INTRODUCTION

1. INTRODUCTION

• For over 6 years, AIRS radiances have been assimilated operationally into
  National (e.g. EMC; Le Marshall et al. 2006)) and International (e.g.
  ECMWF; McNally et al. 2006), operational centers; assimilated in the
  North American Mesoscale (NAM) since 2008

• Due partly to data latency and operational constraints, hyperspectral
  radiation assimilation has had less impact on the Gridpoint Statistical
  Interpolation (GSI) system used in the NAM and GFS

• Objective of this project is to use AIRS retrieved profiles as a proxy for
  the AIRS radiances in situations where AIRS radiances are unable to be
  assimilated in the current operational system by evaluating location and
  magnitude of analysis increments

2. BACKGROUND ON AIRS DATA ASSIMILATION

2.1. AIRS Radiance Assimilation

• Radiative transfer model is run outside of data assimilation system to
  retrieve temperature and moisture soundings

• Using V5 AIRS Science Team retrieved profiles

• Location matching performed to only assimilate AIRS profiles from
  granules that were available in real-time NAM system; observation
  locations within the granules will vary based on data removed by
  radiance assimilation but retained in profile assimilation (see Fig. 6)

• Although not optimal, retrieved profiles are currently assimilated into GSI
  as RAOBs with observation errors identical to RAOBs (Fig. 3)

2.2. AIRS Profile Assimilation

• Diagnostic statements added within GSI source code determine which radiances
  pass the multiple clear-radiance checks and are actively assimilated at which
  pressure levels (see Fig. 6b for example)

• Operationally, the locations of these radiances are thinned to 120 km and only
  free radiances are assimilated (compare convective clouds over eastern
  CO and western KS in Fig. 6a with location of white spaces in swath in Fig.
  6b) leaving large gaps around cloud features that are important for capturing
  storm dynamics

• Use of profiles at full spatial with quality control to determine highest quality data
  fills in gaps around the convective cloud feature and may allow for greater impact
  in meteorologically significant regions

• Model simulations are ongoing using NASA Center for Climate Simulations
  (NCCS) Joint Center in a Big Box (JIBB) supercomputing system

• Once simulations are completed, location and magnitude of analysis increments will
  be compared to the imagery tools shown in Figure 5

5. SUMMARY

• Patterns of the percent of cloud free radiances to be assimilated matches well with
  CTP and visible imagery from MODIS (Fig. 5a,b)

• Quantitative assessment of GSI-determined CTP for radiance assimilation to be
  compared to MODIS CTP, AIRS profile CTP (not shown), and AIRS P_{min} QC variable
  (Fig. 5d)

• Increased impact of AIRS radiances may be achieved by enhancing
  the selection of assimilated radiances within GSI

• Using retrieved profiles to show regions where information from
  AIRS data could impact radiance assimilation may result in additional
  impact from radiance observations

• Results of this regional study can be applied to the global system