Probabilistic Weather Information using an Ensemble Prediction System

Mike Cetinich
Sr. Product Manager

October 22, 2014
The use of Deterministic Model Guidance will be replaced by Probabilistic Model Guidance to assist Decision Support Systems and Risk Managers

Use of Ensemble Prediction Systems (EPS) enables this approach

EPS allows users to see the range of possible weather solutions that may impact enroute and airport operations. It also provides probabilities of weather events that may disrupt operations
Why use an EPS instead of a Deterministic forecast?

- Small Difference in the Initial State
- Big Differences in the Forecast State
How can an Ensemble help decision making processes?
Forecast Uncertainty → Forecast Confidence
Helping to gain awareness about the confidence associated to a specific forecasts.

In the example below the more ensemble members having forecasts the higher the probability of that event happening the higher the confidence a decision making can put on that forecast.
Use of a system that utilizes an EPS and enables user defined thresholds can provide alerts for adverse weather events, even days in advance.

In this case, algorithms combine user defined business rules with the probability of a disruptive event to provide user alerts.

The probabilities are derived from the EPS with a frequency approach and are, whenever possible, calibrated on past events in order to reduce the potential bias (meteorological model used, horizontal resolution, geographical constraints etc.)
### Jeppesen Weather Alerts

#### Risk Levels
- **Green:** None
- **Yellow:** Slight
- **Orange:** High
- **Red:** Severe
- **Grey:** No data

#### Options
- Min. threshold alerts
- 24-h snow
- Nearby hazards (<35 mi.)
- Remove non-alert airports

#### Current time: 10/10/2014 17:01 UTC (The arrow points to the current hour.)

#### Analysis time: 2014-10-10 00:00
(Time in UTC)

<table>
<thead>
<tr>
<th>ICAO/IATA - Airport name</th>
<th>Fri 10 Oct</th>
<th>Sat 11 Oct</th>
<th>Sun 12 Oct</th>
<th>Mon 13 Oct</th>
<th>Tue 14 Oct</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>12 15 18 21 00 03 09 12 15</td>
<td>18 21 00 03 06 09 12 15</td>
<td>18 21 00 03 06 09 12 15</td>
<td>18 21 00 06 12 18 00 06</td>
<td>12 18</td>
</tr>
<tr>
<td>PAAQ/PAQ - Palmer Mun</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PABR/BRW - Wiley Post-Will R...</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PACD/CDB - Cold Bay</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PADL/DLG - Dillingham</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PAEN/ENA - Kenai Mun</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PAFA/FAI - Fairbanks Intl</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**PAEN**

10/11/2014 15Z FCST: +39

Warning triggered by Visibility, Ceiling
## PAEN dashboard

### Risk Levels
- **Green:** None
- **Yellow:** Slight
- **Orange:** High
- **Red:** Severe
- **Grey:** No data

- [ ] Min. threshold alert
- [ ] 24-h snow
- [ ] Nearby hazards (<35 mi.)

### Current time: 10/10/2014 17:04 UTC (The arrow points to the current hour.)

### Analysis time: 2014-10-10 00:00 (Time in UTC)

<table>
<thead>
<tr>
<th>VARS</th>
<th>Fri 10 Oct</th>
<th>Sat 11 Oct</th>
<th>Sun 12 Oct</th>
<th>Mon 13 Oct</th>
<th>Tue 14 Oct</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>12 15 18 21 00 03 06 09 12 15 18 21 00 03 06 09 12 15 18 21 00 06 12 18 00 06 12 18</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>WIND</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>VIS</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CIG</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SNOW</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>RAIN</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>TMAX</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>TMIN</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>TSTM</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>FZRA</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>XWND</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>WSHD</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Ceiling
- 10/11/2014 15Z FCST: +39

#### Probabilities
- P(<200 ft) = 64.5%
- P(<500 ft) = 72.5%
- P(<1000 ft) = 78.5%

#### Deterministic value
- 585.8 ft
Deterministic and probabilistic forecasts

PAEN's main page  Main dashboard

**Ceiling [ft]**
- 20-40%
- 40-60%
- 60-80%
- 80-100%

**Visibility [mi]**
- 20-40%
- 40-60%
- 60-80%
- 80-100%

PAEN

VT: 10/11/2014 18Z  FCST: +42h

Prev. forecasts  Next forecasts
Runway cross winds: PAOM airport

Risk Levels
Green: None
Yellow: Slight
Orange: High
Red: Severe
Grey: No data

Current time: 10/10/2014 17:14 UTC (The arrow points to the current hour.)

Analysis time: 2014-10-10 00:00
(Time in UTC)

Aircrafts | Fri 10 Oct | Sat 11 Oct | Sun 12 Oct | Mon 13 Oct | Tue 14 Oct
--- | --- | --- | --- | --- | ---
B777 | | | | | |
B757 | | | | | |
B737 | | | | | |
B727 | | | | | |
MD11 | | | | | |
MD10 | | | | | |
A300 | | | | | |
A310 | | | | | |
C172 | | | | | |
B787 | | | | | |

Deterministic XWND values

**RW03/RW21**
Cross wind component: 15.1 [kts]

**RW10/RW28**
Cross wind component: 26.0 [kts]
We believe the use of probabilistic weather information that utilizes an EPS can provide long term benefits.

When utilized with a Decision Support System and a Cost/Loss model, decisions derived from such a system will provide large financial benefits.