulated precipitation value of 0.01 is accepted. Otherwise, it is replaced with a value of zero.

Values for maximum and minimum temperature, precipitation, and maximum and minimum temperatures "so far" in the ObX product are updated hourly as described above. As the ObX products are issued each hour, valid times for a number of the weather elements change. For example, at 7:00 p.m. LST the current day's Maximum Temperature "so far today" becomes a complete period Maximum Temperature. At that point, the previous Maximum Temperature "so far today" becomes the Maximum Temperature, and the Maximum Temperature "so far today" becomes undefined until 12:00 p.m. Local Time (LT) the following day.

Figure 6 represents a portion of a sample ObX product. In this example, Philadelphia had a maximum and minimum temperature of 89 and 69 degree Fahrenheit respectively, a minimum temperature "so far tonight" of 72 degrees Fahrenheit and yesterday's total precipitation amount was 0.00 inches.

```
<parameters applicable-location="Philadelphia">
  <temperature type="maximum"
    units="Fahrenheit" time-layout="k-p12h-n1-4">
    <name>Maximum Temperature</name>
    <value>89</value>
  </temperature>
  <temperature type="minimum" units="Fahrenheit"
    time-layout="k-p13h-n1-4">
    <name>Minimum Temperature</name>
    <value>69</value>
  </temperature>
  <temperature type="minimum" units="Fahrenheit"
    time-layout="k-p8h-n1-4">
    <name>Minimum Temperature So Far</name>
    <value>72</value>
  </temperature>
  <precipitation type="liquid" units="inches" time-
    layout="k-p24h-n1-1">
    <name>Yesterday's Liquid Precipitation
          Amount</name>
    <value>0.00</value>
  </precipitation>
</parameters>
```

Figure 6: Portion of a sample ObX Product

### 4.3 *TEX Product*

Generation of the TEX products will require the collaboration of HPC and NCO. First, the two organizations need to identify a filter list of stations or cities that will be considered for the National High/Low Temperature. This filter list will generally reflect the station criteria currently used in the SCS.

Once the filter list is established, then the process will begin with NCO software searching the appropriate surface observations, identifying the National High/Low stations, generating a draft version of the TEX and making it available to HPC forecasters. HPC forecasters will then review the TEX, make adjustments as needed and issue the product.

Figure 7 represents a portion of a sample TEX product. In this example, La Mesa, California, had the Nation's High Temperature at 85 degrees Fahrenheit and Williston, North Dakota, had the Nation's Low Temperature at 9 degrees Fahrenheit.

```
<data>
 <location>
  <location-key>La Mesa CA</location-key>
  <city state="CA" summarization="conus">La
   Mesa</city>
 </location>
 <location>
  <location-key>Williston ND</location-key>
  <city state="ND" summarization="conus">
   Williston</city>
 </location>
 <time-layout time-coordinate="local">
  <layout-key>k-p12h-n1-1</layout-key>
  <start-valid-time>2006-07-05T07:00:00-08:00</start-
   valid-time>
  <end-valid-time>2006-07-05T19:00:00-08:00</end-
   valid-time>
 </time-layout>
 <time-layout time-coordinate="local">
  <layout-key>k-p13h-n1-2</layout-key>
  <start-valid-time>2006-07-05T19:00:00-06:00</start-
   valid-time>
  <end-valid-time>2006-07-06T08:00:00-06:00</end-
  valid-time>
 </time-layout>
 <parameters applicable-location="La Mesa CA">
  <temperature type="maximum" units="Fahrenheit" time-
   layout="k-p12h-n1-1">
   <name>Maximum Temperature</name>
   <value>85</value>
  </temperature>
 </parameters>
 <parameters applicable-location="Williston ND">
  <temperature type="minimum" units="Fahrenheit" time-
   layout="k-p13h-n1-2">
   <name>Minimum Temperature</name>
   <value>-9</value>
  </temperature>
 </parameters>
</data>
```

Figure 7: Portion of a sample TEX Product

### 4.4 *SCS Text Product*

The NWS plans to issue the SCS text product will continue to be generated twice daily. Doing so will ease the transition for our users and partners. The methodology for generating the legacy SCS text product will be to use an XSLT stylesheet to transform the FoX, ObX, and TEX products into the SCS. This stylesheet will be made available to our users and partners. Our users and partners could develop their own stylesheets to create the SCS or other similar text products at hourly intervals. The resulting SCS text will have the exact same format as the HPC-produced SCS product, meaning no immediate software changes are required by the SCS users.

## 5. TIMELINES

The NWS plans is generate these products experimentally early in 2007 for a period of 6 months. During this experimental period, the legacy SCS and TAV products will continue to be generated and issued by HPC. The new product suite will be introduced by the Office of Climate, Water and Weather Service (OCWWS) consistent with NWS policies for managing the provision of environmental information. This will include the introduction, experimental products, and feedback periods. OCWWS will manage all three periods. The feedback period will be crucial for determining how and when to retire the legacy tabular product suite.

## 6. CONCLUSIONS

The TPEX plan is in place to modernize, evolve and improve upon the NWS legacy CCF, SCS, and TAV tabular products. This paper describes how the current tabular product suite will be modernized and improved. The new set of four XML products (FOX3, FOX7, ObX, and TEX) provides more data more frequently in ways that better serve today's 24-hour news cycle. The XML products will be generated in formats that will enable our NWS users and partners to capture the data they need when they need them. Because of the use of XML, additional cities, weather elements, and time projections could all be added in the future with minimal software development costs and minimal impact to our users and partners.

This paper also shows how the future product suite will be streamlined and automated. The net result of these fully automated techniques will be to reduce the chances for human error, while at the same time increasing the stability of the products. While HPC forecasters will still likely need to provide human input into the national high/low contained in the TEX product, their contribution should be small compared to the level of effort they spend with the legacy SCS and TAV. In addition, WFO forecasters will also benefit since they will no longer be responsible for the CCF product.

Finally, this paper shows how TPEX will maximize the role of the NDFD in the generation of the future product suite. Using NDFD data feeds to populate the FoX and automated SCS ensures that these products

remain consistent with many other NWS products and helps NWS make more efficient use of its resources.

## 7. ACKNOWLEDGEMENTS

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