

Group 2

Trump Avalanche Program

Four topics

- Data availability / collection
- Variables
- Methods -
- Logistics - Products, Dissemination, distilling

Datasets

- Real time and historical observations:
 - NOHRSC, Snotel, satellite, etc
 - Crowd sourced avalanche reports
 - Avalanche climatology database
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- Layers of data with tourism activity and population for private sector to derive human-induced related index for avalanche risk
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- NWP datasets
 - Global reanalysis, reforecasts
 - Real-time global and shorter range regional ensembles

Variables

- Land surface – past, current, forecast
 - Snow history - density, layers, etc
 - High resolution terrain
- Trigger - future
 - land surface (snow accumulation)
 - Freshly accumulating snow
 - wind, solar, temperature fluctuations

Methods

- Calibrate global ensemble forecasts
 - Use reanalysis / reforecasts
- Analyze connection between
 - Past / current snow conditions
 - Avalanche occurrence
 - Use multiple downscaling methods to represent uncertainty

Methodology, Post processing

- Downscale analog neighbor quantile + CSGD method for regions most impacted by avalanches (e.g. Rockies, etc.), combined with probabilistic precip type, e.g from WPC, expand code already developed at CPC to WPC time scales
- Reforecast calibration (especially at 2 weeks), combined with shorter calibration
- Stacking multiple methods (for various time scales or specific variables), and then potentially combining for a probabilistic avalanche index forecast
 - Random forests (conditional trees), neural nets, gradient boosting (e.g. things to go into RF: if there is > 1" liq equiv., > 32 deg more than a few days, snow pack > ? => issue medium level)
- Initially need to analyze connection between
 - Avalanche climatology
 - Large scale conditions
 - This will help us develop our decision tree logic

How to decide post process method?

Need ways to split work (e.g. research and dev) for finding post processed methods that use proxies to get variables like snow density forecasts which we may not have yet.

Product - Risk level for favorable conditions for avalanches

- Predict conditions for aval., not aval. occurrence
- Components
 - Human vs. naturally induced
 - Large vs small size
 - High, medium, low risk
 - Internally associated w probabilities
- Watches, warnings for above
 - Risk maps - gridded product

Forecast products

Various levels of support

NOAA : probabilistic forecasts of natural conditions, e.g. WPC days 3-7

probabilistic winter forecast products with more variables, CPC week-2

probabilistic forecasts with conditional trees, e.g. probs of daily 8-14 days > 1”

liquid equiv/24-hours, temps above freezing, etc.

Private sector/University: Specialized deterministic forecasts for e.g. short term ,
improved discussions packaged for public and decision makers

Logistics - Coordination and dissemination Ideas

- **Code:** Shared open repository to contribute to, with groups sharing code already developed. Need coordination to establish an inventory of what we have and what other codes need to be done. This could also include requirements from various groups in terms of how flexible code needs to be (e.g. WPC tell AER that their e.g. post process code needs to entail ability to ingest specific datasets). Establish a group from private and gov't sector that would be the admins for the shared repo, evaluating and accepting push requests (e.g. Ben and Mike (CPC)).
- **Data:** A NOAA contact will put in request to NCO to either set up a separate server farm to sync reforecast data for access, or give everyone in the working group NOAA accounts to access reforecasts. Also should be sharing various post-processed output from various groups (easy access for private companies to add on post-processing techniques)
- **WFOs:** Learn how to utilize a scoped group of new tools to use to help improve the local forecasts, potentially extend their regional avalanche watch/warnings further out in lead time with new 1-14 day guidance.
- **Issues:** Not every ski resort or area can afford specific products from private sector

Partners

- Private sector
 - History of human activities
 - Fine scale applications
 - Distribution of info to public
- NOAA Testbed - Avalanche center?
 - Test areas
- Reach out to center that understands the North American Avalanche Danger Scale, ask how they determine it, suggestions for how we can use our probabilistic information to translate to that. (<http://www.cnfaic.org/advisories/current.php>)
- Research at universities / private sector in outyears
 - Alternative methods in selected areas

Evaluation

- Use avalanche / reforecast climatology
 - Withhold data for independent evaluation
 - Climatological benchmark
- Large scale conditions
 - Traditional scores
- Products
 - Frequency of avalanche reports under types of warnings
- How to create evaluation indices and reports that management and Tiffany and her dad can understand?

Notes

What avalanche-related predictor information should be saved from the global ensemble reforecasts that are soon to be generated?

Currently the plan is to generate a 5-member ensemble reforecast every 5th day over the past 20 years, though if there is a good reason, the configuration of the reforecast could be changed.

We likely have enough variables to create proxies for needed variables specific for avalanche prediction (wind, temperature, snow depth?)

Discussions during meeting (some repeated from above)

(a) what observation and avalanche data should NOAA gather from existing sources?

(b) How will you save the data and make it conveniently available to all partners

(d) What post-processing methodologies will you attempt, and why? What provides the reference for indicating whether your method is an improvement? (e) How will NOAA work with the private and academic sector partners? What will be the respective roles and responsibilities? (f) How will the avalanche forecast products be evaluated? (g) What is your plan for setting up a durable infrastructure so that avalanche forecasts can be further improved in the coming years, ideally an infrastructure that can be leveraged for other post-processing applications.