Implementation and validation of the ROM SAF level2b product

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ROM SAF DMI

Austria Sept. 2013
Outline

ROM SAF 1D-Var overview.

Configuration

B/O tuning

Where to go?

Summary
ROM SAF Level2b activities

Metop A/B NRT

Metop A/B offline

Other offline products (COSMIC, ...)

Level 2a Refractivity

ECMWF background + background error estimate.

ROM SAF 1D-Var

Configuration choices

Level 2b (T,p,q)

ROM SAF NRT

ROMSAF offline

ROMSAF climate
ROM SAF Level2b current status

NRT

- 1D-Var version 2.5 running (stable) since January 2012.
- Version 2.6 running pre-operational.
- Version 2.6.2 (described on following slides) to go operational in Q4 2013.

Offline

- In pipeline

CLIMATE

- COSMIC data currently processed operationally and disseminated through gridded (level3) climate products.
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Summary
1D-Var configuration

\[ J(x) = \frac{1}{2}(x - x^b)^T B^{-1}(x - x^b) + \frac{1}{2}(y^o - H(x))^T O^{-1}(y^o - H(x)) \]

where \( x = (T; q; p) \)

- Observation covariance \( O \) (or \( R \) if you wish). Stdv. 2% enhanced below background tropopause. Correlation \( 1/e \)-length 3 km.
- Background covariance provided by ECMWF. Fixed temperature error and fixed relative humidity error.
- Currently 137 state vector labels.
- Logarithmic representation of \( q, p \) (also prevents \( q \leq 0 \))
- For current NRT: 8 km geo-potential height cut off, due to closed loop sampling and geometric optics. -To be upgraded in 2014.
Recent update of B for NRT

![Graph showing error of f.g Temp. (K) and error of f.g Spec. Hum. (g/kg) with respect to pressure (hPa).]

- ECMWF Ens. Err. Est.
- ECMWF Old Err. Est.
- M. Fisher
Error reduction

This example is from COSMIC data. 1D-Var version 2.5 before update of B
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Desroziers relations

In refractivity space:

\[ \langle (o - b)(o - b)^T \rangle = HBH^T + O \]

- plus 3 more.

Desroziers et al. (2005)
Desroziers ratio

\[ \log_{10} \sqrt{\frac{\langle (O - B)(O - B) \rangle}{\sigma_o^2 + \sigma_b^2}} \]  Global-All

Altitude (km)

Jan10  Apr10  Jul10  Oct10  Jan11 Date  Apr11  Jul11  Oct11
Desroziers relations before and after B update

- this is what we move on with in NRT for now. It is robust but too close to ECMWF.
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Summary
1D-Var is needed to process Offline / Climate data, and suited to use as testbed, but what about NRT 1D-Var? Originally the intention was to provide $T/q/p$ profiles for NWP, but few NWP’s use $T/q/p$ assimilation. A few NRT/offline users are currently active, asking for pre-operational data.

Additional value:

- available before ECMWF analysis
- different information content than ECMWF
- good for QC and Monitoring
- possibly of interest for meteorologists

Probably best to keep the door open for new users.
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Summary
NRT 1D-Var to go operational in Q4 2013.

COSMIC data processed and validated for ROM SAF on-line climate products.

1D-Var is a framework. Configuration may be tweaked for various purposes.

The background error correlations estimates from ECMWF are not necessarily the right choice for all observations and all O-matrices, and it is certainly possible to design O/B for given purposes.