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Interactions Between Vestige Atlantic Tropical Cyclones and Mid-latitude Cyclonic Storms Over Mediterranean Basin

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One of the more interesting tropical-mid-latitude interactions is one that has important effects on precipitation within the Mediterranean basin. This interaction consists of an Atlantic tropical cyclone vestige whose original disturbance travels eastward and northward across Atlantic basin, eventually intermingling with a mid-latitude cyclone entering southern Europe and/or the western Mediterranean Sea. The period for these interactions is from mid-September through November. If the tropical cyclone and its vestige is able to make the eastward Atlantic transit within the low to mid-levels, or if an upper level potential vorticity perturbation (jet streak) emitted by a Hurricane in its latter stages within the central Atlantic is able to propagate into and along the longwave pattern affecting the western Mediterranean Sea (MED), then there is the prospect for the tropical cyclone remnant to produce a major modification of the mid-latitude storm system preparing to affect the MED region. For such an occurrence to take place, it is necessary for an amplifying baroclinic perturbation to be already situated to the rear of a longwave trough, or to be excited by the emitted jet streak to the rear of a longwave trough – in either case, preparing to affect the western MED.

The Algiers City flood of 9-10 November 2001, which killed some 700 people, was produced by a Mediterranean cyclone that had been influenced by two vestige Atlantic tropical cyclones, Lorenzo and Noel. A published modeling study involving various of

this study's authors has already described the dynamical development of the Algiers storm as it amplified from a developing baroclinic disturbance in the Rossby wave train, into a northern Africa hazardous flood system, then lingered in the western MED as a semi-intense warm core cyclone.

In our new modeling experiments, we investigate the impact of what might have happened in the eventual precipitation field, had the main features of the tropical cyclones NOT interacted with the developing baroclinic disturbance as it penetrated the western MED. To do so, we first remove the moisture and dynamical features of the two vestigial tropical cyclones from the large scale meteorological fields used to initialize the Mediterranean cyclone simulation. This is done through depletion of the moisture front associated with the two tropical cyclones, accomplished by relaxation to the suppressed east Atlantic conditions. The dynamical effects are removed through energetic destruction of the latter stages of the eastward traveling tropical cyclones, accomplished by lowering the underlying sea surface temperatures. A precipitation-distribution impact experiment is then run by initializing with the customized large-scale fields. The final precipitation-impact field is described by differencing the "impact" run from the "control" run – the latter defined as the original simulation which intrinsically includes the effects of the two vestigial tropical cyclones.