IR SPECTRAL SURFACE EMISSIVITY

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IMPORTANCE OF IR SPECTRAL EMISSIVITY

ε_i is critical in computing surface leaving radiance $\varepsilon_i B_i(T_s)$

Errors in $\varepsilon_i B_i(T_s)$ contribute to

- Errors in $\eta, \hat{R}_i$
- Errors in lower tropospheric products
- Large values of A_{eff} - rejects many cases over land

To alleviate above problems $\varepsilon_i B_i(T_s)$ needs to be correct

- ε_i, T_s do not need to be correct individually

However, ε_i, T_s are useful products in their own right

Our first objective is to correct $\varepsilon_i B_i(T_s)$

- Hopefully ε_i and T_s will improve as well

STEPS IN VERSION 4.2 PHYSICAL RETRIEVAL

1. AMSU/STRAT IR retrieval - uses MW product
2. Determine $\eta^1, \hat{R}_i^{\,1}, \Delta F^1$ (cloud clearing fit), $A_{eff}{}^1$
3. Regression - first product using $\hat{R}_i^{\,1}$
4. AMSU/STRAT IR retrieval - uses first product
5. Determine $\eta^2, \hat{R}_i^{\,2}$
6. AIRS surface, T(p), q(p), O_3(p) retrievals using $\hat{R}_i^{\,2}$
7. AMSU/STRAT IR retrieval - based on retrieved state
8. Determine $\eta^3, \hat{R}_i^{\,3}$
9. Repeat surface and T(P) retrievals using $\hat{R}_i^{\,3}$
10. Quality control including $\Delta F^1, A_{eff}{}^1$

POSSIBLE NEW STEPS IN VERSION 4.3 PHYSICAL RETRIEVAL

1. AMSU/STRAT IR retrieval - uses MW product

2. Determine $\eta^1, \hat{R}_i^1, \Delta F^1, A_{eff}^1$

3. Use $\hat{R}_i^1$ with state 1 retrieved parameters to get ε_i^1 - should be better than climatology (ε_i^0)

4. Determine η^2, $\hat{R}_i^2$, ΔF^2, A_{eff}^2 using AMSU/STRAT IR retrieval and ε_i^1

5. Regression - first product using $\hat{R}_i^2$ (instead of $\hat{R}_i^1$)

   Improves regression?

6. AMSU/STRAT IR retrieval - uses first product

7. Determine improved ε_i^2 using retrieved state from step 6 and $\hat{R}_i^2$

   Improves regression emissivity ε_i^{reg} ?

8. Determine $\eta^3, \hat{R}_i^3$ using ε_i^2 and state 6

   Improves clear column radiances?

9. AIRS surface, T(p), q(p), O_3(p) retrievals using $\hat{R}_i^3$

10. Determine $\eta^4, \hat{R}_i^4$

11. Repeat surface and T(p) retrievals using $\hat{R}_i^4$

12. Quality control including ΔF^2, A_{eff}^2

CONCEPT FOR DETERMINATION OF IMPROVED ε_i

R_i^{comp} depends on $\varepsilon_i, T_s, T(p), q(p), O_3(p), \rho_i$

Assume $T_s, T(p), q(p)$ and $O_3(p)$ are known - appropriate AMSU/STRAT IR state (1 or 6)

Use surface retrieval channels including 1043.4 cm^{-1} (minimal O_3 absorption)

Find ε_i, ρ_i consistent with $\hat{R}_i^1$ (after microwave product) or $\hat{R}_i^2$ (after first product)

Currently using surface parameter retrieval subroutine modified to only solve for ε_i, ρ_i

Testing results with 5 emissivity perturbation functions, 1 reflectivity perturbation function

Emissivity hinge points

909 cm^{-1}, 1043 cm^{-1}, 1111 cm^{-1}, 2400 cm^{-1}, 2500 cm^{-1}

Perturbs regression state

QUESTIONS

1. Does this approach improve $\hat{R}_i$ used to generate first product state?

   a) Over land

   b) Over ocean - maybe do not use new emissivities over ocean

   Success is measured by improved regression

2. Does this approach improve ε_i^2 compared to the first product ε_i^{reg} ?

   a) Over land

   b) Over ocean, is it better than Masuda

   Success is measured by improved final product T(p), q(p), O_3(P), spatial coverage of accepted retrievals

3. Does this approach improve retrieved ε_i ?

   Need validation studies

Minimum goal

Yes on Question 2a